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NOTICE TO SUBSCRIBERS.

Subscribers who desire to avail themselves of the reduction in the subscription to the JOURNAL by paying in advance for the year 1877, are reminded that this can only be done during January.

Vol. XXVIII. (second half of 1876) will shortly be ready, bound in cloth, gilt letters, price 18s. Cloth cases for binding may now be obtained on order from any bookseller, or from the Publisher.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

C. T. S., R. The publication of your first letter was unavoidably delayed, although it had been in type for some time. We shall always be glad to hear from you.

S. E. writes:—"Will any manager of a gas-work be kind enough to explain, if he can, a very singular accident that has just taken place in this town, happily without loss of life or property, further than the total destruction of a five-light wet-meter. The meter was fixed in a shop, below the window-sill, and there had been no frost for days to affect it, nor any fire near it. One gas-jet was burning in the shop to-day, when, without any warning whatever, a sharp report like the sound of a rifle was heard, which shook the place. As I happened to be passing within three minutes of the accident, I examined the meter, and found the breast of it blown clean off, destroying case and everything. The force of the explosion tore off the screw of the spindle of the cylinder, cutting the pin as clean as a file. The cylinder itself is torn, and bulges out, and everything destroyed except the front plate of the meter and index. I found the breast of the meter blown off, leaving 5½ inches clear space between that and the cylinder-case. The couplings and overflow-pipe were all tightly screwed up."

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 2, 1877.

Circular to Gas Companies.

THE prospects of the year just commenced, if not of a brilliant, may, at all events, be said to be of a cheering description. There can be little doubt that the general prosperity of all substantial gas undertakings is well assured for another twelve months. Trade is slowly reviving, but there is no chance that the present year will see such an expansion of our manufacturing industry as will raise, to any important extent, the price of our raw material, coal. Contracts will, no doubt, be made on much the same terms as last year, and thus we may expect that gas will continue cheap, while full dividends are maintained.

There are but few threatening signs. In the Metropolis all

agitation against the Gas Companies has ceased. Not a word was said on the "Gas Question" at the City Wardmotes on St. Thomas's Day, and the vestries are quiet, except one or two who make small complaints about nuisances.

In the provinces also the general aspect of affairs is satisfactory. One or two Companies, it is true, will be compelled to defend in Parliament their interests against the cupidity of Local Authorities, but we shall be surprised if either suffer material wrong. We believe they will be left secure in their property, but if a compulsory sale be enforced in either case, we have no doubt at all that the justice of Parliament will award an adequate price. The Isle of Thanet Company, we feel convinced, need be under no alarm. They go to Parliament with a liberal Bill, in pursuance of a stipulation made with, or a recommendation made by, a Parliamentary Committee last session, and they are opposed by the Local Board of Ramsgate, whose desire it is to confiscate the undertaking. That these latter will not succeed, may be safely predicted, and the ratepayers of Ramsgate will again suffer in their pockets. The expenses of the Board in the next session will, probably, be four times the amount incurred in the last session, and the rates will necessarily be increased in proportion. Some ignorance would seem to prevail on both sides as to the incidence of the costs. If the Board succeed, they will have to pay the costs on both sides; if they fail, the ratepayers will have to pay those incurred by the Board. It would be well if these facts were put clearly before the inhabitants, prior to the poll being taken on the 16th inst. They seem at present to be buoyed up with a hope of success which is by no means justified, and which, if realized, would not for some years place them in a better position with respect to the gas supply than they are at present.

Returning to the Metropolis, we may notice the two Bills, one promoted by the Chartered, and the other by the Crystal Palace District Company, to relieve them of the sulphur purification difficulty. The latter Company are tied down to a maximum of twenty grains of "sulphur" in one hundred cubic feet of gas, and we believe that they have kept fairly within that limit. But of late they have experienced a difficulty in getting rid of their foul lime; and, moreover, have not been happy in the selection of a spot on which to deposit the refuse. We have had to report proceedings taken by the Lewisham Board against them for a nuisance created by the drainings from heaps of foul lime.

The Bill promoted by the Chartered Company is a very simple one. It merely proposes to repeal two clauses in the Act the Company obtained last year. Section 30 of that Act gives the Referees power to fix the maximum amount of impurity to be allowed without occasioning a nuisance in the neighbourhood of the works; and section 51 makes the Company liable to a fine of £50 if the average results of three days testings show that the maximum has been exceeded in the gas delivered from any station. The object, as in the previously mentioned case, is to get rid of the sulphur difficulty; and it must be admitted that in works situated like those at Camden Town and Haggerston, the difficulty is very serious. How far these Bills, and particularly the latter, will be opposed by the Local Authorities, remains to be seen. Public opinion seems to have undergone some change on the vexed sulphur question; but it would not be safe to infer that these proposed measures will be allowed to pass without opposition. A Gas Bill is, to a Local Authority, what a red flag is to a bull, and it is not unlikely that the Corporation of the City of London and the Metropolitan Board of Works will make a rush to toss the Bill of the Chartered Company into the air. That of the Crystal Palace District Company, we may confidently expect, will be opposed by, at least, one Local Authority, and we shall probably have the old question fought over again with considerable vivacity.

In another column, we publish the report made by the Metropolitan Gas Referees on the alleged nuisance at the Haggerston works of the Chartered Company. It would seem that the inhabitants of St. Leonard's, Shoreditch, and the neighbouring district, have suddenly become alive to the possession of olfactory nerves. Unless we are mistaken, wet lime purification was carried on at those works for very many years by the Imperial Company; and we think we remember an occasion, not very remote, when one of their purifiers burst. It is certain that such an accident, and even the simple emptying of wet lime purifiers, must have caused far worse smells than could possibly be experienced from the emptying of dry lime purifiers. But, so far as we remember, no complaints were ever made until the month of October last, by persons resident in the neighbourhood. It would seem clear, from the report of the Referees—who visited the scene some time after the complaints

were made, but who witnessed the exact operations which had been carried on, and are alleged to have occasioned the nuisance—that the offence, if it can be called an offence, is of a very limited extent. The agitation evidently does not originate with those who are more immediately exposed to the offensive gas, and the Referees are perfectly right in deciding that the complaints are destitute of foundation. We may be forgiven for holding a strong opinion that no smell that emanates from a gas-works is deleterious to health. Sulphuretted hydrogen does not possess an agreeable odour, but it has never been proved that it is injurious to health, except in a concentrated form. If it were, most analytical chemists would die in an early stage of their professional existence. What will come of the present outcry cannot be foreseen; but the Bill now promoted by the Chartered Company, if successful, will remove all the present grounds of complaint, with what consequences need not here be referred to.

While on this matter, we may once more call attention to a method described in our columns two years ago, which would seem to offer the possibility of abolishing all nuisance, while reviving the lime for repeated use. The foul mixture of sulphide of calcium and carbonate of lime has only to be carried to an oven, where it will be exposed to heat, in the presence of steam, so long as sulphuretted hydrogen is given off, and then to a current of air, which will carry away the carbonic acid, leaving at the end caustic lime in the oven, that has only to be slaked for repeated use in the purifier. The experiment is easily and quickly made, on a small scale, in the laboratory, and we see no reason why it should not succeed, with properly constructed appliances, on the largest scale. Of waste heat there is plenty in gas-works that might be utilized in heating the ovens, and every grain of sulphur might be fixed in an oxide purifier, and would go some length towards paying the expenses of the process. We cannot help thinking that it would prove highly remunerative to revive lime in this way; but the very least result would be the suppression of what some people regard as an intolerable nuisance.

Going back to the provinces, we find that a Sub-Deputy Gas Committee of the Corporation of Hull have had an interview with a Committee of the Directors of the Kingston-upon-Hull Gas Company, in order to ascertain on what terms the Company would sell their undertaking to the Corporation. The answer may be readily guessed. The Company have no desire to sell, and, therefore, asked for an offer. The Corporation had none to make, and thereupon the deputation withdrew. The Sculcoates Company, it would seem, declined to receive a deputation from the Corporation, and nothing can be done with them, unless under compulsion, which some Hull Councillors are disposed to try. Next year we may have a pretty quarrel in this quarter; and, as a preparatory step, the Gas Committee have resolved to ask all corporate towns having gas-works, for a return of the profits made, and the success of the management. The results will be satisfactory in one sense, but will hardly encourage the Corporation of Hull to attempt the compulsory purchase of the several gas undertakings within their limits. The case is peculiar. There is, we think, nothing like it, except in the Metropolis; and the obstacles in the way of a compulsory purchase are very great.

We are naturally liable to be misled by penny-a-liners, who make up sensational stories for the edification of readers of provincial prints. One such case occurred in our issue of the 19th ult., in which we made some remarks on the gas supply of Newcastle-under-Lyme. A credible correspondent informs us, that the deficiency of gas lasted only twenty-four hours, and was owing to the breakdown of an exhauster. It being full moon at the time, the public lamps were, not unwisely, extinguished, so that private consumers might have the largest possible supply.

The first reported event of the current year which presents interest to gas companies, is the arrival in the London Docks of the *Martin Luther*, with a freight of 400 tons of Hartley Mineral, or Australian Boghead. We have before referred to this Mineral, and its extraordinary gas-producing power, and a further reference to it will be found in another column. The cargo, we understand, has been purchased by the Chartered Company, and we shall shortly, no doubt, have a full account of the results obtained by its use. According to Professor Chandler, in America, and experimenters in New South Wales, from which country it is imported, the quantity of gas obtained from it, and the richness in illuminating power, far exceed that procured from the Scottish Boghead, or even the famous Nova Scotian Albertite. In view of the rapid exhaustion of our native canal-fields, this importation becomes of vast consequence. If the supply can be kept up, and the price of the

Mineral be maintained within such limits as Gas Companies can afford to meet, the demand will become very large, not only as a gas enricher, but as a material to be distilled for illuminating oils. The advanced price of American petroleum has given a considerable impetus to the production of these oils in Scotland. It is curious to note how, as the price of these rich oils rises, the schemes for manufacturing gas from them subside. We believe that there is now only one manufactory of petroleum gas in existence in the United Kingdom, and that, we rather think, has not received the extension anticipated. "Coal is King!" and on him, or it, we have still to rely for warmth and light. Petroleum oil, we know, is plentiful in the Old World as well as in the New. The Holy Wells of Baku have yielded it uninterruptedly for perhaps two thousand years, but they have never been pumped. There can be no doubt, however, that a vast store of oil exists on the shores of the Caspian, but it will be very many years before a single *pood* of it finds its way into the Thames, and in the meantime the Pennsylvanian and Canadian wells may be dried up.

From New South Wales coal or shale to Victorian gas squabbles is an easy transition. The City of Melbourne, as we have before informed our readers, is lighted with gas by three companies, two of which, at all events, are in competition in the southern districts and suburbs of the City. The Collingwood Gas Company have at present statutory power to charge 17s. 6d. per 1000 feet, and to divide 25 per cent.; but it does not appear that they have ever done either. They are now in Parliament to obtain further powers, among which is authority to raise additional capital to the amount of £600,000, and as here, when a Gas Company go to the Legislature for any fresh powers, they have to submit to new restrictions. It seems likely that a maximum price of 9s. will be imposed, and that a standard of illuminating power will be fixed. The price at present charged by the Company is 7s. 6d. Except where they are in competition with the City of Melbourne Company, it is 5s. 10d., so that 9s. would not appear to be an unfair maximum. In their last session, the Victorian Assembly passed an Act not unlike the Burghs (Scotland) Gas Supply Act, which gave Local Councils, with the consent of their constituents, power to start gas-works, when no Company furnished a supply. The Councils of St. Kilda and Prahran attempted to avail themselves of the provisions of the Act, but they were stoutly opposed by the City of Melbourne Company, who principally supply the districts, and on a poll being taken, the Municipal Councils were beaten by four to one. The shrewd ratepayers in the suburbs of Melbourne evidently do not perceive the advantage of competing municipal gas-works. Somebody prophesied an extra threepenny rate—a not unlikely result of competition—and that frightened the ratepayers.

The conditions in Melbourne, as we have said before, are not unlike those which obtain in this Metropolis, and we can only give the advice we offer at home. The circumstances of the Melbourne Companies can hardly be so diverse that they will not allow of amalgamation on fair and equal terms, and in that alone can they find full protection from the assaults of Local Authorities. Let them try it as soon as possible, and the sooner the better for both consumers and companies.

We question whether those who advocate the purchase of the Warrington gas undertaking are doing their best to promote the success of the cause they support. No amount of "chaffing" correspondence in the newspapers, or (without offence to Mr. Diggles) hireling oratory, is likely to convince the hard-headed Lancashire men that the bargain made is a good one for the town. That it is, we have no doubt whatever; and if we did not prefer to see the undertaking left in the hands of the Company, we should much regret the course adopted by some members of the Town Council. We think we may assume it as certain, that the poll about to be taken will be adverse to the design of the Council. It is not that the majority are opposed to the purchase; it is the price they object to. Now, it cannot be difficult to show by plain figures—and Mr. Spice has already demonstrated what we consider to be the fact—that the price agreed upon is reasonable, and that the prospects of the Corporation in possession of the gas-works would be of a most promising character. A certain amount of speculation is, of course, involved in such a transaction; but probabilities, and all past experience, go to show that, in growing districts, the consumption of gas goes on increasing in a pretty clearly defined ratio; and if this hold good in the case of Warrington, the Corporation must, in the course of a few years, if they acquire the gas-works, have very considerable surplus profits. This is what should be made clear to the ratepayers of Warrington, if they are to be expected to vote for the purchase.

Water and Sanitary Notes.

THE report of Messrs. Rawlinson and Read, to which we alluded last week, has been published, and a hasty glance through it confirms the opinion we expressed, after reading an abstract, that it is almost entirely of a negative character. While saying this, we may at once admit that, in the main, we agree with the conclusions of the Commissioners. The report will, we have no doubt, be assailed from several quarters. Mr. Hope will, of course, contend that sewage farming must necessarily be profitable, if there be only enough sewage distributed on a farm. The Native Guano Company, who, no doubt, still continue to sell the manure they make for £3 10s. per ton—the price they have always obtained for it, whether it contain crystals of sulphate of ammonia or not—will, of course, energetically contend for the advantages of a chemical precipitation scheme, and lament over the stupidity of capitalists and the obtuseness of Local Authorities, who cannot be made to recognize the merits of their system. Alderman Taylor, too, can have little difficulty in proving that the Commissioners are wrong in their estimate of the "pail system" at Rochdale. He will, of course, prove that commercially it is a great success, while the sanitary condition of Rochdale has been greatly improved since the system was inaugurated. All this, and much more, we expect in reply to this report, of which we here append the general conclusions arrived at by the Commissioners:—

That the scavenging, sewerage, and cleansing of towns are necessary for comfort and health; and that in all cases these operations involve questions of how to remove the refuse of towns in the safest manner and at the least expense to the ratepayer. That the retention for any lengthened period of refuse and excreta in privy cesspits, or in cesspools, or at stables, cow-sheds, slaughter-houses, or other places in the midst of towns, must be utterly condemned; and that none of the (so-called) dry-earth or pail systems or improved privies can be approved, other than as palliatives for cesspit middens, because the excreta is liable to be a nuisance during the period of its retention and a cause of nuisance in its removal; and, moreover, when removed, leaves the crude sewage, unless otherwise dealt with by filtration through land, to pollute any watercourse or river into which such sewage may flow. We have no desire, however, to condemn the dry-earth or pail systems for detached houses, or for public institutions in the country, or for villages, provided the system adopted is carefully carried out. That the sewerage of towns and the drainage of houses must be considered a prime necessity under all conditions and circumstances, so that the subsoil water may be lowered in wet districts, and may be preserved from pollution, and that waste water may be removed from houses without delay; and that the surface and the channels of streets, yards, and courts, may be preserved clean. That most of the rivers and streams are polluted by a discharge into them of crude sewage, which practice is highly objectionable. That, as far as we have been able to ascertain, none of the existing modes of treating town sewage by deposition and by chemicals in tanks appears to affect much change beyond the separation of the solids, and the clarification of the liquid. That the treatment of sewage in this manner, however, effects a considerable improvement, and when carried to its greatest perfection, may in some cases be accepted. That, so far as our examinations extend, none of the manufactured manures made by manipulating towns refuse, with or without chemicals, pay the contingent costs of such modes of treatment; neither has any mode of dealing separately with excreta so as to defray the cost of collection and preparation by a sale of the manure been brought under our notice. That town sewage can best and most cheaply be disposed of, and purified by the process of land irrigation for agricultural purposes, where local conditions are favourable to its application, but that the chemical value of sewage is greatly reduced to the farmer, by the fact that it must be disposed of day by day throughout the entire year, and that its volume is generally greatest when it is of the least service to the land. That land irrigation is not practicable in all cases, and therefore other modes of dealing with sewage must be allowed. That towns situate on the sea-coast or on tidal estuaries may be allowed to turn sewage into the sea or estuary below the line of low water, provided no nuisance is caused; and that such mode of getting rid of sewage may be allowed and justified on the score of economy.

The Richmond Vestry are making a great effort to substitute their own supply of water, for that hitherto given by the Southwark and Vauxhall Company, before the 13th inst. If we express a doubt of the possibility of their success, it is by no means with a view to discourage them in the attempt. We shall not endeavour to appraise the relative amount of blame attaching to the Water Company and the Vestry for bringing about the existing crisis. There have been faults on both sides; as usual; but if any serious interruption presently results, the blame must rest entirely with the Vestry.

SALE OF GAS AND WATER SHARES.—At a public auction on Friday last, five £10 shares (fully paid up) in the Sevenoaks Gas Company realized £100, and a similar lot £107. The last dividend was 7 per cent. Two £20 shares in the Sevenoaks Water-Works Company fetched £43, and one £10 share in the Tenterden Gas Company £14. On the 20th ult., at a sale by auction, three £10 shares in the Stoke Gas Company sold for £22 per share; 23 original paid-up shares of £10 each in the Longton Gas Company realized £20 per share; and five ordinary 7 per cent. shares fetched £14 5s. each.

WATER SUPPLY OF MEXBOROUGH.—The local board of this town, at a meeting held on the 21st ult., passed the following resolution respecting the water supply:—"That this board allow the town to be supplied with water by a private company, in accordance with the regulations of the Local Government Board; this board reserving to itself the right to purchase the works at any time by paying to the company 10 per cent. profit on the original outlay." It was also resolved to throw the matter open to competition by advertisement.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXIII.

MAIN-PIPES (continued).

In the case of clip joints, fig. 10, being employed, a taper or A-shaped bead is usually cast near each end of the several pipes, their distance from the ends varying from 1 inch to 2 inches, according to their size. The clips, in two halves, have recesses corresponding in

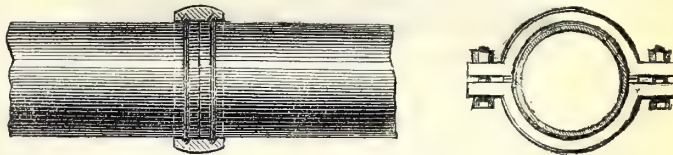


FIG. 10.

shape and distance apart to the projections on the pipes. The latter being placed in the trench, a belt of tarred webbing, of the proper width, and painted on both sides with a mixture of red and white lead, is put round the ends, the semicircular clips placed in position, and tightened by means of screw-bolts at their extremities.

This method of jointing is not much employed, and having had considerable experience with it, we cannot recommend its indiscriminate use. The slightest subsidence in the ground causes it to yield. As a joint for pipes about the gas-works premises it is extremely useful, from the ease and rapidity with which the pipes can be taken asunder and replaced when required.

Collar joints for main-pipes have been adopted by some engineers. These are, with but slight modification, the ordinary thimble arrangement generally used in uniting a broken main where spigot and socket joints are employed. That known as Belgrand's, fig. 11, made by Fortin Hermann Brothers, may be taken as a sample of this class

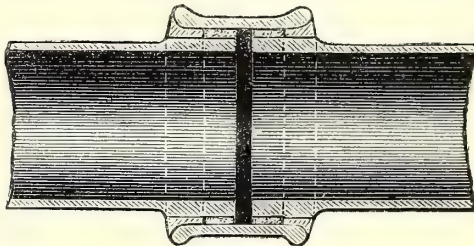


FIG. 11.

of joint. It consists in enclosing two cylindrical tubes, when placed together, with a cast-iron band, tarred yarn being driven in on both sides, filling up the space between the pipes and the band to within an inch and a half or two inches of the rim of the latter. Molten lead is then run into the collar at both ends, which fills up the remaining space, and this is beaten carefully in all round.

M. Chamero's collar joint, for uniting his sheet iron and asphalt-coated pipes, already described, is shown in fig. 12. This is also

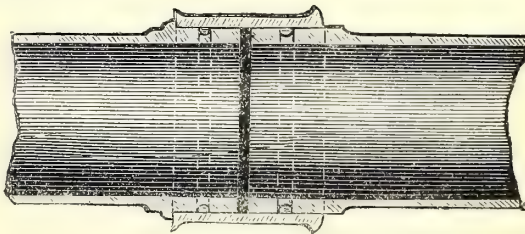


FIG. 12.

suitable for use in uniting cast-iron mains. A rounded projection or shoulder is cast on the pipe, about 4 inches from the end, with an annular groove to receive the hemp, caoutchouc, or other packing. The collar is of sheet iron, and is lined with lead, being made to fit closely on the pipes. When the packing has been placed in the groove on one end, the collar is driven over it, and hammered against the shoulder, and the end of the next pipe, also having its ring of packing material upon it, is inserted in a similar manner. A mixture of melted tallow and black lead is painted over the pipe ends, to allow of their sliding freely within the collar.

The conspicuous drawback attending the adoption of the collar is, that two joints have to be made in every connexion. Now, if the advantage of yielding under variations of temperature, without the risk of leakage, can be secured by the use of any other description of joint—as, for instance, that of spigot and socket, it is clear that the latter, on the ground of convenience alone, not to mention expense, is the preferable joint to employ.

The screwed joint of the same maker is shown in fig. 13. This,

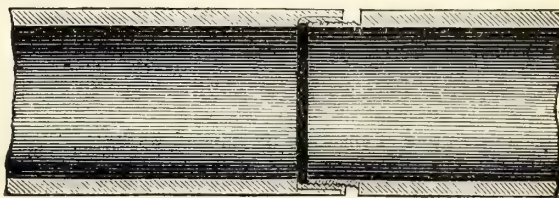


FIG. 13.

however, has been abandoned on account of its rigidity, and the difficulty of its manipulation with the larger sizes of pipes, in favour either of the collar-joint last described, or of the grooved spigot and socket joint, fig. 14. In uniting the pipes after this

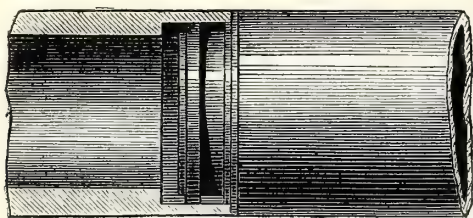


FIG. 14.

method, the spigot end containing the groove is bound round with hemp yarn that has been steeped in wax and tallow, or, what serves equally as well, in red-lead paint. A coating of black lead and tallow

is then given to the two ends, and the joint completed by forcing the spigot of one pipe into the socket of the other. This joint, which is largely in use in France, is said to be cheap and durable, can be made with great ease, and affords perfect compensation in case of contraction and expansion from changes in temperature.

A form of screwed joint, applicable to cast-iron pipes, was patented by Mr. C. M. Barker, of London, and is shown in fig. 15. This construction of joint was not intended to be applied to pipes of greater diameter than 12 inches. The screws are cast with a lash or play on the thread, permitting the pipes to lie obliquely, or in a curve. In laying pipes of this description, the cones and cavities of the screws are filled with a luting of Portland cement, so that when the connexion is made, the luting is confined and compressed in the annular rings in such a way as perfectly to seal the joint and prevent leakage. Provision is also made for readily attaching junction-pipes by "cast lengthening screw sockets," with back nuts, as shown. Hexagonal bands, at regular distances, are also cast on the several lengths, to give a proper thickness of metal in drilling for the service-pipes.

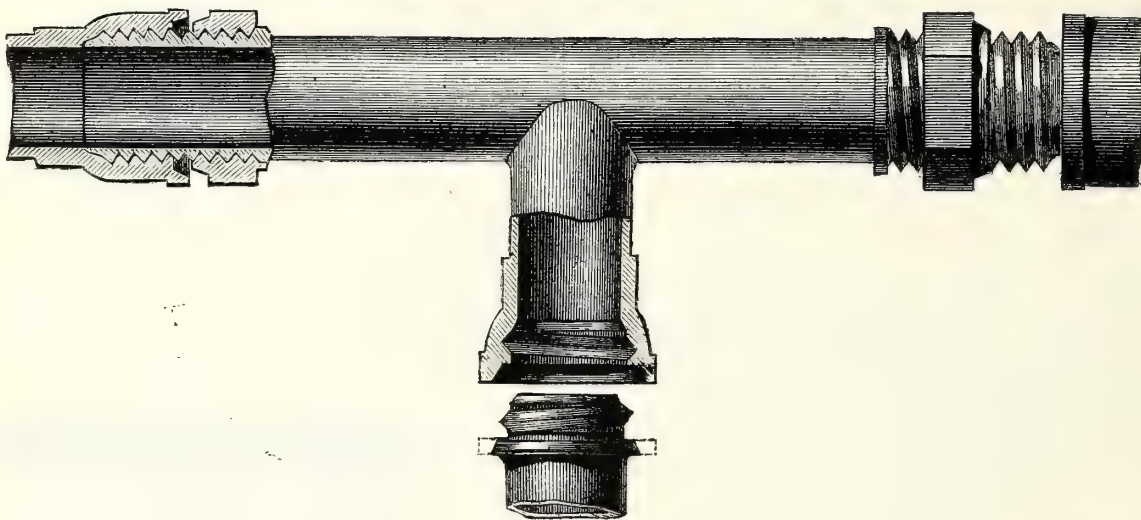


FIG. 15.

Communicated Articles.

FRENCH PRACTICE IN THE CONSTRUCTION OF GASHOLDERS.

At the Vienna Exhibition of 1873, the *Compagnie Parisienne d'Eclairage et de Chauffage par le Gaz* contributed various articles connected with their establishments, such as chemical products, drawings, models, and specimens of gas apparatus; and they published, at the same time, a "Note," in the form of a book of considerable size, intended to describe and explain the articles exhibited. This book contained much interesting matter, one chapter (with several plates) giving a description of the system of wrought-iron bitumenized mains, which have been exclusively used by the company for the last twenty years.

But the great bulk of the publication was devoted to a series of "Notes on the Construction of Gasholders," by M. Arson, one of the engineers to the company. These were afterwards presented separately, as a *mémoire*, to the *Société des Ingénieurs Civils* of Paris, and were published in their Transactions.

The engineers of the company appear to have devoted much attention to the various points which enter into the design and construction of these important portions of a gas establishment, and they have, with praiseworthy frankness and liberality, given their brethren in the profession the benefit of their experience and study.

The original *mémoire* may, I believe, be purchased,* or it may be referred to at the Institution of Civil Engineers in Westminster; but, as an account of its contents may be interesting to the readers of the JOURNAL OF GAS LIGHTING as an illustration of French practice and French ideas on the subject, I venture to offer the following notes.

To a large extent, they consist of a translation of the original, but I have not adhered strictly to this condition. I have in many places abbreviated the matter, or altered the forms of expression; always, however, preserving the sense intended. And I have further omitted some portions entirely, for reasons stated in each place.

Westminster, December, 1876.

WILLIAM POLE.

The gasholder is always a work of great importance in the design of gas-works, not only on account of the capital it absorbs, but also from the difficulty of its construction. Hence it should receive the best attention of gas engineers, with the view of diminishing its first cost, and of ensuring its efficient working.

The dimensions and proportions of a gasholder cannot be subject to fixed rules. It is desirable to have several holders, whose aggregate

capacity (which will depend on the nature of the service to be performed) shall be capable of storing the gas made during the hours of minimum consumption.

It often happens that the diameter is determined by the area of land available, the height being then capable of variation. In good ground the depth of the tank may be carried to 12½ mètres (41 feet), and there is then little inducement to adopt the telescopic system. On the other hand, in ground where water is met with at a small depth, and where it would be difficult and costly to carry down masonry,* the telescopic system becomes applicable.

Whatever system be adopted, the design must inevitably comprise several parts of very different character, each of which will require the engineer's careful attention. The nature of the ground on which the structure is to be placed; that of the earth to be used for the filling in behind the masonry; the nature of the masonry, and of its coating; the bell† and its system of guides; the inlet and outlet pipes—these are all subjects which admit of considerable variation of treatment, and in respect to which it is necessary to judge with great discernment, in order to arrive at the most satisfactory and the most economical solution of the general problem.

A long and extended experience has thrown much light on the study of this problem, but it has not previously been treated in so precise and sure a method as has been lately done by the Parisian Company. The thickness of the masonry of the tank has been gradually reduced, but it has been uncertain to what limit this economy might be carried with safety; the chains and counter-weights, which originally ensured stability to the bell during its motion, have been abandoned, but the conditions of resistance to which the guides are subjected in consequence have not been fully appreciated. It is customary to use hydraulic seal troughs, to unite together the two rings of a telescopic bell, but there is no written law of any authority to guide the constructor in the determination of the dimensions of this junction.

The Parisian Company have not been satisfied with this kind of uncertainty. They desire that all their works should be designed on data so sure as to exclude the chance results of unreasoning experience; and for this reason they have studied and solved the various questions arising in the design of gasholders. In this study they have not advanced precipitately. In regard to each element, they have drawn out general rules, and have verified them in important practical examples, before publishing them as worthy of confidence.

It has not been practicable to provide for all possible cases that

* The French word "*maçonnerie*" includes brickwork as well as stone. It is often customary to use the English equivalent in this more comprehensive sense, and I have done so here throughout.—TRANS.

† "*Cloche*," a useful word to distinguish the inverted floating vessel, the term "gasholder" being applied to the structure generally as a whole.—TRANS.

may occur; but it will be quite possible to draw, from the data given, rules that will furnish good solutions for other cases.

It will be convenient to consider the following subjects under separate headings, viz.:—

1. Earthwork.
2. Masonry.
3. Cements and coating.
4. The bell, simple or telescopic, with its guide-rollers.
5. Inlet and outlet pipes.
6. Guides.
7. Scaffolding for the construction and support of the bell.

I.
EARTHWORK.

The construction of a large gasholder begins by the excavation destined to receive the masonry tank.

Examination of the Nature of the Ground.

The ground in which the excavation is dug may be of three different kinds—

- Firm, and capable of being left with steep sides; or
- Loose, and requiring slopes more inclined; or
- Firm in some parts, and loose in others, as usually happens where the solid natural ground has been partially covered with loose earth.

The first case is the most advantageous that can happen, and need not be further commented on.

The two others may be considered as identical as regards the execution. It is expedient always to remove the loose earth, and substitute for it something that offers sufficient resistance. We may form spurs of masonry to act as buttresses supporting the tank wall, or simply increase the thickness of the latter till sufficient resistance is obtained; or we may interpose between the exterior of the wall and the natural ground, a filling in of earth (*remblai*) of sufficient resistance to arrive at the same result. This latter plan is evidently the cheapest, and it has been employed in many cases with success, especially in the construction of a gasholder of 25,000 cubic mètres (880,000 cubic feet) erected at the gas-works at Les Ternes.* It is expedient to give some particulars of this, one of the largest erected in Paris.

The loose earth removed had to be replaced by filling of proper resistance. The tank required to be 1·30 m. (4 feet 3 inches) thick, and it had to support at its base a column of water of 12·75 m. (42 feet) tending to thrust it outwards.

The artificial earth, which had to be removed beyond the theoretical excavation, amounted to 6800 cubic mètres (9000 cubic yards), presenting a maximum width of 12 mètres (40 feet). It was replaced by sand watered and rammed in thin layers, brought up *pari passu* with the masonry of the tank.

It is well known that sand watered and rammed constitutes an excellent foundation for buildings where vertical pressures have to be resisted. The resistance to horizontal pressures has been determined by direct experiments which are about to be described.

Experiments on the Resistance to Compression offered by Earth-Filling.

[These are described in the original at considerable length, and drawings and dimensions are given of the apparatus employed. I have not thought it necessary to reproduce all this in the present paper; it will suffice to give a general brief description, stating the results obtained. The details can be easily referred to in the original.—TRANS.]

The experiments were made on three kinds of material—namely, sand, white tufa of the Parisian beds (a light stony powder), and vegetable earth mixed with gravel, which is common in the neighbourhood.

A portion of the material to be tried was filled into a frame, being watered and punned, in thin layers, as it would be in actual use. It was then pressed horizontally with a piston of known size (for low pressures, one mètre square; for high pressures, one décimètre square) and the pressure was noted when the piston first began to move—i. e., when the resistance of the material was attained. Each material when rammed weighed about the same—namely, 1800 kilogrammes per mètre cube (112 lbs. per cubic foot).

The resistances found were—

	Kil. per Square Décimètre.	Pounds per Square Foot.
Sand	100 ..	2050
White tufa	80 ..	1640
Vegetable earth with gravel	44 ..	900

The punned sand transmits the pressure very badly, the molecules butting one against the other, and hence it forms an excellent filling, as well as an excellent foundation.

As a result of these experiments, the engineers of the Parisian Company, charged with the construction of the gasholder at Les Ternes, have not hesitated to supply, by a filling of watered and punned sand, the earth removed between the exterior of the masonry tank and the natural ground in which the excavation was made. The upper part, about 1½ mètre deep, having to sustain but little pressure, was, for economy, rammed with ordinary earth.

II.
MASONRY TANKS.

The masonry which composes the tank of a gasholder absorbs a large portion of the total cost, and requires, therefore, scrupulous consideration.

In the preceding section, the conditions of external resistance have been laid down. When the depth of the tank exceeds 10 mètres (32·8 feet), it is indispensable to make the masonry co-operate in the strength.

The masonry of the tank possesses two elements of resistance—its *weight*, which opposes the overturning of each elementary vertical prism, into which the whole may be supposed to be divided; and its *cohesion*, which offers a horizontal resistance that must not be neglected. These elements vary, moreover, in their value, according to the nature of the materials employed.

The tank may be built either of brickwork or of rubble stone masonry. The mortar is prepared with hydraulic lime, more or less quick-setting, or with Portland cement.

Choice of Material.

Bricks, if sound and well burnt, make an excellent material for the construction of a gasholder-tank. Their price, and their abundance on the site, will determine their choice. They are not obtainable in Paris, and consequently the Parisian Company have been obliged to have recourse to stone.

For rubble stone, each stone should have two parallel faces sensibly plane, rendering its setting easy and secure. Its hardness is a secondary matter, but it ought to be greater than that of the mortar used. It ought not to be friable, as this character corresponds to a bad quality, which may cause it to disintegrate under frost or other actions.

Placing of the Material.

Whatever be the materials chosen, they ought to be so laid as to satisfy one condition, which can alone ensure the co-operation of the resistance of the ground.

If the ground is cut and shaped to correspond with the exterior form of the masonry, the latter ought to be made to bear forcibly against it. Each stone should be struck horizontally, so as to impress itself against the earth, and squeeze out the mortar placed between them, by which means the pressure of the water in the tank may be transmitted by the masonry to the earth without displacement or fissure of any part of the work. This condition is indispensable to ensure the resistance of the earth.

If partial slips occur in the ground, the cavities must be carefully filled, either with masonry or rammed sand, in order that the pressure may be transmitted to the solid earth behind.

Mortar.

The mortar used plays an important part in the success of the work. Limes which are feebly hydraulic, or even those which become very hard under water, but which set slowly, are inconvenient in use. Those which set too quickly, like Roman cement, are difficult to use, and almost always make defective work. Portland cement, which takes twelve hours to set, is the material best suited to ensure a good construction.

Thickness of the Tank Wall.

The thickness and the form of the tank wall depend both on the requirements of the work it has to support, and on the resistance it has to add to that of the ground. If the ground is solid, and if it can be excavated with vertical sides, the tank wall should have a uniform thickness. If the ground is loose, having first to be excavated with a slope and then filled in again, as is the case with sand, the wall may be brought up with a reduced thickness, except under the seats of the columns where piers will be formed. This latter mode has been adopted at Vaugirard with complete success.

Determination of the Forces and Resistances in a Gasholder-Tank of Masonry.

The study of the equilibrium between the thrust of the water in a gasholder-tank, and the resistances offered by the masonry and its earth backing, constitute a problem easy to solve with the aid of the data which the Parisian Company have obtained.

In the first place, observation has shown that the rupture of these tanks has always occurred in a vertical fissure, widest at the top and diminishing as it descends. We are therefore justified in considering that the work is exposed to an effect of tilting or overturning, having its greatest movement at the summit, and not, as might have been supposed, to a rupture at the base, where the pressure is greatest.

It has also been observed that the overturning movement actually produced is extremely limited, that it often appears only as a crack scarcely discernible; and we are led to conclude that this small displacement suffices to bring into play the resistance of the earth to such an extent as to limit the disturbance. Hence we may further infer that a previous pressure of the earth against the masonry would have prevented the rupture, and we see the importance of causing the masonry to abut strongly against its earth backing, as previously directed.

Starting from these considerations, the analytical study of the question will show that the tendency is to break the cylindrical tank into two equal parts, by a vertical line of fracture passing through the axis of the cylinder, each half tending to move outwards in opposite directions. It is also necessary to assume that the resistances of the masonry and earth are uniform in all parts of the circumference, and to neglect any change of form.

The forces to be considered are—on the one hand, the pressure of water; on the other hand, the weight of the masonry, its cohesion, and the pressure of the earth backing.

(To be continued.)

* The most important gasholder of the company is that constructed at La Villette in 1870-1, having a capacity of 31,000 cubic mètres (1,100,000 cubic feet).

GAS EXPLOSION AT SHEFFIELD.—On Thursday night last a somewhat alarming explosion of gas, which had escaped from a leaking joint, took place in the St. Paul's School-room, Sheffield, doing some damage, and seriously injuring a man living on the premises.

CONTRIBUTIONS TO THE THEORY OF LUMINOUS FLAMES.

By Dr. KARL HEUMANN.

[Translated from the *Journal für Gasbeleuchtung*]

PART FIRST.

Until lately, Davy's theory of luminous flames sufficed to explain all observed phenomena; but a series of researches has since then enlarged our knowledge of the subject by many facts which cannot be made to harmonize with the theory hitherto accepted.

Thus the luminosity of the flame of hydrogen and of carbonic oxide, under high pressure, observed by Frankland, contradicted the idea heretofore entertained, that the brilliancy of a flame was derived from solid particles floating in it, and raised to a white heat; and the observation of Knapp, that the flame of illuminating gas lost its brilliancy, not only by an admixture of air, but also by admixture of a certain proportion of nitrogen, or of carbonic acid, with the gas to be burned, could no longer be explained by an immediate oxidation of the carbon contained in the flame.

From these, and similar considerations, it appears that Davy's theory no longer suffices, and that it must be modified, or altogether replaced by a new one. But it also appears to me certain, that the latter alternative is unnecessary, and that a complete reversal of the hitherto received views is not required. The present paper will, therefore, be directed more to the enlargement of the existing theory than to its supersession. The genius of Davy is specially manifested in the circumstance, that his hypotheses are neither overthrown nor even greatly shaken by new discoveries which he could not possibly have anticipated, but that they only require to be remodelled on a broader basis to suffice for the present state of science, so much richer in ascertained facts.

I cannot refrain from quoting H. Kopp's* remarks with reference to Davy's theory of combustion: "From the history of chemistry we learn better to appreciate the real value of scientific researches, and we arrive at the conviction, that every labour, and the elaboration of every theory, however complete at the time of its promulgation, is only a preparatory step to subsequent increased knowledge, so that no views can claim to be retained without modification, and the best result is that which, while fulfilling the requirements of the day, itself induces increased research in such a direction that it may more speedily be replaced by a better one; that the best contribution to science is one which contains within itself the germ of some fresh discovery, which shall ultimately supersede it."

As a rule, I have retained the chronological order in which the several researches have been made, for only in this way is it possible to carry out logically my chain of argument. A more systematic arrangement would, no doubt, be to give the simpler first, and then the more complex; but, in the case before us, the complicated subject of the carbon-containing luminous flames has, on account of its great importance, been the most studied, while the experience here gained, and views formed, will find their application to, and confirmation by, simpler flames, and thus elucidated and corrected will serve to explain all flames.

Carburetted Hydrogen [Hydrocarbon, German, Kohlenwasserstoff] Flames; their Disillumination† and Reillumination.

Most researches hitherto on the luminosity of flames have dealt exclusively with those whose illuminating power was attributable to the presence of carbon, and many observers endeavoured to solve the problem of the origin of luminosity by appliances for diminishing or withdrawing light. In fact, this apparent *detour* offers many advantages, but its chief disadvantage has not been sufficiently allowed for; this disadvantage, which tends to vitiate the conclusions drawn, consists in the complication of relations by the simultaneous introduction of various agencies, of which some will act in similar, and others in opposite directions, in experiments on disillumination.

The neglect of this circumstance has led to experiments yielding directly contradictory conclusions, and thus, since Davy's theory is proved insufficient, we are still without any comprehensive point of view from which to explain the luminosity of flame.

Frankland suggested the hypothesis, that it was not solid, glowing carbon, suspended in a flame, which caused the luminosity, but rather dense, glowing vapours of hydrocarbons which emitted the white rays. It was, however, hardly possible to bring forward proof of this theory, which completely upset the usually received explanation, and Frankland, therefore, based his views chiefly on his observations, that many flames yield a bright light where there can be no possibility of solid glowing particles. To the well-known instances of the considerable luminosity accompanying the combustion of arsenium, phosphorus, and sulpho-carburets in oxygen, he added the interesting observation, that hydrogen and carbonic oxide will burn in oxygen, under a pressure of from 10 to 20 atmospheres, with a bright flame, yielding a continuous spectrum, and that even the feeble flame of spirits of wine will, under a pressure of 18 to 20 atmospheres, burn as brightly as a wax candle.‡

The former results are not so surprising as might at first sight be imagined, for increased pressure raises the temperature of the flame, as St. Claire Deville had announced,§ and it is well known that

many gases, when their temperature is increased, will, under electric discharge, yield a continuous spectrum instead of single lines.

The light-emitting power of gases then varies greatly under these conditions, and it does not seem a necessary conclusion, as Frankland assumes, that the increased luminosity is due to the greater density of the gas, though this may probably contribute to the result.

But the explanation of these appearances is quite independent of the question as to the nature of carbon-containing luminous flames, and though Frankland adduces the above-named phenomena of combustion as analogous to his views respecting carbon flames, they do not really afford any proof; for, as W. Stein* pertinently remarks, it is not proved that the process in carbon flames is necessarily analogous.

Frankland's assertion that soot is a collection of the densest light-giving hydrocarbons, the vapour of which is condensed on the cold body introduced into the flame, may be considered as refuted by W. Stein's argument, that in this case the soot ought, at a high temperature, to be reconverted into vapour (which is not the case), and so this portion of the accepted theory of flame, in so far as it refers to flames containing carbon, remains unimpaired.†

Fresh doubts as to the accuracy of the prevailing views were entertained when Knapp announced‡ that not only atmospheric air, when mixed with coal gas, rendered the flame non-luminous, but that nitrogen, carbonic acid, and other perfectly neutral gases produced, the same effect. It was no longer possible to ascribe the cessation of brilliancy to the immediate oxidation by the air of the carbon separated in the flame, because gases perfectly free from oxygen produced the same effect; and Stein,§ as well as R. Blochmann,|| in attempting to explain this result, while maintaining the instantaneous conversion of the carbon of the flame into carbonic oxide, was forced to assume that the oxygen of the atmospheric air was enabled to penetrate the flame more freely, and so oxidize the carbon particles more readily.

While the two last-named authors regarded disillumination as occasioned solely by rarefaction, F. Wibel,¶ on the other hand, propounded an entirely different theory, according to which absorption of heat from the admission of the neutral gas is the only cause of the disillumination.

Wibel arrives at this conclusion from observing that a mixture of coal gas and air, nitrogen, or carbonic acid gas, burning with a blue flame, becomes a bright flame yielding soot, if the burner from which it issues is made red hot. In this case the rarefaction of the flame-gas would be increased by the higher temperature, and yet the flame becomes luminous.

To judge of the admissibility of the sweeping deductions from this observation, it is necessary to consider more closely the manner in which Wibel conducted his experiments. He says: "On an ordinary Bunsen burner, the air-openings of which are all closed, except one, through which the disilluminating gas is introduced by means of a tube luted on, is placed a platinum tube, 8 to 10 centimètres long, and which is easily made by rolling spirally a strip of platinum. The ordinary luminous gas flame is produced of a moderate length, and the neutral gas introduced till complete disillumination is attained; the platinum tube is then heated from the outside by two non-luminous horizontal Bunsen flames, diametrically placed, so as to heat the tube equally all round. . . . Even with the ordinary Bunsen flame—that is to say, disillumination by air—the same result is obtained by placing the platinum tube over the mouth of the burner, and heating it."

This latter result, as described by Wibel, especially requires very careful examination before we can be justified in identifying the disillumination in the Bunsen burner with Knapp's experiment.

Some time ago Barentin** made the observation that the volumes of light-giving (coal) gas escaping in equal times from a burner vary greatly according as the gas is lighted or not. Barentin considered the 26.33 per cent., &c., less volume escaping when the gas is lighted, to be accounted for by the counter-pressure exerted by the burning, and therefore expanded, gas, on that pressing in its rear; Blochmann,†† however, showed that the diminished consumption of gas was entirely owing to the increase in volume sustained by the gas in passing through the heated top of the burner.

It is possible, therefore, that the illumination of a gas mixture issuing from a Bunsen burner through a heated tube may arise from other causes than that assigned by Wibel—namely, the higher flame temperature; for it is *primâ facie* improbable that the volume of gas, and also the volume of air absorbed, should be quite unaffected by the passage through a long glowing hot tube, and just as little can it *a priori* be affirmed that exactly the same relation obtains between the air and the coal gas in passing through a cold as through a heated tube.

I was, therefore, induced to vary the conditions of the experiment, so as to eliminate this possible effect of the heated tube on the result.

By heating, not the mixture, but say only the neutral gas, the result must remain exactly the same, if the increased temperature of the flame is the cause of the brilliancy, and, in fact, the experi-

* Dingler's Journal, 1875, pp. 317, 543. Compare *Journal of Practical Chemistry* (2), viii., 401, *et seq.*

† In a subsequent chapter I shall refer again more specially to the nature of the light-yielding body.

‡ *Journal of Practical Chemistry* (2), i., 425.

§ *Journal of Practical Chemistry* (2), ix., 180.

|| Dingler's Journal, 1873, pp. 395 *et seq.*

¶ Dingler's Journal, 1875, p. 287. "Reports of the German Chemical Society," viii., 226.

** Pogg. Annal., 107, 183.

†† Schilling's Journal für Gasbeleuchtung, vol. v., p. 355.

* H. Kopp, "History of Chemistry," i., 16.

† For the sake of brevity, and in accordance with precedent set by others, I shall use the words disillumination to signify the disappearance of the yellowish-white light, yielding a continuous spectrum, usually emitted by flames containing carbon; the flame then appears blue, and the light exceedingly feeble. A complete cessation of all light would, of course, be equivalent to extinction of the flame.

‡ Dingler's Journal, 1875, pp. 341, 369. Compare also L. Cailletet, *Comptes Rendus*, lxxx., 487.

§ *Comptes Rendus*, lxvii., 1089.

ment may easily be made with the Bunsen burner, by inserting tubes of rolled platinum foil about 7 centimètres long into the two lower air-holes, the outer openings of these tubes being compressed till only just sufficient air for complete disillumination is admitted. Instead of the ordinary brass burner, a thin glass tube must be used, such as a test tube, with the bottom removed, as the metal tube would cool the heated air too rapidly. If the coal gas mixed with cold air be lighted at the top of the glass burner, the latter being protected by a ring of platinum to prevent any colouring of the blue flame through the ingredients of the glass, and the two platinum tubes are then heated by powerful Bunsen heat-flames (preventing, however, any of the products of their combustion from entering the platinum tubes), the blue flame on the glass burner will become bright as soon as the platinum tubes are glowing hot.

This result might, however, be explained by the gas, in fact, requiring just as great a volume of air with heated as with cold platinum tubes; but that the actual volume of air admitted is in the first case much less, and that the oxygen contained is, therefore, not sufficient to destroy illumination by complete combustion of the carbon. To remove this objection, and to prove that the brightening of the disilluminated flame was due entirely to the heat imparted, the experiment had again to be varied.

The coal gas was now collected in a gasometer, and air or carbonic acid gas carefully introduced, till the mixture, on issuing from a platinum tube about 10 c. long and 8 mm. in diameter, burned with a perfectly blue flame. The platinum tube being now heated, the brightness of the flame rapidly increased, and at length became nearly as brilliant as if pure gas was burning. When the heating apparatus was removed and the platinum tube cooled, the flame of the mixed gas became proportionately feebler, and finally became again perfectly blue.

Only now are we justified in concluding that the increased heat alone had made the flame bright, for diminished access of air could not, as in the former experiments, have had any influence on the result.

It was necessary further to ascertain, whether the gas mixture which in consequence of being heated burned with a brilliant flame, might not have been altered in such a way that it would now burn with a brilliant light even though cooled again to its original temperature. In other words, if the brilliancy be caused directly by the higher temperature, and not by any chemical change taking place, the gas mixture, which burns with a bright flame when issuing from a heated burner, ought again to yield a blue flame if it can be cooled after passing through the heated tube, and then lighted.

This experiment was conducted by passing glass tubes on to each end of the platinum tube and fastening them with putty; the mixture from the gasometer was then admitted through one glass tube into the platinum tube, and passed into the second glass tube, which was bent into a U form and surrounded with cold water. When the gas escaping from this tube was lighted, it burned with a perfectly blue flame, which did not become brilliant however strongly the platinum tube was heated. But when the refrigerating glass tube was taken away, and the gas lighted at the end of the heated platinum tube, it yielded a bright flame.

A still more simple method is to allow the blue flame, yielding mixture, say of coal gas and carbonic acid, to escape from a platinum tube, 12 to 15 c. long, and then light it. If the platinum tube be heated near the open end, the blue flame immediately becomes brilliant; but if the tube is heated further from the flame, the latter does not become brilliant, because the heated gas is cooled again by passing through the cold portion of the platinum tube.

In employing air and coal gas, Wibel noticed that under certain conditions "the gas escaping from the burner will show by its proportion of water and carbonic acid, as well as by brilliancy under ordinary combustion (I suppose he means after having been previously cooled), that a partial decomposition has taken place." But this will depend especially upon the proportion of air and coal gas, and on whether the heating process may not have been carried too far.

While Wibel observed, in the passing of air and coal gas through a glowing platinum tube, a not inconsiderable deposit of carbon, my own experiment, in which only the air drawn in by the Bunsen burner passed through the heated tube, showed neither soot nor tar deposit in the glass burner, even after lengthened combustion. That such a deposit took place in Wibel's experiment is probably due to some local overheating of the particles of the gas mixture in immediate contact with the platinum. Therefore such a very high temperature is not necessary for obtaining the results sought for.

Wibel draws a sweeping conclusion from the reillumination by heat of a flame disilluminated by a neutral gas. He rejects the explanations of previous observers, but falls into an opposite extreme. He ventures, e.g., on the following conclusions:—

1. The disillumination of a flame, in Knapp's experiment, cannot be caused by rarefaction of the gas, as understood by Frankland, or by Blochmann, for in the above experiments any rarefaction could only be increased by heating, and yet brilliancy was produced.

2. The disillumination in Knapp's experiment, as in the simple Bunsen burner, depends on the cooling of the interior of the flame by the gases entering. If the latter are heated, the gas becomes brilliant.

Wibel finds "a most remarkable confirmation" of these two assertions in the peculiar action of flame produced by coal gas and oxygen. On the one hand, disillumination was most difficult to effect, even with a strong current of oxygen, and the application of a wire-gauze screen for cooling; and yet, on the other hand, under proper arrangements, it afforded an intense light. Both these circum-

stances, in Wibel's opinion, go to show that neither rarefaction nor oxidation bear any active part in disillumination.

Put in this form, Wibel's theory is at once proved incorrect, if applied to the disillumination by air of the flame in a Bunsen burner, because daily experience shows that the flame of the Bunsen burner, as well as every blow-pipe flame, possesses a much higher temperature than the more brilliant flame; while, according to Wibel's explanation, the disillumination, being caused by a cooling of the bright flame, the logical result would be a lower temperature in the blue than in the bright flame.

Even if one were disposed to consider a flame disilluminated by air as belonging to a different category from flame disilluminated by a neutral gas, and, therefore, to allow it an exceptional position, this would not mend matters, for the Bunsen flame, in respect to becoming brilliant, behaves precisely like the flame in Knapp's experiment, the only distinction—viz., the higher temperature due to the oxygen of the air, not being relatively altered by the heating of the burner, yet brilliancy ensues. But while, in the case of flame, disilluminated by a neutral gas, it might be assumed that the heat absorbed from the heated tube only served to replace the heat absorbed by the inert gas introduced, the otherwise analogous case of disilluminating by air contradicts this explanation, because there can be no question of withdrawal of heat from the luminous matter when the flame itself becomes much hotter.

In disilluminating experiments with perfectly neutral gases free from oxygen, the temperature of the flame is naturally much reduced, because the heat is spread over a larger quantity of gas.

But W. Stein* has shown that, in these cases also, some other cause than a diminished temperature of the coal gas is operative; he shows that a gas, disilluminated by nitrogen still possessed a temperature sufficiently high to decompose coal gas passed through the flame in a glass tube, and produce a deposit of carbon; he observed further, that a gas, itself combustible—namely, carbonic oxide, the pyrometric effect of which closely approximates to that of coal gas, will disilluminate the flame of the latter. One volume of coal gas required for complete disillumination in the Bunsen burner 1.6 volume, and in the Brönner burner 0.9 volume of carbonic oxide. In this case, therefore, disillumination takes place without any material diminution of heat, and the only alternative left is the belief that rarefaction of the burning gas is, in reality, an important element, and by itself alone, apart from the often co-existing diminution of heat, is capable of disilluminating flame.

Wibel's experiment, therefore, by no means proves, as its author supposes, that the cooling of the interior of the flame is the whole and sole cause of disillumination, because the flame is at the same time, by the admission of the neutral gas, very materially altered in its composition—i.e., much rarefied.

When, therefore, some observers consider disillumination by an admixture of gas as due solely to rarefaction, while Wibel ascribes the effect entirely to refrigeration, it would now appear that the truth lies between these two opposite views.

It is difficult to devise experiments in disillumination, in which several causes may not be combining to produce the effect, and yet everything depends on severing, as far as possible, causes of disillumination not hitherto sufficiently discriminated. Only in this way does it become possible to obtain a clear idea of what is going on within the flame by studying separately from all others the operation of each individual cause that comes into play, and so dividing the very complicated relations into simple but simultaneous processes.

To this end it seemed necessary to bring the old maxim, that a flame is disilluminated by refrigeration, to a crucial test, by an experiment which should exclude all possibility of any other explanation. I proceeded in the following way to prove that refrigeration alone can disilluminate a flame, and that simply restoring heat will restore brilliancy, neither rarefaction nor oxidation interfering to affect the result.

From the point of a luting tube, or similar narrow tube, a gas flame, 3 to 4 centimètres in length, is produced, and directed horizontally against a vertically hung platinum plate, in such proximity that the flame spreads out and becomes perfectly blue.† We are not, however, justified in ascribing this well-known case of disillumination simply to refrigeration by the metal plate, because the flame has spread out, and its constituent particles offer a much more favourable surface to the air for oxidation, rarefaction, and refrigeration.

If the platinum surface is now heated to glowing, from the opposite side, by a powerful Bunsen burner, held horizontally, the gas flame becomes more brilliant as the temperature of the platinum surface rises, and finally regains its former brilliancy. Of course the metal plate must be perfectly clean, and must not be touched by the finger during the experiment, or the light will show a colour.

This proves that increase of temperature alone caused the brilliancy of the flame to return when disilluminated by the platinum plate.

If the Bunsen burner is removed, the gas flame remains brilliant for a short time, and then gradually becomes blue as the plate cools.

In this last experiment of disillumination by refrigeration, the objection could no longer be entertained, that the extension of the flame had any influence, because the slight change in volume produced by the cooling would tend in the opposite direction.

It is therefore experimentally proved that refrigeration alone act as a disilluminator on flame.

I have already noticed the reasons which justify us in concluding that rarefaction of a flame, by mixture of other gas, will also of itself

* Dingler's Journal, 1874, p. 543. Journal of Practical Chemistry, ix. 183.

† There is no deposit of soot from a blue flame.

produce disillumination* (Bunsen's flame, disillumination by carbonic oxide), and as a cold gas introduced into the flame will act as a heat-absorber equally with a metallic plate, we come to the conclusion that the disillumination of carbon-containing flames by the introduction of a neutral gas, is caused not only by refrigeration (absorption of heat), but also by rarefaction of the flame gas.

The fact that a flame, disilluminated by neutral gas or air, again becomes brilliant by heating the burner, I think may be explained by the following position:—A blue burning mixture of gas, consisting of coal gas and neutral gas or air, requires a higher flame temperature to make it brilliant than the temperature belonging to the brilliant unrefined flame. In the disillumination by air in the Bunsen burner, the flame, in consequence of the concentrated combustion, becomes far hotter, and yet only becomes brilliant when, by heating the burner, the flame temperature is raised still higher.

The support which Wibel found for his theory in the action of coal gas and oxygen gas, is explained by my view very exactly. When oxygen is introduced into one of the lower openings of a Bunsen burner while the other opening is closed, Blochmann observed, and Wibel confirms him, that disillumination becomes exceedingly difficult, and can only be effected by a strong current of oxygen and a cooling wire gauze; simply because the flame temperature, when pure oxygen is present, is very high.

The absorption of heat by the admission of the cold oxygen, as well as the absolutely higher temperature required by the mixture to become brilliant, are supplied, or nearly so, by the intense heat caused by the active, concentrated combustion in presence of pure oxygen. This causes disillumination to be so difficult; of course, a strong current of oxygen and cooling gauze will, at length, effect it.

It is well known that the introduction of pure oxygen in a proper quantity and manner will cause a gas flame to become exceedingly brilliant, a fact which, no doubt, is also based on the production of the highest possible flame temperature without, as when air is employed (in the Bunsen burner or blowpipe), the existence of a rarefaction highly detrimental to the brilliancy by the neutral nitrogen.

In this experiment it appeared that the greatest brilliancy of the flame occurred when the oxygen was introduced in a very moderate stream, but that a larger admixture of oxygen, equally with too small a one, produced a much feebler intensity of light. As, apparently, a much higher flame temperature ought to be attained when the quantity of oxygen corresponding to the maximum brilliancy was increased, it induced the conjecture, that the disilluminating effect of the excess of oxygen was not only through rarefaction and refrigeration, as with neutral gases, but that a third, perhaps still more powerful, cause must be in operation, and that this was to be found in the rapid oxidation of the light-producing matter.

This induced a more careful examination of the changes caused in the coal gas flame by an excess of oxygen.

If a flame from a wide burner is introduced into an atmosphere of pure oxygen, a greatly increased development of light takes place within the luminous flame-cone, which is much reduced in size, while the outer, non-luminous envelope is enlarged.

To show more clearly the effect of pure oxygen on the combustion of the light gas, it readily occurred to me to make the flame very thin, by letting the gas issue from a very narrow tube, or a slit-burner. The result was very surprising.

If a gas flame 4 to 5 centimètres long, issuing from a luted tube, is conducted into a vessel filled with oxygen, and with the mouth turned downwards, the flame is at once altered in shape; the outer, scarcely visible, envelope extends enormously towards the interior, and occupies nearly the whole of the luminous portion of the flame. Only a very small brilliant point represents the originally considerable light-cone, while the whole flame has become considerably less than its size in atmospheric air. This is caused by the absence of rarefaction through nitrogen, which cause also necessarily produces a much higher flame temperature. This kind of disillumination can be referred to no other cause than the considerable excess of oxygen which is diffused in the narrow flame, and causes immediate oxidation of the carbon, so that this latter is not obliged to remain for a time glowing, while rising in the flame to find further outwards, sufficient oxygen for complete combustion.

If this explanation be correct, it follows that this kind of disillumination through oxygen gas can only take place in flames, the luminous portion of which is converted by excess of oxygen into a feeble light, but that flames whose light depends on the presence of a glowing fixed or vaporous body not oxidizable by oxygen into a feeble light, should, even when issuing from the smallest aperture, always burn with a brilliant light in an atmosphere of pure oxygen gas, while the light will be increased because the flame temperature is considerably raised.

Direct experiment confirms this conclusion, and therefore the premises, most completely.

Hydrogen gas saturated with chromoxychloride, $\text{Cr O}_2 \text{Cl}_2$ [Cl], the flame of which is due to glowing chromoxide, burns in pure oxygen, even from the smallest aperture, with a brilliant white light. Hydrogen gas saturated with the vapour of fuming chloride of tin Sn Cl_4 [Cl_4] also yields, under these conditions, a blue flame, of much

* Frankland has also observed that rarefaction of a flame through diminished atmospheric pressure produces a diminished brilliancy of carbon-containing flames, and has established the fact that the enfeeblement is in proportion to the diminished pressure. I have not, however, adduced his experiment as a proof of the disilluminating effect of rarefaction, because it is not an absolute demonstration; for the diminished pressure also occasions a reduction in the temperature of the flame by which also the light may be enfeebled.

greater brightness than when burnt in atmospheric air. The product of combustion in this case also is a fixed, non-volatile substance (oxide of tin).

(To be concluded.)

Correspondence.

QUANTITY OF BRICKWORK IN RETORT-SETTINGS.

SIR,—I demur to the conclusion of your correspondent "C. T. S." (vide last week's JOURNAL), that the arguments in vol. xxiv., p. 227, demonstrate the error of the opinions of those who are in favour of putting a proper and reasonable quantity of brickwork in an oven of gas-retorts. The arguments referred to are irrelevant to the subject, as was well pointed out by a correspondent in the same volume, p. 538. No one that I am aware of desires to employ a useless excess of brickwork in a setting, the effect of which would be simply to obstruct the draught. There is, however, a happy medium that may be attained without following the *ipse dixit* of one that is fond of referring with tiresome iteration to the result of certain very questionable experiments with some unheard-of (either before or since) Belgian retorts. These, though supported only at the extremities, were asserted to be in such perfect preservation, after two or three years working, as to be intact from end to end, being fit for resetting, and were indeed reset. It would have been more satisfactory to have been told what the production of these none-such retorts was during the "two or three years," and what the consumption of fuel. Did any but the author of that racy anecdote ever hear of such wonderful prodigies? I fear they are as scarce as the fabled salamander or the sea serpent we read of every now and again. The name of the maker of these unique retorts, too, is withheld "for obvious reasons." In what respect "obvious"? Is it not obviously to the advantage of gas managers to know where to get the best article? It is simply unfair to whisper these big stories to the gas maker, giving "no name," and placing him in the position of the unfortunate Tantalus, who was made to stand up to his chin in water, with branches of fruit hung over his head, the water receding when he wished to drink, and the fruit when he desired to eat.

It is a fact to which there is abundant testimony, that English or Scotch clay retorts, set seven in a bed, and properly supported by transverse walls, produce from 5000 to 6000 cubic feet of gas per mouth-piece per diem during a period of three to five years, and with an expenditure of fuel under 20 per cent. Can Belgium, or Barcelona, or Brixton beat that?

The author of the Belgian story recently propounded the question, "What becomes of the light from a lighted candle when placed under a bushel?" George Stephenson answered that query by anticipation when he spoke of the sunlight bottled up in the coal. It would be more *à propos* of the subject, however, to ask, "What is the action of a sponge with water?" It absorbs its quantity, of course; but it does not go on absorbing it. No more does the brickwork go on absorbing the heat of the furnace. There, I have had my snarl; but the recital of that Belgian story, and the no-support theory, are enough to stir up the bile of a saint, much more that of your correspondent,

S. N. A. P.

THE "CHAMEROY" PIPE-JOINT.

SIR,—We have read with pleasure the particulars given by you in the article "A Treatise on the Science and Practice of the Manufacture and Distribution of Coal Gas," contained in your JOURNAL of the 28th of November last, respecting the pipes of our company. We desire, however, to point out to you an error which has crept into the sixth paragraph. You say, "On the other hand, engineers who have had experience in their use have condemned their employment, though principally on account of the difficulty of making the joint." Our system of jointing, called the "*joint précis*," is acknowledged by all engineers, even by those in England, to be the one which has attained the highest perfection, and which offers the greatest facility for laying pipes in trenches. You could call upon the directors of the European Gas Company, who are proprietors of the gas-works at Amiens, Caen, Boulogne, Havre, Nantes, and Rouen, and whose head offices are in London, and obtain a confirmation of what we are now writing.

If, in saying "making the joint," you mean "inserting a branch-pipe," there also you are in error.

In support of the rectification which we have now the honour of addressing to you, we enclose a list of the works executed by us from 1838 to Dec. 31, 1875, showing that we have delivered 9,200,000 mètres (about 5680 miles) of "Chameroy" pipes of from 1 to 0.035 mètre (39 inches to 1½ inch) internal diameter, representing more than 60,000,000 francs. The Paris Gas Company alone have laid more than 1,500,000 mètres (about 930 miles) up to the present time; while the European Gas Company, and many other very important undertakings, still make use of our pipes exclusively,

Paris, Dec. 28, 1876:

CHAMEROY AND CO.

LIGHTING BY ELECTRICITY.—Professor W. A. Anthony, of the Physical Department, Cornell University, U.S.A., sends the subjoined account of a recent experiment to the *Scientific American*:—"The following is a brief description of my experiments:—To my electro-magnetic machine, which was driven by a Brayton petroleum oil engine of five-horse power, wires were connected for conveying the electricity produced to a room some 300 feet distant, from which daylight could be excluded, for photometric experiments. In this room, the wires were connected with a Foucault regulator for the electric light, the light being produced by the passage of the electric curve between two carbon points. The electric light being too brilliant for direct comparison with the standard candle, I took from my house a common coal oil lamp, having a flat wick 1 inch wide. The electric light was found to be equal to what would have been produced by 234 such lamps. But 234 such lamps would have consumed nearly 16 lbs. of oil per hour, while the engine, whose power developed the electric current, which in turn produced the electric light, consumed but 6¼ lbs. of oil in the same time. This fact was stated in the paper giving the results of my experiments, merely as showing, in a striking manner, how very small a proportion of the energy of combustion of the oil in the common lamp is utilized as light."

Miscellaneous News.

METROPOLIS GAS SUPPLY.

THE ALLEGED NUISANCE AT THE HAGGERSTON GAS-WORKS.

The Vestry of St. Leonard's, Shoreditch, having addressed a letter to the Board of Trade, complaining of a nuisance caused by the operations of The Gaslight and Coke Company, at their Haggerston station, in the purification of gas by lime, the matter was submitted by the Board to the Gas Referees for inquiry and report, and the Gas Referees have made the following communication to the department:—

"17, Buckingham Street, Adelphi, W.C., Nov. 22, 1876.

"Sir,—We have inquired into the causes of the gas nuisance in Haggerston, to which our attention was called by your letter of the 20th of October and the letter and report enclosed therewith from the medical officer and vestry-clerk of St. Leonard's, Shoreditch.

"We have paid two visits to the Shoreditch gas-works, and have witnessed there the discharging of a lime purifier, which is the operation stated in the above-mentioned report to be the cause of nuisance.

"During a part of the time occupied in discharging the purifier, we made a circuit of the immediate neighbourhood of the gas-works, and observed in what positions and to what extent the smell of foul lime was perceptible. We also inquired of occupiers of houses or shops at short intervals throughout the circuit, whether they had suffered any nuisance from the neighbourhood of the gas-works, and if so, at what times.

"Our own observations showed that the foul lime smell was perceptible, on the side towards which the wind was blowing, at some distance from the works; and we believe that it may be carried to a considerable distance—probably half a mile or more—before it ceases to be recognizable. At the same time the smell was not, in our judgment, very offensive even close to the works, and the statement in the report, that 'the gas which is given off when the tanks are opened is a most foul, offensive, and dangerous poison,' is not in accordance with anything that we have observed at Shoreditch or elsewhere.

"The questions addressed by us to persons living in the neighbourhood of the works received in most cases the same answer—viz., that three weeks ago there had been bad smells from the gas-works, but not since then. One or two persons had nothing to complain of, and one or two others had noticed a smell from the gas-works more recently. One smelt it every night, whereas a purifier is only discharged every fourth or fifth day; another thought it very bad that morning, but fixed the time at which he had first observed it, two hours before the purifier was opened.

"It seems probable that the nuisance which occurred in the middle of last month was caused by a process of ventilating the purifiers which was intended to diminish the risk of nuisance, and which it was reasonable to try. But, unfortunately, under the actual conditions of the experiment, this process seems to have caused a far greater nuisance than that which it was designed to avert. The manufacture of gas cannot be conducted without the production of a certain amount of unpleasant smell, of which the occupiers of houses in the immediate neighbourhood of the works are naturally inclined to complain. When any new process slightly aggravates the unpleasantness, an outcry is easily excited; and when the process is one which the company have reluctantly adopted in lieu of a less costly and troublesome, but also less efficient, process, and when the local authority, as in the present case, simply accepts and records the opinions of the company's engineer, it is inevitable that the evils of the process should be exaggerated as they undoubtedly are in the Haggerston report.

"According to the best judgment we can form, the process of purification by lime, as now conducted at the Shoreditch works, can scarcely be considered to occasion a nuisance to the neighbourhood in which the works are situate, and we think the risk of nuisance may be further reduced by additional precautions.—We are, Sir, your obedient servants,

(Signed) "A. VERNON HARCOURT.

"WILLIAM POLE.

"JOHN TYNDALL.

"The Assistant Secretary, Railway Department, Board of Trade."

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health, on the composition and quality of the metropolitan waters in December, 1876:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitro- gen. — As Ni- trates, &c.	Ammonia.		Hardness (Clarke's Scale).	
				Sal- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.
<i>Thames Water Companies.</i>							
Grand Junction	Grs. 20.76	Grs. 0.128	Grs. 0.165	Grs. 0.003	Grs. 0.009	Degrs. 13.2	Degrs. 3.8
West Middlesex	22.61	0.100	0.165	0.006	0.009	14.3	4.6
Southwark and Vauxhall	21.14	0.114	0.150	0.002	0.008	14.3	4.6
Chelsea	19.18	0.132	0.135	0.006	0.010	12.1	4.6
Lambeth	19.46	0.110	0.150	0.001	0.007	12.7	4.6
<i>Other Companies.</i>							
Kent	26.73	0.007	0.216	0.000	0.002	19.4	5.1
New River	19.28	0.092	0.160	0.000	0.004	14.3	4.2
East London	23.21	0.052	0.135	0.002	0.006	15.4	3.4

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid, namely:—Grand Junction, West Middlesex, Southwark and Vauxhall, Lambeth, Chelsea, and East London. C. MEYMOTT TOWN, M.B.

GLASGOW STREET LIGHTING.

In our "Trade Notes from Scotland," on the 19th ult., it was stated that the sub-committee appointed by the Watching and Lighting Committee "had submitted an interim report on the comparative merits of various kinds of gas-burners for street lighting; and the committee, having considered the same, agreed to recommend that the inspector of lighting be instructed to remove all rat-tail burners from the public street-lamps, and substitute burners consuming not less than two cubic feet of gas per hour, and directed the sub-committee to continue their experiments and to report further. A good deal of discussion ensued in reference to this minute, and the report was remitted back to the committee."

The Glasgow News states that, at the fortnightly meeting of the Police Board, on the 25th ult., the Watching and Lighting Committee brought up their minutes, from which it appeared that, with reference to the

minute of last meeting regarding increased street lighting, the inspector of lighting *ad interim* reported that there were at present in use in the street-lamps about 5200 rat-tail burners; the cost thereof for gas, at the present rate (15s. 6d. per annum), would be about £4030, and if burners consuming two cubic feet of gas per hour were used instead, as proposed, the cost for gas would be double.

Treasurer OSBORNE, in moving the approval of the minute, said he might confess to the board that the committee were still in darkness on this subject; but one thing they had arrived at—namely, to recommend that the streets should be lighted with jets burning two feet of gas per hour. The increased cost was estimated at about £4000 per annum, but they had reason to believe that it would not amount to anything like that sum. The special committee were still making inquiries, and scientific experiments were being made; but they were not yet in a position to determine what plan they would ultimately adopt. There was one principle they should always adopt—namely, they should do their work well, and they should light the town well.

The CHAIRMAN (Baillie Collins) was not very clear as to the meaning of this minute. He was at one with the committee that the rat-tail burners should be removed, but the committee got authority to do that on the 15th of September. He had failed to obtain information why that minute, which provided for an increase in the lighting of the city to the extent of 30 per cent., had not been carried out. They were told that the reason why Horton's burner, then recommended, had not been introduced was that each burner cost 4d. instead of 2d.; but he held that the first cost of the burner was as nothing compared with the maintenance. He wished them to understand that the increased charge of £4000 would entail an additional tax of 3d. in the £1, and were they prepared for that? He thought that this subject required more consideration, and moved an amendment to that effect.

Mr. OSBORNE read a letter which the Lord Provost had received, as to the Edinburgh gas. The burner which consumed 2 feet per hour cost 3s. 10d., and the others which burned one foot per hour, by a regulator, also cost 3s. 10d. He, however, remarked that the small burners were better than the ones used in Glasgow, while the large ones were not quite so good.

Baillie ADAMS seconded the amendment.

Mr. URE, after referring to the various kinds of burners which had been before the board, said the question was not so much one of burners as one of lighting the streets. They had found, on examination, that the regulators on the lamps were altogether unreliable; for out of eight which they tried four were altogether unreliable, in some cases burning one-half more gas than they ought to have done. Indeed, it was a question whether they should not burn gas in the lamps without regulators. He was prepared to prove that the present gas lighting was altogether insufficient. They paid far less for the lighting of the streets than did second-rate cities in England, and he was almost prepared to prove that they got less than they paid for. They had 8010 public lamps at a cost of £8600, or about an average of 21s. 6d. per public lamp, while their population was about 550,000. In Manchester they had 10,762 lamps, costing £18,823, or an average cost of 35s. per lamp, and that, too, with a population of 200,000 less. In Leeds, with a population of 291,000, they had 6000 public lamps, at a cost of £12,000, or an average of 40s. each. He would like to draw their attention to another fact—that while in Leeds, with a population of 291,000, and spread over a much larger tract of ground, there were only 340 policemen; in Glasgow there were fully 1000, and it had been said a lamp was better than two policemen. Another thing was that about 4000, or one-third, of the whole of the lamps in Glasgow were paid for by private individuals. He, therefore, suggested that, while the central parts of the city were well lighted, additional light should be thrown upon the residential part, as it was in the quiet streets that there was a great deal of concealed crime.

Mr. W. MILLER said the question they had to deal with was the 5200 rat-tail burners. These at present cost £4030, and if a burner which consumed only a foot of gas per hour cost that sum, another burning 2 feet would cost £8060. It was, therefore, for the board to fix what increase they proposed to make. For that sum they would get more than double the light in those places where the rat-tails were at present, and it was well known that these included about five-eighths of the whole of the lamps in the city. He contended that the committee were just as able to judge of that matter as the board, and concluded by seconding the motion for the adoption of the minutes.

Baillie SCOTT mentioned that in the report presented to the board in September last they were promised double the light at an additional cost of £1200 per annum; and the question before the board was whether they would now pay £4000 for that double light or £1200. He concurred in the suggestion which had been thrown out, that the streets where the additional light was to be placed should be selected—especially those places where crime was possible and even probable—and if that arrangement was carried out a great deal of money might be saved to the city. He would hesitate very much before he would agree to a taxation of an extra halfpenny per pound.

Mr. W. R. W. SMITH supported the statements of Mr. Ure, and remarked that if the board should agree to burn an additional foot of gas per hour in the lamps, they should leave the sub-committee to try and find out the best and cheapest burner. He maintained that it was from Dr. Wallace that Mr. Foulis obtained his data, and it was from him the board ought to seek direction in a matter of this kind. He supported the motion.

Baillie LAMBERTON contended that the town of Leeds was spread over a much larger area than Glasgow, and that according to the ground occupied it was not so well lighted. Indeed, he did not know any city so well lighted as Tringate, and he also thought more light would be obtained by adopting the square instead of the round lamps.

Baillie WALLS said there were two questions in connexion with this subject which required attention—namely, that of the regulators and that of the burners. They were not all at one on the subject of the burners—Dr. Wallace and Mr. Foulis were not at one—and he thought an effort should be made to ascertain which was the best and most efficient burner that could be adopted. He was quite willing that the minute should be adopted on the condition that the rat-tail burners be used until it was definitely ascertained which was best.

Mr. MORR considered that it was absurd to suppose that a square lamp would give more light than a globe. He was also satisfied that more information was required, and he did not agree with those who seemed to think that some dreadful calamity was certain to happen unless more light was given. There were a greater number of embezzlements and robberies during the sunlight than during the darkness; and immorality would exist, although light was abundant in the streets, just as it did in the darkness. He thought, therefore, that the subject should be fully considered before any action was taken.

It was ultimately agreed that the minute be approved, but that the question with reference to the burners to be used should be remitted to a joint committee of the Police Board and the Gas Commissioners to ascertain which is the most efficient burner that can be used instead of the rat-tail.

GLOUCESTER NEW GAS-WORKS.

[From the *Gloucester Chronicle*.]

The growth of Gloucester, which has been going on rapidly during recent years, necessitated an enlargement of the old line of the borough boundaries, so as to take in the suburban extensions which had been spreading in almost every direction. By this step the population of the city was about doubled, and the area of Gloucester more than trebled. In the face of these prospective changes the quiet old "Gloucester Gaslight and Coke Company," with their small works in a thickly-populated neighbourhood, were fully conscious they could not properly respond to the requirements of the enlarged city, and that the erection of extended works was imperative. The Local Board of Health insisted that the company should remove their works from the present site, and so in 1872 this prosperous company decided upon the erection of new works upon a commodious site beyond the city boundaries, where there would be "ample room and verge enough" to manufacture gas, with all improved modern appliances, without annoyance to neighbours. To do this it was necessary for the company to apply for a new Act, and in it they obtained powers to increase their capital by the issue of new shares, and also to borrow additional capital. Under the pressure of the Local Board the company undertook to close the manufacture of gas at their present works in the city within a period of eight years from the passing of their Act, unless with the permission of the Local Board. The Royal Assent was given to the Bill in May, 1872, so that of this period five years will have elapsed next May. There is, however, no fear but that the new works will be in full operation long before the date fixed for the closing of the old works.

The most favourable district which offered itself for the new works, as presenting facilities for the requisite water communication, was that bordering the Bristol Road—a dead level, with the ship canal on one side, and the two great railways, the Midland and the Great Western, on the other. In selecting the site, the company were naturally desirous of not going too far out into the country, as, besides the increased cost of mains, the working expenses would naturally be heavier the farther the works were removed from the coal-supplying and coke-consuming city. The piece of land known as the "Exhibition Field," where the Royal Agricultural Show was held in 1853, was first pitched upon as being most desirable, and application was made to the owners, the Ecclesiastical Commissioners, who sent down a surveyor. On his report, however, they decided they could make a better bargain with their land if it were reserved for building purposes, although the gas company would have given £300 an acre; and the commissioners soon afterwards expended a large sum in the construction of a road uniting the Bristol with the Tuffley roads. Two fields near the back of this spot were next considered, but as works on this site would be in full view of Hempsted Court, Canon Lysons threatened parliamentary opposition, and offered the company land further out, at a much less sum. As the threatened opposition, with this fact before the Parliamentary Committee, might have succeeded, the company decided upon accepting the offer, and 10½ acres of land were agreed to be taken, with a lie-by on the other side of the road along the canal, which the canal company agreed to allow the gas company to construct, with a tramway running across the high road from the company's works. Plans for the new works were prepared by Mr. Morland, the engineer of the company, who has designed the whole with a view to carry out all modern improvements in gas manufacture. Tenders were invited for the construction of a portion of the works, which it was intended to complete before they are extended to their full capacity. Unexpected difficulties, however, had arisen. The strikes which had taken place, and the advance in the price not only of manufactured articles, but of raw materials, caused a suspension of the works. Had their construction been at once proceeded with, the price of iron, &c., would have greatly increased their cost, and thus the company would have been saddled with a heavier perpetual charge for interest. In the summer of 1873 the excavation for one of the gasholders was commenced, and the clay extracted was found to be admirably adapted to the manufacture of bricks, each thousand requiring about three cubic yards of clay. The price of iron having fallen, the laying of the necessary mains, &c., was proceeded with; the difficulties, however, before referred to, with others which pressed heavily upon Mr. Meredith, who commenced a contract in February of last year, more especially those connected with the price of labour, compelled him to throw up his contract, and the company then took its completion into their own hands, and the work has since been steadily progressing. It is, however, yet far from completion, but in consideration of the importance of the works, and to satisfy the public that Gloucester will have its new gas-works all in good time, we proceed to give a sketch of them as they are intended to be when completed, with an account of the progress made up to the present time.

The site of the works is on the left-hand side of the Bristol Road going from Gloucester, a short distance past the Hempsted Bridge. The complete works will comprise four gasholders and four retort-houses. A road will run through the centre of the works, on each side of which the gasholders will stand. Only one gasholder and one retort-house have yet been erected. The tank containing the gasholder is 35 feet in depth and 132 feet in diameter. It has been lined with bricks, about 800,000 having been used. In digging out the enormous mass of clay, which is the blue-lias of the district, only a few of the ordinary fossils were found—namely, ammonites and gryphæ. From the clay thus obtained over two million bricks have been made, and enough remains for another million. Most of the clay came out in a shaly state. It was crushed by being passed between rollers, and was found, without any admixture, to make good ordinary bricks. Owing to the difficulty of keeping the brickmakers to their work, a brick-making machine has been introduced, and has worked well, making the bricks with great certainty and speed. The gasholder is what is known as a single lift, and will hold nearly half a million cubic feet of gas. This will be sufficient for present requirements, while the gasholders of the old works continue to be utilized. The first of the four retort-houses will contain 168 retorts, comprising 28 beds of six in each. Patent lids will be used for the retorts, by which luting is rendered unnecessary. The house is 150 feet long and 62 feet wide. This great width will give ample room for working the retorts, and will materially conduce to the comfort of the men by reducing the heat and allowing of more ventilation, while space will be afforded for the introduction of machinery for filling and emptying the retorts, should such be decided upon. At the end of the retort-house is a circular chimney-stack, 90 feet in height, and 5 feet 6 inches in the clear. This is so built as to be wider inside at the top than at the bottom, by which increased draught is secured. It is being fitted with a copper-wire lightning conductor. Near this is the stokers house, with outhouses adjoining, and large coal-stores will be constructed by the side of the retort-house. The gas leaves the retorts by pipes leading to a main, which conducts it, with all its impurities, to the condensers, which are not yet put up, though the material is on the ground. The tar, &c., which results from the cooling of the gas, will run along pipes into a huge tar-well, which has been sunk in the ground, and which will hold about 60,000 gallons. A new apparatus, known as the steam-jet exhauster, will be employed to draw the gas from the retorts, and along through the series of pipes and apparatus by which it is purified

until it reaches the gasholder. After the gas has passed through the condensers, it is subject to what is known as the "scrubbing" process, the gas being brought into contact with water, which descends in a shower, carrying with it the ammoniacal and other impurities with which it is charged. These scrubbers are now in process of construction. The gas next undergoes the process of purification and revivifying, passing on to the purifiers, of which four have been erected. Externally they resemble gasholders. They are made of iron, and are each 24 feet square, which is double the size of the old ones. Inside these purifiers will be placed a number of wooden perforated trays, loaded with oxide of iron and occasionally lime, and the gas being forced through successive layers of these materials, the sulphuretted hydrogen which it contains is absorbed by the oxide, and the carbonic acid, which, however, is scarcely considered an impurity, is absorbed by the lime. Any deficiency of illuminating power resulting from the presence of carbonic acid can, however, be generally more cheaply repaired by the use of a little cannel coal in mixture with the ordinary coal, and then the oxide can be used alone in the purifying process. The oxide of iron used for this purpose comes chiefly from the bogs of Ireland, where it is known as bog ochre. The oxide can be used for some time, and after being exposed to the air and turned over it can be employed 30 or 40 times before it becomes so saturated with sulphur as to be useless for gas purification. It is, however, then useful to the sulphuric acid manufacturer, into whose hands it is transferred. These purifiers are ingeniously constructed, so as to allow of their being easily charged and emptied. The cover of each of them, which weighs about five tons, is made to traverse a tramway, and by means of a small hydraulic apparatus one man can easily raise and remove it. A novelty has also been introduced in the method of joining together the iron plates of which these purifiers are built. Instead of a caulking of iron rust being placed between the plates, which was the old method, the plates are first planed smooth, and they are then screwed up tightly together without the possibility of leakage. A shed will be erected over these purifiers and over other apparatus in the different portions of the works. When the gas is thus purified, and rendered fit for consumption, it passes on through the meter to the gasholder. This meter will be capable of passing and registering 40,000 feet of gas per hour; but arrangements are made for adding another meter. The next gasholder which will be constructed will be placed between the present one and the road. It will be on the telescope principle, and will hold double the quantity of the existing one. Two others of the same capacity as the present may be constructed on the opposite side of the road which passes through the works. The storage capacity of the four gasholders will be over three million cubic feet. The second retort-house will be constructed at the back of the present one, and the two others in corresponding positions on the other side of the road through the works; they will be connected in front probably by coal stores, &c., with a clock facing the Bristol Road. The works when fully completed will be capable of manufacturing three million cubic feet of gas per day, which is about five times the present make. The lie-by which has been formed on the bank of the canal is 200 feet long, with a depth of 15 feet of water. It has been built in a most substantial manner. A tramway will run along its whole length, and will furnish every facility for landing coal, &c., and the removal of tar and coke. It would, however, be a great advantage if the company could obtain a siding into their works from the Midland and Great Western lines at Tuffley, a desideratum which may perhaps be obtained when the Littleworth level crossing having become unbearable, the dock line will be diverted from its present route across two much-frequented roads by the Park and Spa, to the banks of the canal, and across the Bristol Road to a junction at Tuffley. The works at present being carried out also include a pair of boilers and chimney-stack, which are built (one being a duplicate in case of accident), with engine-house, &c., and four cottages for men engaged on the works, whom it is desirable should be at hand. This feature of duplicating the apparatus is largely employed in other portions of the works. A house for the manager and engineer, Mr. Morland, has also been built adjoining the road, and some stables and other requisite buildings are constructed. Owing to the thickness of the clay soil no water has been found in the deepest excavations that have been made; consequently tanks have had to be built for the collection of rain water for the houses. A well is to be constructed, which will be filled from the canal. This will supply a cistern, from which water will be conducted into the retort-houses and wherever it may be required. At the entrance to the works, just inside the gates, will be on one side the gate-keeper's house, weighing machine, &c., and on the other the test-house, experimental room, &c., with the governor for regulating the pressure of the gas as required. Gas-mains of 24 inches diameter have been laid to the Bristol Road; from the works up into the city and through the chief streets the diameter of the main is 18 inches, and provision is made for carrying another 18-inch main when necessary. In carrying out this work many obstacles were encountered, not the least being the lines of sewerage which had to be intersected. But all these were promptly met and successfully overcome by the engineer, who deserves no little credit when it is remembered with what nicety gas-mains have to be laid in regard to their levels, with due arrangements for intercepting and drawing off the water which condenses from the gas, for which receptacles are made below the level of the mains. It is expected that the works will be sufficiently complete to commence working early next summer.

ENRICHERS.

[From the *American Gaslight Journal*.]

It is proposed to give our readers some results obtained by using Mr. Farmer's "Candle Feet" formula, in determining the relative values of different "enrichers," in the manufacture of gas from ordinary caking coal. The gas maker is constantly under pressure of one kind or another to adopt this or that kind of coal, or oil, or naphtha, in his works. Often his decision is made from a general idea that "there is no saving in it," or that "it is profitable," without having any well-established facts to base his opinion upon. Sometimes necessity forces the use of materials which are the best to be had, although it is known that others, if obtainable, would be better.

In this statement, for the purpose of a fair comparison, certain things must be assumed as a basis of calculation, as, for instance, the price of coal, naphtha, or petroleum, which, from its very nature, is a variable quantity; but, if our figures are right for one price, they can easily be adapted for different prices.

By enrichers we mean anything mixed with or added to the ordinary caking coals, whereby the yield may be increased without lowering the quality and candle power of the gas. The most common enrichers, and the most generally available, are cannel coal, and either petroleum or some of its products. There are some minerals known as the Ritchie mineral, the Australian shale, and the "Albertite," which have great value as enrichers, but they are unfortunately scarce, and consequently high-priced. It is understood that the Boston Gaslight Company now use what little "Albertite" there is, and have obtained some excellent results from it. The other two varieties are not in the market. The ordinary cannels in general use in the East are the Kanawha cannels, such as the Cannelton and Peytona. The most common caking coals are the Penn

and the Westmoreland, and, using these as the basis, it is proposed to examine the relative value of the others as enrichers—for the purpose of making an 18-candle gas, with a yield of 4·66 cubic feet to the pound, or, in other words, to make a gas giving 84 candle feet.

Petroleum.—From the best experiments that have been made it has been found that petroleum will yield 70 cubic feet, of 70-candle gas per gallon. In practice it is believed that the experimental results cannot be obtained invariably, or fully, on a long working, and that the value of the gallon of petroleum will not exceed 55 or 60 cubic feet of 70-candle gas; but, for the purpose of this paper, we will assume the experimental value to be correct. A gallon of petroleum weighs about 6·6 lbs., or 339·4 gallons = 1 ton of oil—which, at 15 cents per gallon would cost 50·85 dols. One ton of oil yields $(2240 \times 70) \div 6·6 = 23,757$ cubic feet of gas, or 10·6 cubic feet per lb., which would give us for the "candle feet" of petroleum $-10·6 \times 70 = 742$.

Naphtha.—One gallon of naphtha will yield 60 cubic feet of 60-candle gas, weighs about 5·5 lbs., or 406·3 gallons = 1 ton of naphtha which, at 10 cents would cost 40·73 dols. A ton of naphtha then would yield $(2240 \times 60) \div 5·5 = 24,436$ cubic feet of gas = 20·9 cubic feet per lb., and its candle feet would be $10·9 \times 60 = 654$.

Albertite.—This is a very rich mineral, and perhaps its full value is not yet determined, but owing to the fact that the supply is limited, it is not of so general an interest as it otherwise might be. Experiment has shown that, for a yield of 15,000 feet per ton (6·69 feet to the lb.) it will give a 58-candle gas. This is believed to be a low estimate, but, nevertheless, this having been undoubtedly obtained; we take it on this basis, which would give us for this enricher 388·02 candle feet. It costs about 23 dols. per ton.

The Kanawha Cannels.—These are coals well known in this market, and their value is variously estimated; but we deem it perfectly fair to assume that they will give, upon a yield of 5 feet to the pound, a 40-candle gas. We are aware there is a difference in the value of the coals according to the kind, the method of marketing, and the exposure to which they are subjected; but for a general discussion the above value is taken, because it is known that they will give that in practical working when tolerably fresh-mined. So that for theseannels we have 200 candle feet.

Caking Coals.—For the basis of our mixture we take either the Penn or Westmoreland coal, which are very nearly identical in quality, and will ordinarily give 4·25 feet of 16-candle gas—hence the candle feet will be 68. From the above we have the following table of candle feet and price:—

	Candle Feet.	Price per Ton.	Remarks.
Petroleum	742	50·85 dols.	15c. per gall.
Naphtha	654	40·70 "	10c. "
Albertite	388	23·00 "	—
Kanawhaannels	200	10·00 "	—
Penn and Westmoreland.	68	6·00 "	—

For the purpose of determining the cost of materials for mixtures, let us assume the above values of candle feet and cost as correct.

Taking a mixture of 5 per cent. of Albertite and 95 per cent. of Penn, what will be the yield if 18-candle gas is made?

$$·95 \times 68 = 64·60 \text{ candle feet of Penn.}$$

$$·05 \times 388 = 19·40 \text{ candle feet of Albertite.}$$

$$84·00 \text{ candle feet of mixture.}$$

Now, if this is 18-candle gas, from the definition of candle feet, we have a yield of 4·66 feet to the pound—as $84 \div 18 = 4·66 +$. If the yield was increased to 5 feet per pound, the candle power would be $84 \div 5 = 16·8$ candles.

Let us now find what per centage of naphtha would have to be used to obtain the same amount of equal gas; i.e., using Penn coal, how much naphtha must be used as enricher to give us a mixture of 84 candle feet = 4·66 feet to the pound of 18-candle gas.

Let x = per centage of naphtha, then

$$(100 - x) = \text{per centage of caking coal}$$

$$654x = \text{candle feet of per centage of naphtha}$$

$(100 - x) 68 = \text{candle feet of per centage of caking, from which we have the equation}$

$$654x + (100 - x) 68 = 84 \times \frac{100}{18}$$

As the sum of the candle feet of the parts of the mixture must equal the candle feet of the mixture, which is to be 84—solving the equation, we have $x = 2·73$ = per centage of naphtha, and $(100 - x) = 97·27$ per centage of Penn.

Proof—

$$654 \times ·0273 = 66·143$$

$$68 \times ·9727 = 17·854$$

$$83·997 = 84 \text{ candle feet of mixture.}$$

Having determined the relative amounts of the two enrichers necessary to produce the same gas, let us now see what is the relative cost of the materials.

1. Penn and Albertite.

$$0·05 \text{ ton of Albertite at } 23 \text{ dols.} = 1·15$$

$$0·95 \text{ ton of Penn at } 6 \text{ dols.} = 5·70$$

$$1·00 \text{ ton of mixture} = 6·85 \text{ dols.}$$

The Albertite yields 15,000 feet of gas per ton, and the Penn 9520 feet.

$$·95 \text{ of } 9,520 = 9044 \text{ gas from Penn.}$$

$$·05 \text{ ,, } 15,000 = 750 \text{ ,, Albertite.}$$

$$\text{Total yield of mixture} = 9794$$

$$\frac{6·85}{9794} = 69·9 \text{ cents, cost per 1000 Penn and Albertite mixture.}$$

2. Penn and Naphtha.

$$·0273 \text{ tons of naphtha at } 40·70 \text{ dols.} = 1·11 \text{ dols.}$$

$$·9727 \text{ ,, Penn ,, ,, } 6·00 \text{ ,, } = 5·84 \text{ ,,}$$

$$\text{Cost of mixture} = 6·95 \text{ dols.}$$

$$·0273 \text{ of } 24,436 = 667 = \text{gas from naphtha.}$$

$$·9727 \text{ ,, } 9,520 = 9260 = \text{ ,, coal.}$$

$$\text{Total yield of mixture} = 9927$$

$$\frac{6·95}{9927} = 70 \text{ cents, cost per 1000 of Penn and naphtha mixture.}$$

From which it would appear that the cost of the materials, for the gas made from the two mixtures, is about the same on the basis assumed.

By a similar course, it will be found that 2·37 per cent. of petroleum, and 97·63 per cent. of caking coal, will give 84 candle feet; that the cost of the materials will be 7·06 dols. per ton, the amount of gas made 9857 feet, which will make the cost of materials for 1000 feet equal to 70·6 cents.

Using the Kanawhaannels, by the same kind of calculation, it will be found that the per centage of channel necessary is equal to 12·12, and the per centage of caking coal 87·88; that the cost will be 6·48 dols. per ton,

the yield 9723 feet; and the cost per 1000 feet for the materials will be 66½ cents.

Table of Mixtures giving 84 Candle Feet.

Enrichers.	Per Cent. of Enricher used.	Per Cent. Caking.	Cost per 1000 Feet for Material.
Petroleum*	2·37	97·63	70½ cents.
Naphtha†	2·73	97·27	70 "
Albertite	5·00	95·00	69½ "
Cannels.	12·12	87·88	66½ "

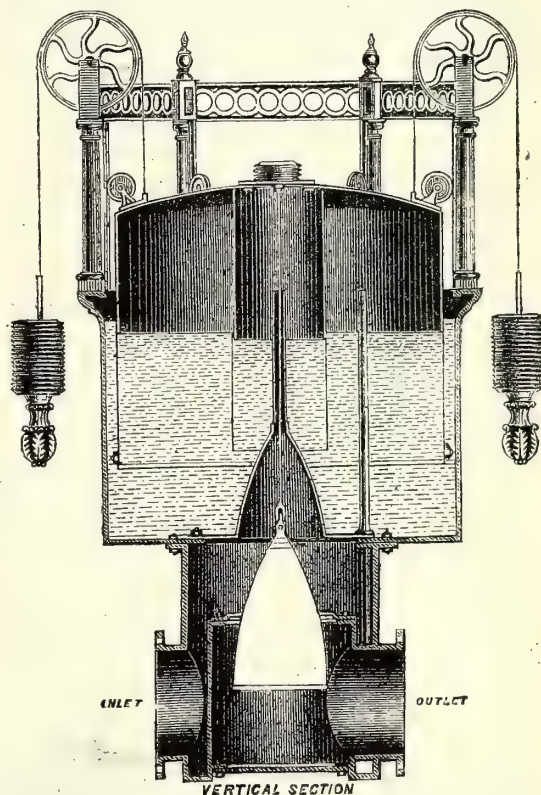
* 15 cents per gallon.

† 16 cents per gallon.

The question of cost is considered only with reference to the purchase of the materials, not deducting for coke and other residuals. When oil is used, the coke will be diminished not only by the amount that would be obtained by using coal, but also by the amount used as fuel in distilling the oil.

It takes 7½ bushels of coke to convert 42 gallons of oil, or 72½ bushels for one ton of oil. One ton of coal can be carbonized by about 18 bushels of coke. We believe that this method of comparison is a correct one, and it certainly gives results that correspond very closely with actual workings.

BRADDOCK'S COMPENSATING GOVERNOR.



The object of this invention (which has been designed and patented by Messrs. J. and J. Braddock, of the Globe Meter-Works, Oldham) is to regulate and govern the flow of gas in pipes, for the purpose of maintaining an uniform pressure at the outlet of the governor, under all the various changes of the flow of gas, when such flow is not in excess of the capability of the size of the governor, and the quantity of gas it is made to control.

The class of governor to which the invention applies principally is that in which a bell floating in water is caused by the pressure of the gas to raise or lower a conical or other plug bedding against a valve-seat, thus regulating the supply, and keeping it of an even pressure.

In operation, the gas is caused to flow in such a direction that its tendency is to open or depress the plug or valve, and in order to counteract the effect of the varying inlet pressure on this plug, there is constructed within the bell a compensating chamber, the area of which is equal to that of the plug, and communicating with the gas at the inlet pressure. Thus, the pressure tending to raise the bell and depress the valve being equal, an equilibrium is maintained.

The main part of the bell is connected by means of a pipe to the gas in the main or at the outlet pressure, and the bell itself being weighted or counterbalanced accordingly, this outlet pressure will be steadily maintained, however the inlet or initial pressure may vary.

It will, of course, be understood that the initial pressure must in all cases be greater than the outlet pressure required.

From the engraving it will be seen that only the gas required to operate the bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. It is also apparent that in case of accident to the bell no more gas can escape than would pass up the pipe covering the valve-rod and bell supply-pipe.

These governors have been made and sent out of various sizes, for from 2 to 24 inch mains, and give most satisfactory results. They can be made with float in the bell, or counterpoise, as per section.

The invention is also applicable to dry governors, by connecting the compensating chamber by means of a diaphragm.

ON ANTHRACENE PRODUCTION.

By Dr. FREDERICK VERSMANN.

[From the Chemical News.]

My investigation on anthracene testing, published in the last three numbers of the *Chemical News*, has brought me many inquiries and communications, which induce me to supplement this purely scientific investigation, and its practical application, by some remarks on the commercial aspect of anthracene manufacture generally; and I do so simply because I think my information may enable me, perhaps, to throw some light upon this important question, and also because a crisis in this manufacture seems to become inevitable, and that at no distant time; the serious consequences of which it may well be worth while to weigh and to consider beforehand.

We all recollect the profound sensation created by the grand discovery of artificial alizarine and its manufacture on the largest scale, which last

commenced only five or six years ago. In recalling the sanguine expectations raised by this new industry, its present dismal position appears scarcely credible, and yet the fact stands out only too clearly, that no other branch of chemical industry, inaugurated under such bright auspices, has in its results fallen so short of just expectations; nay, I might also say, has become so disastrous to nearly all persons who remained engaged in its pursuit. True, the first pioneers—those who were actually at work while the first excitement was at its height—were wise enough to sell their fortunes at prices which brought them large profits. First among these stood Messrs. Gessert Brothers, who sold their, at that time, flourishing concern to a company, and the English alizarine manufacture has since changed hands a second time.

Putting aside a very few German alizarine makers, who profess to work at a profit, we have at present a disheartening list of many large undertakings which are hopelessly insolvent, or at least uncomfortably near to it.

In Germany all public companies are very properly compelled by law to publish their annual balance-sheet in at least three newspapers, and such document—published only on the 10th Nov. in the *Cologne Gazette*—by the "*Chemische Industrie Actien Gesellschaft zu Elberfeld*," formerly Gessert Brothers, tells its own tale in a few figures. This official document informs the shareholders that the loss on the twelve months' working, ending at Midsummer last amounts to £40,000; and as this dismal statement is merely a repetition of previous equally unsatisfactory balance-sheets, there seems to be little doubt that at next month's general meeting the company will be wound up, and that very likely the whole capital—amounting to some £180,000—will be lost.

Again, a private firm, Messrs. Schöneberg and Hufschmidt, also of Elberfeld, recently suspended payment, with liabilities estimated at £90,000, and assets £60,000, or a deficit of £30,000.

The "*Stueckfärberei Gesellschaft*" and the "*Elberfeld Aniline und Alizarine Gesellschaft*," also joint-stock companies, have been defunct for some time, their capital having been entirely lost.

Plain facts like these—and the list might easily be made more complete—may well lead to an inquiry into the cause of such calamity. It may be justly argued that bad management, want of skill or proper knowledge in the manufacture, and, above all, the general depression in all trades, especially in the cotton trade and everything depending upon it, have a great deal to do with the non-success of so many undertakings; but I believe the real and primary cause to be the most unhealthy state of the anthracene manufacture.

The fact is the production of anthracene far exceeds its demand, which, suddenly sprung up some years ago, tempted many distillers to manufacture an article of a very doubtful quality; competition unreasonably ran up the price of tar, and the principal benefit was pocketed by the gas companies, and by them alone.

I am induced to give a few figures which will clearly show this disproportion, and which, I feel sure, will be very near to the actual truth, because I have every reason to depend upon their correctness.

Up to the end of 1877 there will be produced in England alone, including present stock, at least 1400 tons of pure, or 100 per cent., anthracene. The requirements of all the alizarine works at present do not exceed 2 tons a day, or 600 tons a year, of pure anthracene. The next year is expected to see a considerable increase; but if with present low prices we even double the quantity—making it 1200 tons—England alone will produce 200 tons of pure anthracene more than required.

But it must not be forgotten that the Continent also supplies large quantities. The Paris Gas Company utilize their own residues, and produce, together with the other large French towns, at least 250 tons. Belgium—and, more so, Holland—is very active; and the production in Germany, especially in large towns—such as Berlin and Hamburg—is not inconsiderable; and even America sends her quota, if not in large quantities. Altogether there will be during 1877 an excess of many hundreds of tons of pure anthracene, and, consequently, low prices. The inevitable reaction will produce a reduction in the price of tar, which already shows itself in Germany. A paper there offers repeatedly, and for some time, six tar contracts, without any response; the distillers bide their time, and their English brethren will soon find out, if they have not done so already, the necessity of this line of action.

But—and here I come to the main point of my argument insisted upon in previous communications—the tar distiller must feel to find his advantage in the manufacture of a better and purer article. He must return to the early times of his operations, when with low tar prices a moderate price for anthracene paid him well.

The large stock accumulating during 1877 may somewhat interfere, but after that the permanently reduced prices of tar will enable him to supply genuine anthracene at paying prices.

It is well known that true, pure anthracene passes over at a certain limited stage of the distillation, and this product only was originally sold; the suddenly increased demand for large quantities induced the distiller to separate as much solid hydrocarbons as possible, and thus the quality of anthracene deteriorated to such a degree that any article tested by alcohol, and showing a melting point of 190° C., was sold as anthracene. The increasing impurity of the merchandise called forth improved methods of analysis, until at last the chemist is obliged to demonstrate, by more delicate tests, that most of the anthracene at present in the market is of a very doubtful character.

I think the tar distiller may well bear this in mind, because, upon the good quality of anthracene, to a great extent depends the future existence of the alizarine manufacturers; and the more flourishing these, the better will be the prices of anthracene.

WATER SUPPLY OF NEW YORK.

A correspondent of the *Standard* furnished, in a recent communication to that paper, some interesting facts in connexion with the water supply of New York city. According to his statements it appears that three months ago there was experienced a considerable deterioration both in the quality and the quantity of the supply. The Murray Hill or main city reservoir was only half full, the summer and autumnal droughts having been almost unparalleled in that latitude. The usual daily allowance to the city of 100 million gallons had been reduced to 70 millions, which, certainly, but for the existence of enormous waste somewhere, ought to have been amply sufficient for the needs of the inhabitants, seeing that the average daily supply to London by the various water companies is only about 122 million gallons. The *Standard* correspondent states that "the enormous consumption of water in New York comes from wastes—waste in factories, where thousands of gallons are recklessly used where tens ought to suffice; in bar-rooms, hotels, drug stores, and many residences, where the water is kept constantly running."

"The setting in of winter promises to refill the lakes, the reservoirs, and the city pipes; but they are low yet. The water-rents in the city vary from 4 dols. to 2700 dols. a house. There are about 55,000 buildings that pay from 4 to 10 dols. rent a year, about 19,000 that pay from 11 to 20 dols., and a thousand paying larger sums; so that there are some 75,000 buildings whose aggregate water-rents are 800,000 dols. Thus, a liberal supply of water is liberally paid for. There are no meters used here, and the tax is levied by the number and size of taps in the building. A tap

may be kept running 24 hours a day, and many rent-payers seem to keep theirs so running in order to get the full worth of their money.

"It is the policy of the Department of Public Works of this city to provide against the possibility—so far as human foresight can do so—of another water famine. There are now five reservoirs—the Murray Hill or 42nd Street, the old one in Central Park of nearly 150 million gallons capacity, the new receiving one in Central Park of about one billion (1000 millions) capacity, the Croton reservoir at the head of the aqueduct of 500 million, and, finally, the storage reservoir at Boyd's Corners, estimated at about 2700 million gallons; making a total reservoir capacity of some 4350 million gallons. A new storage reservoir is now in process of erection with a capacity of 3650 million gallons. The aggregate reservoir capacity (counting both storage and receiving, as well as distributing reservoirs) will, when the new one is finished, hold not far from 8000 million gallons. In addition to that there are 13 lakes or lakelets in West Chester and Putnam counties, whose united capacities amount to over 3000 million gallons. These once filled give a maximum supply on hand for two and a half months.

"The Croton watershed embraces 339 square miles, and this, with the usual annual average rainfall of 49 inches, ought to give a daily supply of 300 million gallons, as the engineers estimate. But somehow, from evaporation or other diversions, the city gets less than one-third of this at times.

"Thirty years ago—from 1842 to 1848—a daily supply of even 18 millions gave 40 gallons a day to each inhabitant, and the supply was found to be amply sufficient."

The proposals for increasing the existing supply are—1st. The construction of another aqueduct, at a cost of between 20 and 30 millions of dollars; 2nd. The utilization of the salt water of the rivers and bay for all sidewalk, sewer, water-closet, livery-stable, fire-extinguishing, street-sprinkling, and other like purposes; 3rd. To sink a thousand wells all over the city; and 4th. To tap the Hudson above tide-water level. This latter is the plan of Mr. Serrell, city surveyor and civil engineer, who thinks that for four or five millions—one-fourth of what an aqueduct would cost—engines could be constructed and put upon the Hudson, and a cast-iron pipe, about four feet in diameter, laid to one of the receiving reservoirs, all within a year, whereas four years is the estimated time necessary to get up a new aqueduct. Additional pipes could be added at a small additional cost. He holds that the water would be purer than the Croton; and, as the Croton watershed, even with two aqueducts, may fail, as it is now failing, to furnish the water needed, a new aqueduct, or a dozen new ones, would not increase the actual quantity of water.

The *Standard* correspondent mentions a fifth proposition, which involves, not the creation of a new supply, but the economical distribution of the stores already at hand. It is the adoption of meters, the difficulty in the way of which he states is a political one. "No popular politician dare advocate it, lest it cost him his popularity; for the people would oppose such a wise measure, as they oppose everything that limits what they recognize as their liberty, an unlimited and unquestioned supply of water being so considered by them. The only city in this country using meters seems to be Providence, R. I., and there the consumption is 30 gallons a day to each inhabitant—the least average known in this country."

To prove, however, that the great need of New York is not more water, but more economy, the writer quotes from the report of the Commissioner of Public Works, the following returns as to the average daily supply per head per diem in the cities as named:—

New York	95 gallons.
Chicago	80 "
Hartford	80 "
Reading, Pa.	75 "
Albany	75 "
Buffalo	63 "
Brooklyn	60 "
St. Louis	60 "
Boston	60 "
Philadelphia	56 "
Cincinnati	53 "
Baltimore	50 "
Lowell, Mass.	44 "
Cleveland, Ohio	43 "
Providence, R.I.	30 "
Milwaukee	25 "

These figures he compares with others obtained from the following European cities, on the same basis of calculation:—

Dublin	60 gallons.
Glasgow	52 "
Paris	38 "
Edinburgh	35 "
London	33 "
Liverpool	30 "
Manchester	21 "
Sheffield	20 "

We believe that in the first named (Dublin) the consumption here given is much above the actual quantity at the present time, whatever it may have been in the past; and with reference to Glasgow, the recent report of Mr. Gale, the city engineer, shows that in one extensive district, where the initial consumption had been 60 gallons per head per day, the adoption of the meter system had reduced it to 35 gallons.

Remarking upon the table last quoted, the *Standard* correspondent observes that "if these figures are correct, and the conditions as to other supplies of water the same, it is manifest that our inhabitants of New York waste an immense quantity, fully as much again as they legitimately use. In America, Lowell, a very largely manufacturing city, Cleveland, Providence, and Milwaukee, and in Europe, Paris, Edinburgh, London, Liverpool, Manchester, and Sheffield, all use less than half as much as New York does; and Providence, Milwaukee, Liverpool, Manchester, and Sheffield all use less than one-third of the same."

The following table gives some approximate figures on the same subject. The first column is of populations, and the second of gallons of water daily consumed:—

London	3,880,000	122,000,000
New York	1,200,000	104,000,000
Philadelphia	750,000	42,000,000
Manchester	750,000	16,000,000
Chicago	475,000	38,000,000
Cincinnati	275,000	15,000,000
Sheffield	265,000	5,000,000

With regard to the present works which supply New York with water, the correspondent quotes the following from a recent report of Mr. Campbell, Commissioner of Public Works:—

"These works are costly, nearly 31,000,000 dols. having been expended in this city for the present water system, and millions more must be added as the city grows in population. The charge for interest on the outstand-

ing debt, maintenance, and necessary new works is now not less than 2,000,000 dols. annually. Though the authorities may control the use of water in the streets and at docks, stables, and hydrants, and large manufacturing establishments, yet after all a very large share of the waste occurs in the interior of the 100,000 buildings which make up the city."

ON STREET-MAINS.

By Mr. W. H. PRICE, Ohio.

[A paper read before the American Gaslight Association, Thursday, Oct. 19, 1876.]

Perhaps no department of the complete outfit of a gas company is deserving of more wise or careful attention than that of distribution. Having secured a good field of operations, a good site for the manufacturing and storage of his gas, and having constructed his works and his holders upon the most approved plan for producing a good article at the lowest possible cost, and properly storing the same, an adequate and well-laid network of pipes for conducting the gas to every part of his district is of prime importance to the gas engineer. Every other department may be perfect; but if this is defective, his labours will be thwarted, and his capital will be unproductive. In compliance with a request which I could not disregard, I shall proceed to offer a few practical suggestions relative to this important topic; and, in doing so, I beg that I may not be regarded as presuming to teach, but as merely endeavouring to state the views which have been impressed upon my own mind by the experience of a few years in the management of the interests committed to my care.

In determining the several points involved in a suitable system of distribution for a given town, the first thing to be considered is the size of the mains proper to be laid. The general rule to be carefully observed is this—viz., liberality in the capacity of the mains. Let the pipes be of such size that the volume of gas required shall have free course, and go forward without hindrance. By all means use such sizes of pipe that there shall be no necessity for heavy pressure, in order to give your customers a supply of gas; for excessive pressure is attended with many evils.

1. By it leakage will be much increased; and

2. The bills of consumers will be made so large as to cause complaints and withdrawals. "By doubling the amount of pressure, the consumption of gas will be increased about one-half."

If the engineer make a mistake here the evil will be serious. I will illustrate this by a case that came within my own observation. A certain gas company had pursued a narrow policy in the matter under consideration, and had laid much small pipe in the days of its poverty—some even as small as 2-inch—and when the city where it is located, about thirteen years ago, began to grow afresh, and for ten years expanded and filled up with marvellous rapidity, the gas company I refer to was pressed on all hands to extend its mains, so as to keep pace with the demand for more light; miles on miles were laid, but the chief distributing lines were neglected, and remained for years too small. They answered very well in the season when but little gas was required; they were summer sizes. When autumn and winter came, and the demand for gas became large, then a supply for remote districts could be furnished only by the application of heavy pressure, and this effect followed. The business portion of the town, near where the works were located, had excessive pressure and too much gas, while distant streets had too low pressure and too little gas. All the near by and largest consumers raised a great outcry, because their bills were suddenly nearly or quite doubled, and the more remote consumers sent in a loud cry for more light. As times became hard and economy necessary, the evil grew to be serious, and resulted in an oil war. Hundreds abandoned gas and took to petroleum; in some cases because it was cheaper, and in others because they were angry with the gas company, and wished to punish it. And it did suffer severely in consequence of the error I have described. It should be borne in mind that as winter approaches, gas bills inevitably become large, even under the most perfect system of distribution; and hence it is clearly a great error to either lay or perpetuate a network of mains so small that the bills of consumers are made excessively large at the time when they are naturally large enough for the comfort of those who collect them, thus needlessly increasing the storm, usually sufficiently unpleasant with the best system of distribution that skill and money can provide.

As to what sizes of pipe may be suitable in any given case, it is obviously impossible to speak definitely. In determining this question, everything must be considered—present needs and probable growth. In any case, I would never lay a foot of 2-inch, and but little 3-inch, even for cross connexions. It costs nearly as much to lay a 3-inch as a 4-inch pipe. The digging is the same, and so of nearly all the labour. The joints cost a trifle more, if lead be used; of course, there is more iron in a foot of 4-inch than in a foot of 3-inch; but, in these days of cheap iron, the whole expense of the former is but a trifle, while the capacity of a 4-inch is nearly double that of a 3-inch. These remarks will apply to the larger sizes, in a general way; that is to say, if there is a likelihood of needing a large pipe in a given street, it is generally better economy to lay it at first than to put down a smaller one, which must be removed ere long.

There have been attempts to improve upon the old-fashioned pipes, but I am not aware that anything is better than plain, old-style shapes, cast vertically, with the socket end down to avoid shot-holes. A good quality of foundry iron should be used, so that the pipe may be tapped with a clean, nice thread, and without too much expense of labour. If the pipe is made of too hard iron it will be hard to tap. Sometimes the pipe will crack in tapping, and it will be difficult to make a clean, sharp thread for the reception of the service-pipe.

There is no need that the street-main should be excessively thick; nor, on the other hand, should it be too thin. For ordinary sizes I think three-eighths inch about the proper thickness. Large sizes should, of course, have a corresponding weight of metal.

Having settled the questions of size, thickness, and quality of his mains, the engineer will next look at the question of their proper location in the street.

The streets of a city having all the modern conveniences will be occupied by gas-mains, water-mains and sewers under ground, and by street railway tracks above ground; and in selecting the proper line for the gas-pipe, it is important to consider its present and possible relationship to each or all the above-mentioned neighbours. It will generally be found that the city authorities will insist that the gas-main shall yield precedence to the sewer, and also to the water-main; if, as is usually the fact, the city owns the water-works. I have often known a gas company to be compelled to take up and remove its mains, at a large expense, in order that a sewer or a water-main might occupy its bed, not always because there was a real necessity for the change, but because the city authorities chose to have it so. If the order to budge comes, it is best to pick up and move, as resistance will be in vain, and irritating to those who should be conciliated.

Now, in a growing town, if the gas engineer happens to be in advance of the city engineer, it is well to remember that the latter will soon be along, and, if possible, anticipate his wishes. He will usually desire to locate his sewer in the centre line of the street, and hence, I think it generally better to lay the gas main pretty near the one kerb line or the

other, hoping that the water-main will be laid on the side of the sewer which the gas main does not occupy, and probably this will generally be the result. If the gas-main be placed near the kerb line, it will be easily accessible, under most circumstances. If there be Nicholson or other wood pavement, the objection to disturbing it will be avoided, because the pipe may be reached by removing a small piece of the gutter pavement, which is usually of stone; or if it be of wood, the workmen can get down to the pipe without disturbing it seriously, or doing much damage. This is always important, for obvious reasons. Where the main lies on one side of the street, there is, indeed, a serious difficulty when there is occasion to lay a service to the opposite side, especially in the case of wood pavement, unless, as in a few instances, where the ground is sandy, and the service-pipe can be pushed through under the pavement; but in case of clay or gravel, or of any hard earth, there is no way but to take up the pavement and dig, except one, and that is to double-pipe the street. Sometimes this is the better way, even if the obstacle just mentioned be not in the way. For example, a street is very wide, say 100 feet or wider; long services are liable to trap, and also to other obstructions. In such a case I prefer to lay two pipes, one near each kerbstone. The extra expense is, in part, compensated in avoiding the necessity of laying long service-pipes, if, as in most cases, the gas company furnish the service from the main to the kerbstone, without expense to the consumer. But the great advantage is this—with a short service there is almost always an uninterrupted flow of gas to the customer, and I regard this as of prime importance.

Having decided upon the line, or location, of his pipe, the engineer will next consider the depth at which he should place it. There is one general rule to govern him—viz., the main should be placed below frost, that is, so deep that no ordinary amount of cold will reach it. Every gas manager must be familiar with the evil effect of frost upon gas in a pipe. It depreciates its quality, and interrupts its flow. But there are other evils attendant upon laying a main near the surface. If frost gets below the pipe, it may heave it, and thus disturb the joints. In case frost reaches a main in much force, the contraction caused by it will be injurious to the joints, and it is said that in some cases pipe has been broken by contraction, caused by cold. When laid, the main should never be disturbed by any influence. It should neither expand nor contract, and it should neither be lifted by frost, nor depressed by any force from above.

And this leads naturally to a few words concerning the foundation upon which the pipe should rest. If the ground at the bottom of the trench be solid, that is sufficient; but if it be soft, and liable to either sink or slide, means should be sought to obviate the liability to either. The judgment of the engineer will dictate what should be done in any given case; but he should, by the use of some material—wood, brick, or cement—secure a good bed for his main.

He must look carefully to his grade, and see that, at suitable points, he can secure a complete discharge into drip-boxes of all condensation. The exact circumstances of each case will decide how often, and where, he should place his drips.

Having settled all the foregoing matters, the actual laying of the pipe demands the most untiring supervision. Good joints are of the last importance. Good pipe, good location, good foundation, good grade—all these will not avail unless good joints be secured. Why invest large sums in buildings, retorts, exhausters, condensers, scrubbers, purifiers, and holders, if, after good gas has been made, it is allowed to waste into the ground while on its way to the consumer? I think almost any other error in our business is more excusable than this; and yet, no doubt, this is the point at which a fair profit is wasted annually by many gas companies.

I am not competent to settle the mooted question—which is the better material for joints, cement or lead? My prejudices are in favour of lead. My company have tried both, and now use only lead. Let each decide for himself, but be sure that his joints are tight.

In laying pipe, my method of procedure is this:—

1. I provide the best soft pig lead. I never buy the hard, irregular, uncertain stuff which is sold by the plumbers; because, though nominally cheaper, it is really dearer than good lead; for good joints cannot be made with it every time.

2. I provide a good quality of spun-yarn for gaskets; and to make sure that I have such a quality, I have it manufactured to order.

3. After the main has been placed, the workman drives into the space between the spigot and the socket a gasket of the above-mentioned spun-yarn. This must be thoroughly done.

4. A mould of soft clay is placed about the pipe, near the socket, and melted lead is poured into the mould, so that the space outside of, and next to the spun-yarn, is filled.

Finally, The lead is tamped thoroughly, so as to completely fill the interstice about the spigot.

To make all perfectly sure, the pipe is tested, by letting in the gas, before covering; and, if any leaks are discovered, the remedy is applied at once. Soon after the pipe is brought into use, the line is carefully inspected, and if any signs of imperfect joints are discovered, the pipe is uncovered, at the proper points, and the defect cured.

I have described my own practice, not because I suppose it original, but because it is the best practice I know, and because it has worked well in my experience.

THE CHEMICAL AND METAL TRADES IN 1876.

We make the following extracts from Messrs. J. Berger Spence and Co.'s Retrospect:—

The leading characteristic of last year was the absence of all violent fluctuations, and second to that the fact that the latter months displayed a marked improvement, making the outlook of 1877 brighter than has been the outlook of several years past. Though we are still menaced with the possibility of a war in the East, we ourselves could not view its actual commencement with unmitigated regret. It very often happens that the rumours of war are more disturbing to trade than its actual occurrence. Undesirable as war undoubtedly is from a humanitarian point of view, it nevertheless always creates demands for commodities, stirs up the circulation of money, and creates a vast expenditure; and unquestionably, as was the case directly after the outbreak of the Crimean and Franco-Prussian wars, causes a general revival of trade. Therefore, supposing the Eastern Question again approaches a climax impassable without a recourse to arms, the effect on trade will no doubt be more beneficial than otherwise. We do not wish to be supposed advocates of war merely to bring about some degree of activity in a few branches of trade; but we assert that unless the existing Conference establishes peace on such a firm basis as to render the likelihood of war improbable for some years to come, and relieve men's minds from the turmoil of the past few years in respect to this question, its labours will have been futile, and the inevitable had much better be met at once and summarily disposed of. Capital is abundant, though used with caution, and the rates of interest are extremely low. Credit, no doubt, is limited, but this very limitation will ultimately produce a gradual confidence. Other nations than ourselves have during the course of last year evinced a greater disposition to embrace the principles of Free Trade. The Special Commission to the

French *Conseil Supérieur de Commerce* was sufficiently liberal as to recommend a reduction of many of the imposts and the abolition of others altogether, and doubtless such a recommendation will carry no light weight in the Senate. The accession to power of the Democratic party in the United States is hailed with delight by the upholders of Free Trade principles, and the declaration of its policy is awaited with interest. Russia, it is true, has made a retrograde movement by her threatened protective policy, but we must not expect too much from her in her present state of civilization. These advantages, added to the probability that the days of the lowest prices are past, and to the certainty that trade generally is in a condition of increasing activity, are all circumstances pointing to a more prosperous year than the one just completed. At the same time we would not advise too large expectations. While we have confidence the year just begun will be an improvement on the past one, we do not anticipate a sudden rebound to the prosperity of such a one as 1873, nor would such be desirable for many reasons. The chances are in favour of somewhat better prices and an increased volume of business, and anything beyond this will be unhealthy and forced; but as the year grows old we have no doubt that there will be indications that the country is again preparing to enter on a career of vigorous commercial activity.

Sulphate of Ammonia is one of those articles the exact production of which it is impossible to ascertain. It has been in strong demand all the year, and though it has fluctuated in value at different seasons, its average has been slightly above that of 1875. At no period have stocks been large, certainly not from the want of consumers, though they may have accumulated slightly occasionally through the speculative buying which has been present at various times, but beyond this the supply has at no time been in excess of the demand.

Coal.—Judging from the export statistics, colliery proprietors have had less reason to complain of the adverse influence of dull trade on their particular commodity than they would have it generally supposed. Coal has been in more extensive demand than during any previous year, and the exports have up to the 30th of November exceeded by 1,756,338 tons those of the most active year preceding it. This shows the enormous development of the means of obtaining coal, and unsatisfactory as the prices obtained may have been to owners, they cannot be unremunerative, or there would not be the present expenditure of capital in undertakings which must always be deemed speculations until the mineral is actually reached and the quality proved. The Inspector of Mines has drawn notice to the fact that during 1875 no less than 111 new collieries were in course of sinking in the West Riding of Yorkshire alone. In addition to these there were also 31 in the Leeds district, 17 in Sheffield, 11 in Huddersfield, 6 in Bradford, 14 in Wakefield, 7 in Rotherham, and 12 in Halifax. In many of these ventures the coal has been reached and can now be brought to the surface in quantities varying from 500 to 4000 tons per day, according to the pit. Besides these there are numerous others commenced, of which we have not reliable numbers. The provisions, therefore, for the most accelerated demand which can be anticipated, are ample. At the same time the competition in the future will be keener than in the past, and loud as have been the complaints of low prices during last year, they are not likely to be any the less during the present. The average price obtained for the coal exported last year was 11s. per ton, against 17s. in 1874, and 22s. in 1873. In addition to this, since 1873 colliery proprietors have had restrictions imposed upon them, which slightly increases the cost of obtaining coal. These facts at first sight appear alarmingly disastrous, and seem to justify the outcry against unremunerativeness, but some additional facts will place the matter under a somewhat different aspect. Since 1873 the remuneration paid to the collier has been on a decreasing scale, and that at present paid is variously estimated in different districts at a reduction of from 35 to 75 per cent. If the average be taken as low as 50 per cent. it will explain a great portion of the difference in margin. And to this an increased quantity of 3,500,000 tons in favour of 1876, against 1873, representing additional profit, and the increased output from the new collieries, must be considered. The quantity of coal exported to the 30th of November amounted to 15,144,609 tons.

METALS.

The year 1876 will ever be a memorable one in the annals of iron; not only has the extreme slackness bequeathed by its predecessor been increased, but it has presented phases distinct from other years of stagnation, and developed sources of uneasiness which hitherto have been lightly estimated. Its financial difficulties will give it a prominence distinct from others, and the additional perplexities with which it has surrounded the solution of the future are of themselves matters for serious thought. Vast as have been the losses sustained, they cannot, considering the proportions of the trade, and the peculiar circumstances attached to it, be said to be alarmingly disastrous. Speaking directly of pig iron, makers have been for a long period producing, in many instances, at an absolute loss, and unfortunately had no means of escape. They were placed on a two-horned dilemma, either of which boded disaster. On the one hand, did they resolve to reduce their manufacture, they must have been at once prepared to suffer the serious loss which the blowing out of blast furnaces entails. To adopt such a course would have been almost suicidal, unless the concern were substantially supported financially. It would have meant the disruption of business, the foreclosing of liabilities, possibly grim liquidation. On the other hand, production at a loss could not go on for ever. Whether the production be sold below its cost or be placed in stock, representing idle capital, the resources of the wealthiest concerns have their limit. Thus there were two desperate resources presented, either of which would bring the one inevitable end. Unfortunately, in the hope of a speedy return to remunerativeness, the latter has been the course most generally adopted, but now it cannot be doubted that it would have been infinitely better had many firms—which, by reason of their insufficiency of capital, or inability to realize, have since been compelled to liquidate—boldly submitted to the exigencies of the former in the first instance. Their estates would have realized more satisfactorily for themselves and their creditors, and their action been prolific of good to the trade in general. It must have been apparent to the least foresight that a policy which required, during the days of prosperity, the expenditure of all surplus profits in the rebuilding and enlargement of works, could not possibly constitute a protection against a reaction in trade such as has ensued. The figures given below show that the evil the pig iron trade has had to combat has not been so much a decreased demand, but an unreasonably extended and sustained production, which is alone responsible for the unremunerative prices ruling all the year.

Pig iron exported to—

	Tons.	Value.	Price per Ton.
Nov. 30, 1876 . . .	884,741 . .	£2,658,045 . .	£3 0 0
" 1875 . . .	889,402 . .	3,251,461 . .	3 13 0
" 1873 . . .	1,072,262 . .	6,674,999 . .	6 4 0

The branch of iron industry which has suffered most is the finished iron, particularly rails, and it has become to be an anxiously debated question, whether England will ever regain her recent position in respect to this manufacture. Certain it is that the production of rails has decreased to an insignificant tonnage. True, new railroads are now the exception, and extensions are rare; but it is computed on good authority, that 1,200,000 tons of rails per annum are required for renewals alone.

Whence is this supplied? England is not making anything approaching the quantity; whereas Cleveland, hitherto the chief centre of this branch, used to turn out her 300,000 tons per annum, she now makes comparatively none, and the same rule will apply to a great extent to other rail-producing districts. The explanation is a simple one. We have by our own enterprise and success engendered a spirit of emulation in the mind of the foreigner, which now that it is aroused it will be found impossible to allay. He has not the same advantages which we possess, in some respects, especially in that of the raw material, but he possesses others which we do not, and—the raw material obtained—he is in a far better position to produce the manufactured article at a less cost than we, and this is what is being done. Countries which a short time ago depended on us for their supplies now purchase our pig iron, manipulate it as they think best, and can afford to undersell us even in our own markets. To attribute the absence of activity in the rail-producing establishments to slackness of trade is not sufficient explanation. There are vast current requirements, a tithe of which we are not asked to quote for, and at the same time there is also the almost equally sustained production of pig iron going on which must be utilized somewhere. There is but one remedy for this which suggests itself, and the sooner it is adopted the better, if the industry is worth saving, and that is to place ourselves on equal terms with our competitors in respect to the cost of manufacture. Much is expected by Cleveland ironmasters from Mr. Lowthian Bell's investigations. The task he has undertaken is one of no small difficulty, and sincerely as we trust his success will be great, we would not build too largely on the highest achievements one man can hope to accomplish for a gigantic interest such as the Cleveland rail-making has been. No doubt if he succeeds in producing an iron rail equal in durability to the steel rail, and at a less cost, no more can be expected, but more than this will be necessary before the industry can be restored to its old importance—there must be the possibility of placing on the continental markets an article in every respect equal to the native, to which no doubt his improvements will be added, and at a less cost than the native, otherwise prejudice will decide against it, and uphold home production. Other descriptions of manufactured iron have been in limited request all the year, and makers have had to submit to consumers prices in a great measure to promote business.

Lead.—The demand for this metal during 1876 was so great that we have made additional calls upon our foreign sources of supply to the extent of about 3000 tons. Our imports to the 30th of November amounted to 75,617 tons, valued at £1,641,625, against 72,568 tons during 1875 to the same time, value £1,639,976. The home consumption has been greater, as there is an increase in the imports and a decrease in the exports. Lead has been entirely free from those violent oscillations of price which have distinguished copper and tin, and at present it is almost at the same level as at the opening of the year. Various causes have at different times influenced its value, but only to a limited extent, for the lowest point it reached was £20 5s. During the latter portion of the year the firmness has been sustained, principally by the smaller supplies offered and the disquieting rumours from the East, and these have also encouraged speculation to some extent.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been no work done at any of the manufactories here during this week, owing to the Christmas holidays, and at several places next week will also be void. At many establishments, both in the iron and steel trades, the interval is being made use of for the purpose of stock-taking, it being found more convenient to perform that duty now than at Easter time. Under such circumstances very little can be said of business matters which possesses the merit of novelty, the fact being that the transactions of the week have been wholly *nil*. It may, however, be as well to give the nominal quotations for pig iron now current, in order that those who have files of this JOURNAL may compare them with those prevailing a year ago, and in order that they may form an accurate estimate as to the cost of materials in the beginning of the new year. North of England figures are these:—No. 1 foundry, 49s. 6d.; No. 2 foundry, 48s.; No. 3 foundry 46s. 6d.; No. 4 foundry, 45s. 6d.; No. 4 forge, grey, 45s. 6d.; No. 5 forge, mottled, 45s.; No. 6 forge, white, 43s. 6d.; refined metal, 65s.; Kentledge, 50s.; and cinder pig, 40s.; "Acklam" brands, No. 1, 49s.; No. 3, 47s.; No. 4 foundry, 46s.; and forge, 45s.; "Aireside," Leeds, No. 1, 56s.; No. 3, 52s.; No. 4 foundry, 51s.; and forge, 50s.; North Lincolnshire "Redbourn" No. 1, 60s.; No. 2, 56s.; No. 3, 54s.; No. 4 foundry, 54s.; No. 4 forge, 51s.; mottled, 50s.; and white 50s. per ton. Hematite pigs are steady, but as they do not directly affect the price of ironwork, the quotations need not be given at length here.

Pipes are likely to be fully maintained in price henceforth, many of the leading foundry concerns being very fairly supplied with orders for this class of their productions. Ordinary mains are being quoted at about £5 per ton, but if asphalted by the patent process, and cast direct, rather more money is asked.

There is only a moderate sale for any kind of fuel, the opening up of so many new collieries here and elsewhere having had the effect of causing a complete glut of the markets. Both steam and gas coal are plentiful, but vendors are not disposed to give lower quotations except under extreme pressure.

The proposed new railway from Lincoln to Spalding, and thence by the Great Eastern system to London, is looked on with much favour by the South Yorkshire coalowners, and will probably receive their support.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

In both the coal and iron trades of this district there has only been a limited amount of business doing during the past week. The pits, as a rule, were closed on Saturday for the New Year holidays, and but little work will be done during the present week. At the iron-works also operations will be more or less suspended during this week for the holidays and stock-taking.

So far as any business is doing in the coal trade, there is not much change to notice. The mildness of the weather continues to affect the demand for the better classes of round coal, but prices, as a rule, are maintained. In other classes of fuel for manufacturing purposes there is not much doing, owing to the stoppage of many of the works, and common qualities of slack continue a complete drug in the market. The average pit prices in the Wigan district remain about as under:—Best Arley, 11s. to 12s. per ton; Pemberton four-feet, 9s. to 9s. 6d.; common coal, 7s. to 8s.; burg, 5s. to 5s. 6d.; and slack, 3s. to 4s. per ton; but in the case of large sales, concessions on the above figures might be obtainable.

In the iron trade buyers, as a rule, are holding back until after the holidays, and at the Manchester market on Friday little or no business was done. So far as makers quotations are concerned, they are nominally without change, but pig iron in merchants hands might be bought for a little less money for prompt delivery. Finished iron continues firm, and in some cases rather more money is being asked; but there is no quotable change, Middlesbrough bars delivered into this district being offered at

£6 15s. to £6 17s. 6d. per ton; Lancashire ditto, at £6 17s. 6d.; and Staffordshire at about £7 per ton.

A meeting of the shareholders in the Nantyglo and Blaina Iron-Works Company was held at Manchester on Thursday, Mr. Hugh Mason in the chair, and the annual report which was presented showed a debit in the profit and loss account for the year just ended of upwards of £60,000. This serious item was to a great extent accounted for from three causes—the great depreciation of stock as specially revalued recently by Mr. Radford, C.E.; the present bad state of trade; and the erroneous report a year ago with regard to the stock of small coal on hand. Great economies in the working of the concern, however, were promised, and after some discussion the report was agreed to.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The transactions in the coal trade of the North of England were merely nominal last week. The Christmas holidays and bad weather reduced the shipments to a very limited quantity. Happily for trade, fine weather came in, which enabled large fleets of steamers and sailing ships to leave the Tyne on Thursday and Friday. There will, therefore, be an abundant supply of coals in London this week, and, as the winds have been favourable, it is every way probable that the bye-ports will make up their stocks this week from the arrival of cargoes by sailing vessels.

The freight market is very quiet. Few transactions of any moment were entered upon last week for the coast. In the London trade a few steamers were taken up to replace those detained by the heavy seas. Rather better rates were realized. Mediterranean freights maintain an upward tendency, but there will be no great amount of business entered on until the beginning of January.

Most of the contracts for gas coals have been completed, and with the turn of the year shipments may be expected to be actively resumed at the Tyne Dock. Coasting freights are likely to remain at about the present figure during the remainder of the winter. General trade is quiet. It is not quite so strong as it was a fortnight ago. Through the disturbed state of political affairs in the East, no one can tell what business will be doing at the end of January, and there is little speculation. There is not much to say about the iron trade. It improves but slowly. The chemical business has been a trifle weaker for immediate delivery. But better prices are given for chemicals sold over next year.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The directors of the Linlithgow Gas Company have intimated a reduction in the price of gas from 5s. 10d. to 5s. per 1000 cubic feet; and the directors of the Coldstream New Gaslight Company have reduced the price of gas from 7s. 6d. to 6s. 8d. per 1000 cubic feet.

A special meeting of the Police Commission of Alloa was held on the 18th ult., to consider the propriety of adopting the Burghs Gas Supply (Scotland) Act, when it was unanimously agreed to adopt the Act, and the clerk (Mr. Buchanan) was requested to take all the legal measures necessary for that purpose.

The Johnstone Police Commissioners have officially notified their adoption of the same Act. Thursday, the 8th day of February, 1877, has been fixed for the next meeting, in keeping with the provisions of the Act. It is not anticipated that there will be any opposition to the unanimous decision of the Police Commissioners.

Mr. J. Falconer King reports that the gas supplied to Edinburgh on the 13th ult., by the Edinburgh Gas Company, had an illuminating power equal to 32·88 candles, while that of the Leith Gas Company stood at 28·73 standard candles. I am not aware of any other place in Scotland having gas of such a high illuminating power as that first referred to, nor am I aware that the burners used in the "Modern Athens" have been adapted so as to consume such gas with economical results.

The average illuminating power of the gas supplied to Glasgow during the week ending the 16th ult., ranged from 25·90 candles to 27·90 candles. In no case did the maximum illuminating power exceed 28·77 candles, while the gas made at the Dawsholm station did not exceed 26·11 candles as its maximum luminosity. The minimum ranged between 25·06 candles and 27·04 candles.

Notwithstanding the high illuminating power of the gas supplied to Greenock, as mentioned in my "Notes" during the last few months, I find, from the proceedings of the last meeting of the Police Board of that town, that grumbling is again showing itself there regarding the quality of the gas supplied to some parts of the town. One member of the commission said he had heard many complaints about the gas, but the Provost remarked that the gas supplied to Greenock was as good as that of any other town in the West of Scotland. Treasurer Blackmore said that he had been supplied with what he thought at first was bad gas; but after getting a larger meter, and having the pipes thoroughly cleaned, the gas was now good. Another commissioner believed that the gas in the lower parts of the town would not be so good as in the higher parts, as gas had a tendency to rise rather than to go down. He suggested that they should get a gasholder for the west end of the town; and Councillor Leith recommended that the public analysts should get a photometer in their office, so that the gas could be tested without the knowledge of the Gas Committee.

The illuminating power of the gas supplied to the city of Perth during the week ending Dec. 16, was—maximum, 26·74 candles; minimum, 24·35 candles; average, 25·55 candles.

For the same week, the average illuminating power of the Dumfries gas was 28·03 candles, the price being 5s. 10d. per 1000 cubic feet. The official statement of that fact in one of the local newspapers also includes the illuminating power and price of the gas in other twelve cities and towns in Scotland; and the most surprising fact in the statement is that 29-candle gas is sold at Galashiels at 3s. 9d. per 1000 cubic feet. Coatbridge, I think, is similarly situated.

The quality of the gas supplied to Busby is still complained of; at all events, it was regarded as a crying scandal so recently as the 27th of December. A correspondent who was then suffering from it writes to say that it is a false economy to trifle with the health of an entire village, and that the rate charged (8s. per 1000 feet) should pay for a good gas. It is enough, at all events, he says, for an ordinary good article, in view of the rates charged in other localities.

At the last monthly meeting of the Forfar Gas Commissioners it was reported that during the preceding eight months there had been a decrease in the amount of the gas made, as compared with the corresponding period of the year 1875, of 771,600 cubic feet, and that the total amount collected for coke and tar was £739 17s. 9d.

It has been resolved to reopen the gas-works at Kinnesswood, Fife, after standing unused for the last two years. The works have been put into thorough repair through the public spirit of Mr. William Heggie, to whom the inhabitants of the village are much indebted during these times of dear paraffin oil.

On Friday last seven shares of the Montrose Gaslight Company were sold by public auction, and, notwithstanding the fall on last year's dividend, there was a keen competition, the shares realizing from £51 10s. to £52.

The Grangemouth Water Commissioners have resolved to borrow the sum of £1200, in addition to the £10,000 already borrowed, for the purpose of completing the new water-works.

It was resolved, at the last meeting of the Glasgow Corporation Water Committee, that the meter system, for detecting and reducing the waste of water, which has been so successfully tested in the Great Western Road district, be in the meantime extended over an area embracing, say, 80,000 people, as and in the manner suggested by Mr. Gale in his report.

A meeting of the Works Committee of the Dundee Water Commission took place last Thursday, when the contractors' claims for extra work in connexion with the Lintrathen water supply were under consideration. The special committee appointed in regard to the matter reported that, as the contractors would not agree to meet the commission in conference, as had been suggested, they felt that no other course was open to them but to resist the claims in the court to which the contractors had summoned them. This resolution was approved of by the Works Committee. At the same meeting it was reported by Mr. Watson, the engineer and manager to the commission, that on the 16th of December he had turned on the Lintrathen water into Clatto reservoir. On the 19th a fault occurred in one of the joints of the Lintrathen main, which caused a temporary suspension of the operation.

Under the influence of a strongly-worded communication from the Board of Supervision, the Police Commissioners of Selkirk are about to put their town in order, both as regards water supply and a complete system of drainage.

Dr. Stevenson Macadam, of Edinburgh, has just reported upon the quality of nine samples of water sent to him from Forfar for analysis. His remarks form a powerful condemnation of the conduct pursued by a number of the Forfar town councillors in reference to the question of water supply for that town. He says he has seldom met with a set of waters from a single town which were so grossly impure and unwholesome; and he recommends that immediate steps be taken to close the sources whence they were obtained, and to provide for the introduction of pure and wholesome water.

The authorities of Perth are quite in a muddle on the water question. At a special meeting of the Town Council and Police Commission, on the 18th ult., the proposed water bill of the outside promoters was under consideration; and after a long and somewhat stormy sederunt it was resolved, on the motion of the Lord Provost, to disapprove of the proposal to promote a bill during the ensuing session of Parliament. The committee of the citizens promoting the bill have unanimously resolved that the maximum domestic rate shall be 7d. per £1 of rental (the proposed outside domestic rate being 1s.); that shops, manufactories, &c., shall pay half of the respective domestic rates; that the public rate payable by landlords shall, for the inside, be 1d., and for the outside 2d.; and that arrangements be made for the gradual equalization of the inside and outside rates.

In consequence of the action of the Board of Supervision, the Annan Police Commission recently resolved to send three samples of the water used in the town for analysis to Mr. F. J. King, Edinburgh. That gentleman's report has been received, and it is to the effect that the waters submitted are unfit for dietetic purposes. The result of his analyses, though not altogether unexpected, has rather staggered the inhabitants. The water was polluted with sewage. It has now been resolved by the Police Commission to send twenty further samples from the many sources of water supply, in order to get a more exhaustive report upon the burgh water generally before taking any action in the matter.

Impure water from sewage contamination is getting the credit of a fever epidemic at present prevailing in Newport, and it is seriously proposed to have a main laid from Dundee along the Tay Bridge now rapidly progressing towards completion.

The Glasgow pig iron market closed on Friday for the year 1876. Business was dull and prices were weak, transactions being recorded at 57s. 10d. to 57s. 9d. cash, and at 58s. to 57s. 10½d. one month. The market closed with buyers at 57s. 9d. and 57s. 10d. respectively, and sellers 1½d. more. There was a fall of 7½d. per ton on the week. The year closed 1s. 10½d. above the lowest, 8s. 6d. under the highest, and 9d. under the average price of the year, while the closing quotation was 6s. 9d. under the final quotation of 1875.

There is nothing new to state regarding the coal trade. Prices remain pretty firm, and most of the collieries are kept going tolerably well, but there is no prospect of any immediate improvement in the demand or in the prices.

WATER SUPPLY OF WORSEBOROUGH, BLACKER HILL, AND BIRDWELL.—A short time ago a Local Government Board Inspector held an inquiry as to the water supply of these very thickly inhabited colliery villages and townships, and it was then deemed undesirable to obtain a supply from the Barnsley Water-Works. The inspector suggested a separate supply, but this has been found wholly impracticable, and the local board have now determined to construct a reservoir to contain a fourteen days supply from the Barnsley works, and mains will be laid thence to the places to be supplied. A loan of £450,000 will be applied for in the first instance.—*Engineering.*

"HARTLEY MINERAL."—In our "Circular" of March 21, 1876, we stated that a specimen of this remarkable mineral had been submitted to us for inspection, and we referred to some experiments made upon it by Professor Chandler, of Columbia College, and the results of which were given by him in a lecture delivered before the American Gaslight Association. We are happy to learn that a shipment of 400 tons of this "Australian Boghead Coal," as it has been denominated, is now discharging from the *Martin Luther* in the London Docks. This mineral is produced by the New South Wales Shale and Oil Company at their mines at Hartley, 100 miles from Sydney. It is something similar to Scotch Boghead, but its gas-producing power is said to be 25 per cent. greater. The present shipment has been sold to The Gaslight and Coke Company for use as a gas enricher.

WATER SUPPLY OF BRIDGWATER.—A public meeting of the inhabitants of Bridgwater was held at the town hall, on the 18th ult., to consider the intended application to Parliament by the corporation, with respect to the proposed water-works. The Mayor (Mr. Leaker) presided, and moved a resolution to the effect that the council be empowered to apply for a bill to carry out the works suggested by Mr. Hawksley, at an estimated cost of £30,000, the water to be brought from a point known as Ashford Mills, about four miles distant from the town. The meeting was addressed by several members of the corporation, and others in favour of obtaining a supply in order to improve the sanitary condition of the town, and the only objection offered was in the nature of a suggestion that an effort should be made to discover whether a cheaper scheme could not be promoted. The resolution was agreed to with but four dissentients, and although a poll was at first demanded, it was afterwards withdrawn.

PROPOSED PURCHASE OF THE STOKE GAS-WORKS.—At a meeting of the Stoke Town Council, on the 21st ult., Alderman Sweeting moved the appointment of a committee for the purpose of ascertaining the value of

the Stoke Gas-Works with a view to purchasing the same. He reminded the council that, just after the borough was incorporated, the gas-works were offered for sale. But the borough being then very young, did not feel equal to undertaking so important a purchase, and the matter dropped. Since then, Burslem, Longton, and Hanley had begun to move in the purchase of the gas-works in their districts, and he did not see why Stoke should remain behind the other towns of the Potteries. He was convinced that gas-works ought to be in the hands of the corporations, and there was a general movement in the country to bring that state of things about. All that he now asked for was the appointment of a committee, and that step could not do much harm, if it did no good. Mr. Kirkham suggested that the matter should be referred to the Lighting Committee, who were likely to be best acquainted with the subject. Alderman Sweeting signified his acceptance of that proposal. Mr. Nicholls thought it was desirable that the matter should stand over for a time. If they allowed it to do so for six or nine months, they would be in a better position to judge as to what Parliament would sanction, seeing that, in the meantime, several similar applications would be made to Parliament. The motion was carried.

NAPHTHA WELLS.—A few miles from the town of Bakou, in the Caucasus, are situated the naphtha wells of that district. For hundreds of years naphtha has been extracted by the natives from this locality, and the quantity underground appears to be unlimited. A well 81 feet deep is shown to the visitor which was dug 200 years ago by the Persians, when they were masters of the country. In summer, when gases are generated in the bowels of the earth, the naphtha is thrown up in jets, some reaching 100 feet in height above the ground, and then runs to waste in the absence of means to collect such large quantities of this oil. Mr. Churchill, the British Consul at Resht, Persia, reports that while at Bakou last year, on his way to his post, he visited the wells on the neighbouring plateau of Balakhana. He says that in 1874 the tax of 25c. per pood (36 lbs.) of petroleum produced, brought the Government 280,000r., showing a produce of 1,120,000 poods of petroleum, and a consumption of three times that amount of naphtha. In that year upwards of 180 manufactories were at work in the outskirts of Bakou, but, owing to the enormous competition of American petroleum, many of the smaller manufactories have been compelled to shut up. The two largest are at Surakh Khana, eight versts from Balakhana. This spot was chosen for economy of fuel, as gas issuing out of the surface is used in lieu of coal or naphtha. You have at Surakh Khana the wonderful sight of green fields and waving corn in the midst of which the removal of a foot or two of earth will reveal a jet of gas that will raise an enormous blaze if set on fire. It is here that the Hindu monastery of fire-worshippers is established, where a tongue of flame is perpetually kept up. But against the advantage of cheap fuel must be set the expense of transport from the naphtha wells. The average price of petroleum at Bakou, is stated by the consul at 1r. 10c. per pood, and the cost of transport to Moscow at 57c. There is great room for economy in the transport of the raw material to the manufactories, which might be effected, as in America, by constructing a railway with suitable tanks, or by means of gravitation through an iron pipe; and some saving might also be obtained in the process of purifying the petroleum. It is only by such means that the Bakou petroleum can compete with that of the United States. The naphtha makes a very good substitute for coal in steamers employed in the Caspian Sea.—*The Times*.

CRYSTAL PALACE DISTRICT GAS COMPANY.—In accordance with their usual liberality, the directors of the Crystal Palace District Gas Company arranged for the annual distribution of Christmas gifts of meat to their employes on Saturday, the 23rd ult. Prime joints of beef, legs and shoulders of mutton, turkeys, &c., numbering together about 900, were laid out upon benches in the large meter-room at the gas-works, Bell Green, Lower Sydenham, which, for the time, appeared to have been turned into a meat market. It was a very interesting sight, and must have been exceedingly gratifying to the directors and secretary, whose kind thoughtfulness had determined that each of their servants should at least have the wherewithal for a good dinner on Christmas Day. The men being assembled, Magnus Ohren, Esq., the secretary, addressed a few suitable words to them. He referred to the interest the directors of the company took in their workmen, which was evidenced, he said, by the display of generosity before them, and the provision they had made that each man should carry away with him that afternoon a Christmas joint. The joints varied in size from five to about sixteen pounds, and the men who had served the directors longest would receive the largest pieces of meat. It had always been a great pleasure to him, during the 21 years he had been connected with the company, to assist at annual distributions similar to that they were then engaged in, and he could assure the men that they would lose nothing by doing their duty. He would strongly urge them to be diligent in their work and to keep sober. He regretted very much that their old friend, Mr. Watson, was not present with them that afternoon. Mr. Watson had felt it his duty, on account of ill health, to resign his post of engineer to the company, which they would all, no doubt, regret to hear. Mr. Charles Gandon had been appointed engineer in his stead, and he had the pleasure of introducing that gentleman to them. Mr. Gandon, in addressing the men, said he hoped he should gain their respect and esteem as much as Mr. Watson had done, and that they would all work together as pleasantly in the future as in the past. He wished them each one long life and prosperity. Hearty cheers were given for Mr. Ohren and Mr. Gandon, and then the company broke up, each man bearing away a fine joint of meat to gladden his Christmas meal.—*Sydenham Gazette*.

Register of New Patents.

202.—NEWTON, A. V., Chancery Lane, London, "Improvements in liquid-meters." A communication. Provisional protection only obtained. Dated Jan. 18, 1876.

This invention relates to that description of liquid-meters in which the flow of the liquid is measured by pistons working in cylinders, and operated by a head or pressure, which forces or causes the liquid to be delivered through pipes or otherwise, as required.

It consists in a double cylinder meter, in which each cylinder is furnished with a reciprocating and elongated or double-headed piston, and an intermediate cylindrical valve operated by the piston to control passages arranged for the purpose of effecting the reversal of the pistons, which latter and their valves move successively in like directions. The valves are what may be termed floating balanced ones, and the meter is constructed so that there is a free continuous outlet through the valves from the two cylinders, and a constant pressure of the liquid between the two heads of each piston, and furthermore so that the liquid under pressure is admitted alternately to the four ends of the cylinders outside of the piston heads by means of the intermediate valves which move back and forth with the pistons, causing the contained liquid to be forced out of the opposite ends of the cylinders. The inlet-pipe is situated a little to one side of the longitudinal centre of the one cylinder, and the outlet-pipe to the opposite side of the longitudinal centre of the other cylinder;

and in a line with each of these pipes is a passage connecting the two together. These passages are for admitting liquid from one cylinder to the other, and they are alternately covered by the cylindrical floating valves, which have an annular recess in their outer peripheries, forming passages for the flow of the liquid, and are driven alternately to the right or left by the pressure of their respective piston-heads against pins which project from their opposite edges. On the top of the two cylinders are two cross watercourses or passages, which extend from the middle of one cylinder to the end of the other; and the like arrangement, but the inverse of this is provided at the bottom of the cylinders. These cross watercourses or passages open at one end into their respective cylinders, at points within the control of the floating valves, and at their other end their ports are near the heads of the cylinders. By this arrangement the liquid supplied under pressure to the meter will fill the space between the cylinder-heads, impart a to-and-fro motion to the pistons, and operate the valves so as to allow of a continuous discharge of the liquid.

By providing an indicator, which may be operated by the pressure of one of the piston-heads against a lever, the amount of liquid passed through the meter will be ascertained.

246.—MOORE, J., Wolverhampton, "An improved apparatus to be employed in relieving the pressure in gas-retorts." Patent dated Jan. 21, 1876.

According to this improvement, one side of that part of the dip-pipe which is within the hydraulic main, or as much thereof as required, is formed flat. This is faced on the outside, and a faced valve is made to slide vertically thereon, and is carried in V's or other suitable guides cast to the dip-pipe, or otherwise conveniently fixed thereto, so as to keep the valve up to its face. The valve slides over an opening or port formed in the flat part of the dip-pipe, and above the level of the water in the hydraulic main, but preferably at such a height as to allow of the valve being pulled up over the flat part between the opening and the flange which fixes the dip-pipe to the lid of the hydraulic main. A valve-spindle, which is connected at its lower end to the valve, passes up through a stuffing-box preferably cast upon or formed in the flange of the dip-pipe, which connects the dip-pipe with the lid of the hydraulic main. The top of the valve-spindle is connected to a lever so arranged with a weight at one end, and with a vertical rod or chain passing down in front of the retort-bed at the other, that the weight acts to close the valve by pushing it down, and the valve is opened by pulling down the rod or chain, and thus raising the valve, though, of course, the weight may be arranged to open and the rod or chain to close the valve. A stop is provided to prevent the valve descending below the proper point, and a suitable catch or hook is provided to retain the lower end of the rod or chain when the valve is required to be open.

When the valve is raised the port is opened, and the gas can pass freely from the retort direct into the hydraulic main without passing through the water in the main. When the valve is lowered the port is closed, and the gas from the retort must pass through the water in the usual way; or in the case of charging the retort the dip-pipe (which is sealed in the usual way) prevents any return of the gas when the valve is closed.

249.—VAUGHAN, E. P. H., Chancery Lane, London. "An improved fire alarm and gas interceptor." A communication. Patent dated Jan. 21, 1876.

This invention of an apparatus for signalling the outbreak of fires, and at the same time (when so required) cutting off the gas from the burning premises, is not described apart from the drawings which accompany the specification.

261.—PALMER, J. D., Camberwell, Surrey, "Improvements in the construction and arrangement of burners used for illuminating purposes in which gas is employed as the illuminating medium for diffusing light." Provisional protection only obtained. Dated Jan. 22, 1876.

Instead of making gas-burners as heretofore practised, it is proposed, according to this invention, to construct them in the following manner:—A ring or band of metal, or other suitable material, is formed with a vertical annular groove or channel therein. Into this groove there is fixed and hermetically sealed or enclosed the lower edge and part of an oval or elliptical-shaped dome or cap of very finely woven wire gauze made of platinum, iridium, or other metal possessing the like properties of resisting great heat and non-oxidizable. To the upper part of this wire gauze there is affixed air-tight a rod of metal or other suitable material, the lower end being fastened to a cross-bar fixed by its ends to the ring or band which supports the wire gauze cap.

To one part of the under edge of the ring or band one end of a short bent pipe or tube of metal is fixed, and the other end is connected by a screw to the pipe through which the gas passes, similarly to the ordinary Argand burner of a gas-lamp. Opposite to the bent pipe another short bent pipe is affixed to the lower edge of the annular grooved band. This last-mentioned pipe is either formed open at its lower end, or with holes in its side, or both at the end and side, for the passage of atmospheric air, which is intended to mix with gas in the wire gauze cap. The gas and air pass through holes in the band, and that part of the groove therein which is not occupied by the wire gauze, or the gas and air may be otherwise allowed to pass into the space within the cap.

The operation of the burner is as follows:—Upon gas being admitted inside the wire gauze cap it will mix with the air therein, and, upon a flame being applied to the outside of the cap, the gas will become ignited, and flame for a short time, after which the flame will disappear and be followed by an intense white luminous body covering the entire outer surface of the wire gauze cap, and thus emit a brilliant white light produced by the perfect combustion of the gas resulting from the combination of the air with the gas, and its passage through the meshes or interstices of the heated wire gauze of which the cap is made.

262.—LAKE, W. R., Southampton Buildings, London, "Improvements in the manufacture of gas and in the utilization of the same for illuminating, heating, and ventilating purposes, and in apparatus therefor." A communication. Provisional protection only obtained. Dated Jan. 22, 1876.

The nature of this invention consists in improvements in the method of manufacturing hydrogen gas, in the combination of hydrogen gas, superheated steam, and petroleum and its distillates, and other solid and liquid hydrocarbons, and in the means employed in manufacturing and in using the same.

APPLICATIONS FOR LETTERS PATENT.

4909.—HARRIS, H. G., Westminster, London, "Improvements in steam-pumps." Dec. 19, 1876.

4916.—DUGARD, W. H., Birmingham, "Improvements in fans for blowing, which improvements are also applicable to fans for exhausting, and to centrifugal pumps." Dec. 20, 1876.

4917.—GILL, J., Bridgnorth, Salop, "A new or improved gas-stove." Dec. 20, 1876.

4935.—JENNINGS, G., Lambeth, London, "Improvements in water-closets and latrines, and in valves for regulating the supply and discharge of water and preventing percussion in water-pipes." Dec. 21, 1876.

- 4943.—WATERSON, H., Birmingham, "Improvements in ratchet-braces." Dec. 21, 1876.
4967.—STORER, J., and PUGH, C. H., Stafford, "Improvements in retort-lid fastenings." Dec. 23, 1876.
4987.—HALLEWELL, R., Blackburn, Lancs, "Improvements in gas motor-engines." Dec. 23, 1876.
4988.—HALLEWELL, R., Blackburn, Lancs, "Improvements in gas and water motor-engines, and in gas motor-engines." Dec. 23, 1876.
5006.—HECK, J. H., Perry's Close, London, "Improvements in direct-acting steam-pumps." Dec. 27, 1876.
5013.—KENNEDY, T., Kilmarnock, N.B., "Improvements in water-meters." Dec. 28, 1876.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3095.—SLATER, J. W., Tamworth Terrace, London, "Improvements in deodorizing and purifying sewage." Aug. 2, 1876.
3620.—BOULTON, M. P. W., Oxfordshire, "Improvements in engines worked by the combustion and expansive force of an inflammable fluid mixture." Sept. 15, 1876.
4980.—O'NEILL, A., Baltimore, U.S.A., "Improvements in pipe-joints." Nov. 11, 1876.
4386.—CLARK, A. M., Chancery Lane, London, "Improved apparatus and machinery for generating and utilizing a motive gas obtained from water." A communication. Nov. 11, 1876.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

- 3781.—WHITE, W., "Improvements in the precipitation of sewage and other foul waters, and in the preparation of precipitating materials." Nov. 20, 1873.
3822.—HAWKINS, J. G., "Improvements in the apparatus used in the manufacture of gas." Nov. 22, 1873.
3848.—LAKE, W. R., "Improvements in gas-engines, and in apparatus for producing gaseous mixtures to be used in the same." Nov. 25, 1873.

- 3857.—GOLDSMITH, G., and DILKES, J., "Improvements in self-acting gates or sluices for preventing the overflow of water from rivers or water-courses." Nov. 26, 1873.
3902.—MORTON, R., "Improvements in refrigerators or apparatus for cooling liquids, parts of which improvements are also applicable to distillation, surface condensation, heating or cooling fluids, air, or gases." Nov. 29, 1873.
3953.—PAGER, F. A., "Improvements in the mode of and apparatus for softening and purifying water." Dec. 2, 1873.
4001.—MESSENGER, T. G., "Improvements in pipe-joints, and in the couplings thereof." Dec. 5, 1873.
4038.—COCKEY, H., and F. C., "Improvements in gas-stoves." Dec. 8, 1873.
4130.—PHILLIPS, J., "Improvements in pipe-joints." Dec. 16, 1873.
4160.—FORBES, The Rev. G. H., "Improvements in the manufacture of gas and quick-lime." Dec. 18, 1873.
4172.—AKESTER, J. C., "An improved silica gas-stove." Dec. 19, 1873.
4192.—STRODE, W. W., MACKENZIE, J., and WILLIAMS, E. P., "Improvements in gas-stoves, to be named the 'Cambridge gas-stove.'" Dec. 20, 1873.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

- 3224.—KIRK, A. C., "Improvements in or connected with retorts." Nov. 9, 1869.
3499.—WILSON, J. C., "An improved revolving engine and pump, applicable as a fluid-meter." Dec. 3, 1869.
3522.—PRIDEAUX, T., "Improvements in purifying and calcining gas and soap limes and other chemical refuse of lime which has been used in the manufacture of such articles." Dec. 6, 1869.
3581.—CROLL, A. A., "Improvements in the treatment of ammoniacal-liquor of gas-works to obtain therefrom salts of ammonia." Dec. 11, 1869.
3682.—LIVSEY, G. T., "Improvements in apparatus used in the manufacture of gas." Dec. 20, 1869.

Share List of Metropolitan Gas and Water Companies.

(Corrected by Mr. F. N. GOLDING, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount paid up per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount paid up per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount paid up per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.
10000	£	GAS COMPANIES.	£ s. d.	£ s. d.	£	5000	£	GAS COMPANIES.	£ s. d.	£ s. d.	£	9000	£	GAS COMPANIES.	£ s. d.	£ s. d.	£
20	20	Anglo-Romano . . .	20 0 0	9 0 0	16-18	56000	50	Hong Kong (Lim.)	10 8 0	10 0 0	15-16	1500	4	Unit. Genl. Limrck.	4 0 0	2 10 0	23-3½
5000	20	Bahia (Limited) . . .	20 0 0	2 0 0	15-13	3783507.	100	Imprl. Continental	43 15 0	9 10 0	88-90	1500	10	Wandsworth & Putney	10 0 0	10 0 0	19-20
1000	20	Do., do., redeem.	20 0 0	2 0 0	25-27	1500007.	100	London . . .	100 0 0	10 0 0	214-217	1500	10	Do., do., . . .	10 0 0	7 10 0	11-12
1500	20	Do., 2nd pref.	20 0 0	7 10 0	19-21	15000007.	Sk.	Do., 1st pref.	100 0 0	6 0 0	149-145	2957	10	Do., do., . . .	10 0 0	7 0 0	..
40000	5	Bombay (Limited).	5 0 0	7 10 0	73-73½	14450	Sk.	Do., 2nd pref.	100 0 0	6 0 0	..	993	10	Do., do., . . .	3 0 0	7 0 0	..
10000	5	Do., fourth issue.	4 0 0	7 0 0	5-5½	4350	Sk.	Do., 3rd pref.	100 0 0	6 0 0	..	16000	5	West Ham . . .	5 0 0	10 0 0	8-8½
10000	20	British (Limited).	20 0 0	10 0 0	40-42	7622	25	Do., A shares .	12 10 0	6 0 0	33-34	10000	5	Do., new shares .	2 10 0	10 0 0	3-4
7500	20	Cagliari (Limited).	20 0 0	5 0 0	..	268057.	All	Do., Debent. stk.	100 0 0	57 & 62.	8-10 pm.						
5500007.	Sk.	Commercial . . .	100 0 0	10 0 0	213-215	15000	5	Malta and Mediter- anean (Limited).	5 0 0	2 0 0	23-3½						
70000	100	Do., 7 per cent.	..	..	..	6000	5	Do., preference .	5 0 0	7 10 0	43-5½						
20000	20	Continental Union.	20 0 0	6 0 0	22½-23½	20000	5	Mauritius (Limited)	2 0 0	..	1-2						
10000	20	Do., new . . .	12 10 0	6 0 0	2-2½ pm	25000	20	Monte Video (Lim.)	20 0 0	8 0 0	19-20						
10000	20	Do., preference .	20 0 0	7 0 0	26-28	8600	10	Nictheroy, Brazil (Limited) . . .	10 0 0	3 10 0	6-8	12000	100	Chelsea . . .	100 0 0	6 0 0	145-9 xd
75000	Sk.	Crystal Palace Dis- trict . . .	100 0 0	10 0 0	214-217	30000	5	Oriental (Calcutta).	5 0 0	9 10 0	8½-8½	1800000	100	East London . .	100 0 0	6 0 0	146-9 xd
125000	Sk.	Do., 7 per cent.	100 0 0	7 0 0	150-155	30000	5	Do., new shares .	3 0 0	9 10 0	2-2½ pm.	8000	50	Grand Junction .	50 0 0	5 0 0	73-75
50000	Sk.	Do., preference .	100 0 0	6 0 0	135-140	10000	5	Ottoman (Limited).	5 0 0	3 0 0	2½-3	5840	25	Do., ¼ shares . .	25 0 0	5 0 0	26½-27½
23400	10	European (Limited).	10 0 0	10 0 0	182-192	17500	10	Para (Limited) . .	10 0 0	7 0 0	4-5	2160	25	Do., new ditto;	..	..	..
12000	10	Do., new shares .	7 10 0	10 0 0	7-8 pm.	27000	20	Phenix . . .	20 0 0	10 0 0	42-44	547960	100	max. div., 7½ p.c.	25 0 0	5 0 0	34-36
35400	10	Do., new shares .	5 0 0	10 0 0	5-6 pm.	3600007.	100	Do., new . . .	60 0 0	7 10 0	95-100	970	100	Kent . . .	100 0 0	8 0 0	173-178
37977707.	Sk.	Gaslight & Coke A.	100 0 0	10 0 0	215-218	1440007.	Sk.	Do., capitalized .	100 0 0	5 0 0	100-105	1161	100	Lambeth . . .	100 0 0	6 5 0	146-9 xd
1000007.	10	Do. B. . .	100 0 0	4 0 0	86-90	36000	20	Do., new, 1876 .	..	..	14-16 pm	4475	100	Do., do., . . .	100 0 0	6 5 0	143-6 xd
30000	10	Do. 5 per ct. pref. conv., 3rd issue.	all	5 0 0	20½-21	7359	5	Rio de Janeiro (L.)	20 0 0	10 0 0	32-34	400000	100	New River . . .	100 0 0	7 0 0	185-195
50000	10	Do. do., 4th do., .	6 0 0	5 0 0	8-8½ pm.	2000	5	Singapore (Limited)	5 0 0	7 10 0	52-5½	3036	100	Do., do., . . .	60 0 0	7 0 0	50-55 pm
50000	10	Do. do., 5th do., .	2 0 0	5 0 0	7½-8 pm.	1500	32½	Do., preference .	5 0 0	7 10 0	52-6½	1296	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	101-103
2000007.	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	230-240	4000	50	Shanghai . . .	32 10 0	12 0 0	30-32	..	100	Southwark & Vauxh.	100 0 0	4 0 0	111-114
3000007.	"	Do. D do. do., .	100 0 0	10 0 0	230-240	4000	12½	South Metropolitan	50 0 0	10 0 0	108-110	..	100	Do., pref. stock .	100 0 0	5 0 0	112-114
1650007.	"	Do. E do. do., .	100 0 0	10 0 0	230-240	20000	12½	Do., do., . . .	12 10 0	10 0 0	27-28	..	100	Do., D shares . .	100 0 0	4 0 0	108-111
300007.	"	Do. F 5 do. do.,	100 0 0	5 0 0	114-116	10000	10	Do., new shares .	9 0 0	10 0 0	12½-13½	..	100	Do., ¼ preference	100 0 0	4 10 0	106-108
600007.	"	Do. G 7½ do. do.,	100 0 0	7 10 0	165-170	15000	10	Surrey Consumers.	10 0 0	10 0 0	21-22	1600	100	Do., new ordinary	..	..	4 10 0
13000007.	"	Do. H . . .	100 0 0	7 0 0	150-153	10000	10	Do., new . . .	8 0 0	10 0 0	9½-10½ p.	12172	61	Do., new ord. No.1	40 0 0	4 10 0	106-108
6200	5	Georgetown, Guiana	5 0 0	5 0 0	..									West Middlesex .	61 0 0	6½ p.sh.	133-135

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

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The BEST EXHAUSTERS IN THE WORLD.

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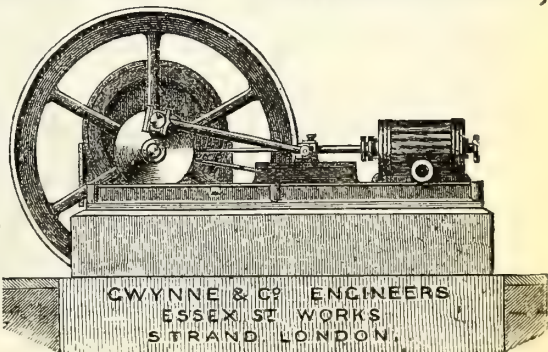


Fig. 225.

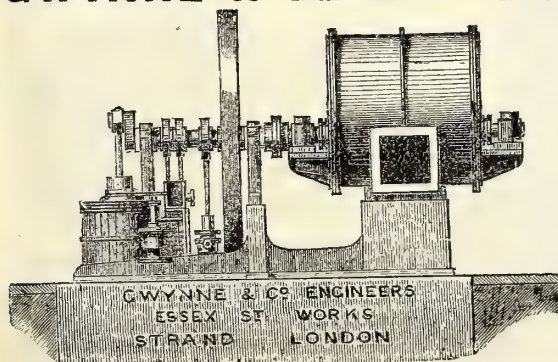


Fig. 224.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the most perfect system of action yet discovered. Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement. Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES, CAN BE HAD ON APPLICATION TO

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 cubic feet Patent Gas Exhausters, and many of all sizes.

WANTED, Spent Oxide. The Sheffield Chemical Company, Attercliffe, are prepared to PURCHASE large or small quantities. Address, with particulars, the Proprietors, HORNBY, FAIRBURN, AND CO.

WANTED, a steady Man, of good character, as STOKER in a country Gas-Work. Average wages 26s. per week. Applications, with references, to be made to Mr. HARVEY, Gas-Works, Winsford, CHESHIRE.

WANTED, a situation as Working MANAGER in a small Gas-Work, or Leading Man in a large Work. Thoroughly understands the manufacture of gas in all its branches. Can take meters, do all main and service laying, and general repairs. Address FRANK SCOTT, Beaufort Gas-Works, SOUTH WALES.

WANTED, by a Working Manager of a Gas-Work, a SITUATION. Can do main and service laying, meter-fixing, setting of retorts, clay or iron, inside or outside fittings of any description. Twelve years testimonials. Abroad preferred. Address No. 332, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO DRY GAS-METER MANUFACTURERS.
WANTED, a situation as Metal Caster, by the Advertiser, who has had 18 years experience in Thomas Glover and Co.'s system. Is acquainted with the various metals used in the manufacture of Gas-Meters. Address No. 340, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Shrewsbury Gas Company, a first-class Man as FOREMAN, who thoroughly understands the manufacture of gas and the machinery in connexion therewith. Wages 35s. per week. House, coal, and gas. Preference given to a married man with no family.

Applications, in own handwriting, stating age and qualifications, accompanied by recent testimonials and fitness for managing men, to be sent to me on or before the 11th of January next.

None but those whose character will bear the strictest investigation need apply.

By order of the Directors,

S. B. DARWIN, Secretary.

Gas-Works, Dec. 28, 1876.

ADVANTAGES OF GAS FOR COOKING AND HEATING.

HINTS ON GAS BURNERS, &c.

By MAGNUS OHRÉN, A.I.C.E., F.C.S.

Specimen Copy by post Threepence, direct from MAGNUS OHRÉN, Gas-Works, Lower Sydenham, London, S.E.

CONDENSERS FOR SALE.

THE Tillicoutry and Devonside Gas Company have for immediate SALE, as they stand—One set of Atmospheric Vertical Condensers, 18 pipes, 11 ft. 3 in. high by 7 in. diameter, with tar-boxes, &c., complete.

Also a Battery Condenser, 13 ft. by 8 ft. by 2 ft., with boxes, &c., as above.

Apply to Mr. FRANK SCOTT, Gas Manager, TILlicouTRY.

BOILERS.
FOR SALE, Cheap, Two 5-h.p. Cornish BOILERS, in good condition. May be seen at the Reading Gas-Works. Particulars can be obtained of Mr. E. BAKER, Engineer.

FOR SALE—A second-hand Gasholder, in good condition, 33 ft. diameter and 9 ft. deep. Has been in use about nine years. Also some 5-in. and 4-in. Donkin Valves. To be sold at a moderate price. Apply to Mr. W. T. HEWES, Gas-Works, HENLEY-ON-THAMES.

FOR SALE—A 10 ft. Gasholder (second-hand), with metal tank, columns, pulleys, and weights, now erected and in working order. Suitable for a small factory or private residence. Apply at LINTZ FORD MILL, Lintz Green, near Newcastle-upon-Tyne.

THE Blackburn Gaslight and Coke Company have FOR SALE one 25,000 feet per hour EXHAUSTER and ENGINE combined, with one 10-h.p. Boiler. The Exhauster is by Musgrave and Co., of Bolton, and is only to be sold as it has been replaced by a larger one. Application to be made for price, &c., to the undersigned. S. R. OGDEN, Engineer.

GOVERNORS FOR SALE.
FOR SALE, at the Eccles Street Works of the Liverpool United Gaslight Company, two GOVERNORS, each having a 10-in. cone and 16-in. bye-pass. Also four GOVERNORS, each having a 6-in. cone and 8-in. bye-pass. These Governors are in excellent order, and are fitted complete and ready for work, and have been replaced by apparatus of larger dimensions. Apply to Mr. KING, Engineer, Gas Office, Duke Street, LIVERPOOL.

TAR AND AMMONIA WATER.
TO BE DISPOSED OF, the Tar and AMMONIA WATER produced at the Merthyr Tydfil Gas-Works.

The Directors of the Company will be glad to receive offers to purchase the same for a period of Three or Five years.

Particulars as to quantity, &c., may be obtained of the undersigned.

The right to accept or refuse the highest or any offer is reserved.

By order,

JOHN LEES COCKER, Secretary and Manager.
Gas Office, Merthyr Tydfil, Glamorganshire,
Dec. 13, 1876.

TO BE SOLD.

THE Keighley Local Board of Health have FOR SALE, by private contract, the GASWORKS PLANT and APPARATUS at present in use at the Low Bridge Works, in Keighley, comprising 165 Mouthpieces, Hydraulics, two 12-in. Vertical Condensers, Engine and Exhauster, Tar and Liquor Pumps, with shafting, &c., wrought-iron Scrubber, Station-Meter (Braddock's), and other apparatus, with the valves and connexions complete (12-in. diameter throughout).

The whole are in good condition, and can be seen at work, on application to the undersigned, at the Offices, Low Bridge Works, Keighley, from whom any further particulars can be obtained.

By order,

JOHN LAYCOCK.

Keighley, Dec. 21, 1876.

THE Swansea Gaslight Company have for immediate SALE, the following Plant:—A 6-h.p. Patent Trunk Engine. (Beale.) Exhauster to pass 15,000 feet per hour. (Beale.) An 8-h.p. Grasshopper Engine. (Easton and Amos.) Exhauster, 20,000 ft. per hour. (Beale.) Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.

Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.

Wrought-iron Scrubber, 5 ft. diameter, 20 ft. high. A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.

May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.

Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

RETORTS, FIRE-BRICKS, AND IRON RETORT FITTINGS.

THE Gas Committee of the Wigan Corporation are prepared to receive TENDERS for the supply of 140 lengths of Fire-Clay through RETORTS, and the necessary Fire-Bricks and Fire-Clay for the same. TENDERS are also invited for the supply of the necessary IRONWORK for the above.

Plans, specifications, and other particulars may be obtained on application to Mr. J. G. HAWKINS, the Manager of the Gas-Works, WIGAN.

Sealed tenders, endorsed "Tender for Retorts, &c.," to be sent in to Mr. HAWKINS, on or before the 17th of January, 1877.

The lowest tender not necessarily accepted.

Dec. 9, 1876.

TO RETORT MAKERS.

THE Gas Committee of the Bury Corporation are prepared to receive TENDERS for the supply of 88 D Fire-Clay Through RETORTS, 18 in. by 14 in. by 10 ft. long; and 23 D Fire-Clay Through RETORTS, 16 in. by 14 in. by 9 ft. 9 in. long, delivered free at the Railway Station, Bury. The whole to be delivered on or before the 30th of June next.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Retorts," to be sent in on or before the 12th day of January, 1877.

The Committee do not bind themselves to accept the lowest or any tender.

Bury, Lancashire, Dec. 23, 1876.

MARPLE GAS-WORKS.

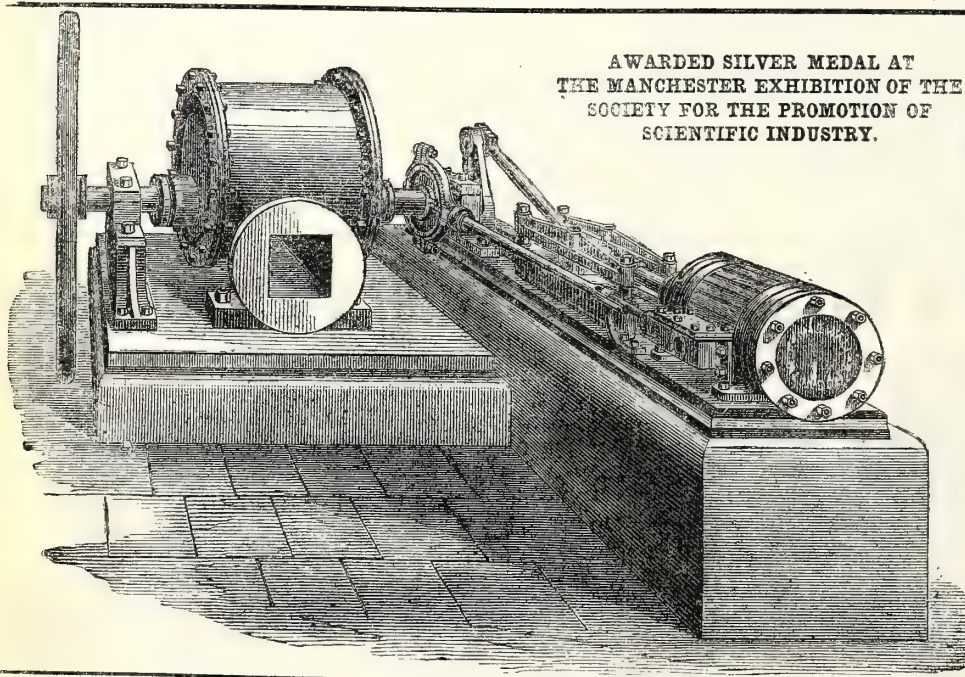
TO GASHOLDER MAKERS AND OTHERS.

CONTRACT No. 2.

THE Directors of the Marple Gas Company, Limited, are prepared to receive TENDERS for the supplying, fixing, and completion of a Single-Lift GASHOLDER, 80 ft. diameter and 20 ft. 6 in. deep, with all necessary guides, wheels, columns, and girders complete, to be erected at their Gas-Works, Marple Bridge. The drawings and specifications may be seen on application at the works.

Sealed tenders to be sent in on or before Saturday, the 13th day of January, 1877, addressed to the Chairman of the Gas Company, and endorsed "Tender for Gasholder." The Gas Company do not bind themselves to accept the lowest or any tender.

Further particulars may be obtained upon application at the works, or to Mr. JAS. JACQUES, Gas-Works, STOCKPORT. Dec. 30, 1876.



AWARDED SILVER MEDAL AT THE MANCHESTER EXHIBITION OF THE SOCIETY FOR THE PROMOTION OF SCIENTIFIC INDUSTRY.

BEALE'S Improved Patent GAS-EXHAUSTERS WITH ENGINES COMBINED.

Sole Makers,
GEORGE WALLER & CO.

Makers of
ENGINES, EXHAUSTERS,
INDEX and DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, and other PUMPS,
SCRUBBERS and PURIFIERS,
CONDENSERS, BOILERS, &c.

PHENIX ENGINEERING WORKS,
HOLLAND STREET, S.E.,
AND
STROUD, GLOUCESTERSHIRE.

D. BRUCE PEEBLES & CO.,
ENGINEERS,
FOUNTAINBRIDGE WORKS, EDINBURGH,
MANUFACTURERS OF WET AND DRY GAS-METERS;
Patentees and Sole Manufacturers of "PEEBLES' GAS-GOVERNORS,"
FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS,
OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.

"These Lamp-Governors are so superior that they are likely to supplant all others."—Dr. Wm. Wallace, F.R.S.E., F.C.S.

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Vol. XXVIII. (second half of 1876) will shortly be ready, bound in cloth, gilt letters, price 18s. Cloth cases for binding may now be obtained on order from any bookseller, or from the Publisher.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

Mr. GOOD (Carshalton) writes: "As the correspondence on the Removable Dip-Pipes is closed, I purpose to bring the subject before the Gas Managers Association at their next meeting."

A GAS MANAGER OF THIRTY YEARS EXPERIENCE writes: "The explosion of the gas-meter described by 'S. E.' in the last JOURNAL seems capable of explanation by supposing that the gas within it must have been mixed with air containing oxygen sufficient to render the mixture explosive. A foolish and dangerous practice is sometimes resorted to, to remove water condensed in the fittings by blowing it backwards and into the meter along with air enough to make it explosive, and an application of light to a jet near to the meter might have the effect described. If, however, one jet was being supplied, and burning steadily from the meter for some time previously—of which there may be some doubt—the explanation offered must fail; and it does seem, from the description of the accident, that the explosion was within, not outside of, the meter."

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 9, 1877.

Circular to Gas Companies.

If the allegation be true, that Gas Companies are in the habit of taking every opportunity for the expenditure of capital, in order that they may extort as much as possible from the pockets of their customers, it must, we fear, be admitted, that many, or most, Corporations possessing gas-works, "starve" their undertakings as regards capital expenditure, and thus prevent the realization of all the advantages that might be derived from their possession. The reason for this is not far to seek. The free-born Briton naturally hates "taxes"; but the intense hatred he entertains for "rates" can only be understood by one who pays them. For the former, he sees a visible result, for the most part embodied in an Army and Navy, of which we need say nothing. For the latter he is often puzzled to see what he gets. Hence, to cut short a story which might be made very long, the ordinary borough ratepayer has a horror of loans, of which he naturally expects that he will be compelled, in part, to pay the interest. Unfortunately, he does not discriminate between loans for works which will be remunerative, and those for works which must necessarily be unprofitable in a directly pecuniary sense. Thus it happens that local councils are not unfrequently deterred, by the fear of popular opposition, from contracting debts to extend such remunerative undertakings as gas-works, which might, in the end, produce great advantages to ratepayers, or, as we prefer to put it, to ratepaying gas consumers.

We always allude with delicacy to the case of Manchester, which is altogether *unique*; but even in this model city, as regards the gas undertaking, it would seem that the Town Council have postponed, to the very latest moment, the construction of additional works, which are, or will be within a year or two, absolutely necessary to keep up an adequate supply of gas. There was no necessity for this delay at Manchester; for any additional works required might have been constructed out of the gas profits, without a fresh debt being incurred by the Corporation.

But if we cross the river to Salford, a somewhat different condition of affairs obtains. The gas-works belonging to the Corporation of Salford, it is clear, are by no means in a satisfactory state, and are quite inadequate to maintain a proper supply of gas at the present time. Perhaps the carbonizing department is not altogether insufficient; but it would seem that the purifying apparatus in existence is capable of only half purifying the amount of gas made. From this cause it seems that many complaints of the quality of the gas arise, and it must be clear to every one that such serious deficiencies should be immediately remedied. With some rearrangement of the existing works, these additions, it is estimated, will cost the Corporation £30,000. But then comes the question of extensions for future requirements, which, it is calculated, will cost £130,000. At the prospect of this expenditure, the Town Council evidently take fright, although their Gas Committee propose that it shall be extended over seven years, additions being made as they are rendered necessary. There are evidently people in Salford who cannot see that this annual expenditure of some £20,000 is certain to prove remunerative to the Corporation in consequence of the increase in the consumption of gas every year. They only look at the capital amount, and fear that this must prove an additional burden. This sort of popular ignorance is what a Town Council have often to contend against. The further consideration of the Gas Committee's report has been deferred for a time; but the ultimate conclusion will inevitably be, that the work recommended must be done. The Gas Committee may, in the past year or two, precipitately, badly-advised, or ill-informed, have made extravagant coal contracts; but on these matters of alterations and extensions of works, they seem to us to be perfectly in the right, and we may be certain that in the end they will receive the full support of the Council.

At Rochdale, a not very dissimilar state of affairs is revealed. There, too, the gas undertaking of the Corporation has been somewhat "starved" by the parsimony of the Council. It would appear that the existing works are barely adequate for present requirements. The statement is made, and does not seem to be contradicted, that one dark day last year the district was within a few minutes of complete darkness, from a want of producing power. This was on an altogether exceptional day; but such emergencies must always be provided for. The Gas Committee now propose to expend £150,000 on the purchase of land and

the erection of new works, and, as a matter of course, there is a great outcry against the scheme. The "hand-to-mouth" system is advocated, as usual. Lengthen the retort-house, and add bench after bench as they may be required; make a single-lift into a double-lift gasholder, and everything that will be necessary for the next five years will be accomplished. We venture to think that this sort of tinkering never answers. In the long run, it is much more economical to build new than to patch old works. This the Rochdale Corporation will, in time, discover. There is one argument used by the opponents of the outlay recommended by the Gas Committee, which deserves consideration. The increase in the consumption of gas in the district of the Corporation is not so large as it used to be in past times. The Corporation have made praiseworthy efforts to secure the consumption of gas, even in the smallest cottages, and they have succeeded. For any increase they have therefore to rely upon the natural development of the population, or upon immigration to the district. From the latter source, with the present condition of things, we rather think no great increase is to be expected, and, therefore, the Corporation may be wise in hesitating before they commit themselves to a large addition to the burdens of the town.

If there are towns—we here avoid the use of the word Corporations—without enterprise, and some without prospects, there are others in which neither enterprise nor prospects are lacking. One of these is Nottingham. Two years ago this town acquired one of the most substantial and promising gas undertakings in the kingdom. During the existence of the company, the annual average rate of increase in consumption amounted to about ten per cent., and it would seem that, since the undertaking came into the hands of the Corporation, the rate of increase has been somewhat higher. Further than this, the Corporation limits exceed those which the Company possessed, and some portions are altogether unsupplied. The existing works—three in number—in their present stage of development, are only equal to the production of 4,700,000 feet of gas per diem, and on the 24th of December, 1875, the quantity of gas delivered or consumed amounted to 4,139,000 cubic feet. Under these circumstances, the engineer of the Corporation, Mr. Tarbotton, has pressed on the Council the necessity for making immediate extensions. It is only fair to the defunct company to say that they had contemplated making large extensions, and had, we believe, acquired the additional land at Basford, which Mr. Tarbotton now proposes to utilize. The last works constructed by the Company at Basford, are some of the handsomest and most substantial in the kingdom, and we may be forgiven for expressing a hope that the general design of the new works will harmonize with that of those already in existence. *Æsthetics* are but little studied in connexion with gas-works; but even in these there is scope for some artistic display.

We need not allude in detail to the extensions recommended. They consist mainly in quadrupling the capacity of the Basford works. But it would seem certain that at no distant time, if a revival of trade take place, the rich mineral district to the north-west of Nottingham will receive a large accession of population, who will require to be supplied with gas. The ground is irregular and perplexing, but Mr. Tarbotton has selected two sites for new works, either one of which appears to be well adapted for the purpose. At the present moment we are not aware that either site proposed has been adopted by the Town Council of Nottingham. No estimate of the cost of the alterations and extensions is given in the report we notice, but that does not matter. The Engineer enjoys the fullest confidence of the Council, and the latter, we believe, have the confidence of their constituents, so that whatever is proposed will, we have no doubt, be carried out, and to a successful issue. The ratepayer, we do not think, will obtrude in this case.

The gas accounts of the Corporation of Carlisle show that in the course of the year ending June 30, 1876, a gross profit of £5401 has been made by working the undertaking. Out of this sum £2228 has been expended on extensions; and, after paying £200 to the Corporation, setting apart £150 for interest on deposits, and paying off mortgages to the amount of £989, there remains a balance of £1833 to be carried forward. We may again object to the form in which the accounts are presented, and once more express a hope that all Corporations will make out their statements in the form prescribed for gas companies by the Gas-Works Clauses Act, 1871. If this be done, we shall always be able to follow the details, and form a judgment as to the results.

Monday, the 22nd inst., has been fixed by the Mayor of Warrington as the day on which voting papers will be distributed to ascertain the opinion of the majority of the ratepayers on the gas purchase question. We shall be glad when the matter is

settled one way or the other, for the flood of ink now being expended on the discussion compels us to much reading, which is not always pleasant, and is never profitable. The leaders of the opposition have displayed so much ignorance, and have been so unscrupulous in making statements which could not be supported, that we are not surprised to hear a considerable change of opinion has taken place in the borough, and that, after all, the Council are likely to be supported by the ratepayers. If we did not believe the directors of the Gas Company to be honourable gentlemen, we might suppose the opposition to be stimulated by them. They have no desire to part with their property, but having agreed to sell, we have no doubt they have loyally abstained from taking any part in the recent discussions.

At the last meeting of the Warrington Council, the question was brought forward, how far the purchase was likely to prove beneficial to gas consumers, as distinct from ratepayers. There is no doubt that a Corporation gas undertaking may be made use of as an instrument of extortion. When a town hall is built out of gas profits, it is clear that gas consumers alone have been taxed for its construction. Now, what might be quite fair in Rochdale, where, as said above, the consumption of gas is almost universal, might be grossly unjust in another borough in which the consumption of gas was less general. Councillor Platt sees this clearly enough, and is, no doubt, perfectly right in his opinion, that no reduction of price is likely to result from a change in the proprietorship of the gas undertaking. The chances of a reduction of price lie rather with the retention of the undertaking by the Company.

If the Warrington people wish to know what a Gas Company can do, they have not to go far to learn. Preston is close by, and the circumstances of the two places are, we think, not very dissimilar. At Preston nineteen or twenty candle gas has hitherto been supplied by the Company, at 4s. 2d. per 1000 feet, with a discount of fifteen per cent. to the smallest, and twenty per cent. to large consumers. The Company have now resolved to reduce the price to 3s. 9d. per 1000 feet, allowing the same discounts, which makes the cost 3s. 6½d. to small and 3s. 4d. to large consumers. The Town Council of Preston wisely consider that they are not likely to do better than this, and show no disposition to acquire the gas undertaking.

With reference to the arrival of a cargo of "Hartley Mineral" from New South Wales, which we announced last week, we have received information that there is practically no limit to the supply, if a satisfactory price can be arranged. The recent importation, we are told, has been sold in the docks for 80s. per ton. With Boghead difficult to obtain in the London market at 75s., there may, considering the alleged superior richness of the "Hartley Mineral," be some advantage in its purchase at the price named.

The report of the Chief Gas Examiner shows that the Metropolitan Gas Companies under his supervision continue to supply gas fully equal to statutory requirements and the Instructions of the Referees. The illuminating power of the gas, it will be seen, has been, with one exception, fully kept up to the parliamentary standard. The Instructions of the Gas Referees, as to the purity of the gas, have been for the most part fairly complied with. Ammonia, of which no Gas Company would lose a grain, if they could possibly retain it, has been kept down to its lowest limits. As regards "sulphur"—the removal of which presents greater difficulties, and the taking out of which is altogether unprofitable, so long as the companies keep themselves within the prescribed limits, and save themselves from forfeitures—it will be seen that the maximum of the Referees has been rarely exceeded. Some sulphuretted hydrogen has been more than once discovered in the course of the past quarter; but whenever the presence of this gas is demonstrated, our word may be taken that it is the result of a simple accident, and arises from unavoidable causes.

DEATH OF MR. JOSEPH BRADDOCK, SEN.—Many of our readers will hear with regret of the death of the above-named gentleman. The event occurred at his residence, Fairfield, near Manchester, on New Year's morning, after an illness of but a few minutes duration. In early life Mr. Braddock received his business training at the Oldham Gas-Works, under Mr. Emmott, and left in 1855 to take the management of the Preston Gas-Works, where he remained two years. In 1857 he received the appointment of manager of the York Gas-Works, and retained the position 31 years. It is not too much to say that it was largely due to his thorough knowledge of the profession that the York Gas Company became one of the most successful in the kingdom. On his retirement from that post in 1868, he returned to Oldham, and, with his nephew, constituted the well-known firm of J. and J. Braddock, of the Globe Meter-Works. Mr. Braddock had attained the age of 64 years. He was interred in the family grave at Mottram Church on the 5th inst.

BUENOS AYRES GAS SUPPLY.—A Reuter's telegram, received at Southampton on the 1st inst., brings advices from Buenos Ayres to the 1st of December. The *Buenos Ayres Standard* says: "The Provincial Legislature is still in session, and has just passed a new municipal law, by virtue of which the Municipality will be able to pay off its heavy debts to both gas companies."

Water and Sanitary Notes.

THE year opens with an abundance of water, and yet we have no assurance that Midsummer will not find many districts in great want of supply. Much has been written by Mr. Bailey Denton and others on the necessity of storing up the rainfall for the supply of those villages which, from their position, are peculiarly liable to suffer from drought, but nothing has been done. If, as is quite possible, after these excessive rains, we have a very dry summer, a lesson will have been taught, which we hope will not be forgotten in the future.

We were quite right in our surmise, that little more would be heard of the York "filibustering" Water Bill. Mr. Gutch has decided on withdrawing it, which, for one reason, we regret. He and his supporters should have been made to pay handsomely for their audacious attempt. But this would have involved considerable expenses to the existing Water Company, and also the Corporation, and matters are, perhaps, best as they are. There can be no doubt that the water of the Ouse, pumped from the new intake of the York Company, will be one of the most wholesome and palatable waters in the kingdom—infinitely superior, in every sense, to the vapid stuff Mr. Gutch would have collected and distributed, if he could have procured it in sufficient quantity, and procured the necessary powers, which he never would have obtained. We hope soon to receive the report of the "Newcastle" analyst on the quality of the Ouse water, and then we may make some remarks on this case in particular, and the reports of water analysts in general. It will be curious to see placed in juxtaposition the analytical results, and the opinions expressed by different analysts as to the wholesomeness or not of different waters submitted to them for examination. The labour of collation will, however, be large, and the work must be deferred for a time.

Our columns show that an attempt is about to be made by the Corporation of Bristol to purchase the undertaking of the Bristol Water-Works Company. The two parties approach each other in the most amicable spirit, and perhaps we shall not be wrong in conjecturing that, before long, the undertaking will belong to the Corporation. We are rather afraid that Water Companies have, since the precedent established in the Stockton and Middlesbrough case, been disposed to behave, in the face of a Corporation, much in the same way as did the racoon in a tree, who found himself face to face with the renowned American sportsman, Colonel Crockett. "Don't shoot," said meekly the animal, when he saw himself covered by the Colonel's gun; "I'll come down." So Water and Gas Companies seem disposed to "come down" whenever a Corporation offers to take a shot at them. There is really no necessity for this exhibition of meekness. The Bristol Company are perfectly secure, notwithstanding the threats of corporate and other opposition. Nevertheless, they may "come down," and with good grace, and accept such terms as the Corporation Crocketts will be compelled to pay. The Bristol Company are a ten per cent. Company, and the parliamentary terms for the purchase of such an undertaking are now fully settled. No *laches* can be attributed to the Company, and therefore the best terms must be given. The Corporation of Bristol will probably consent to pay the only price that could be accepted, and thus one more important water undertaking may pass into the hands of a Municipality.

An appeal by the Birmingham Corporation against the assessment of their reservoirs, filter-beds, engine-houses, and works, in the parish of Shustoke, came before the Warwickshire Quarter Sessions last week. The gross amount of the rate appealed against was £5350, the net rateable value being taken at £4280. After an inquiry extending over three days, the Court amended the rate by substituting £3593 as the gross, and £2875 as the net rateable value. We reserve a report of the evidence till our next number.

LAMBETH WATER-WORKS COMPANY.—Mr. G. H. Louttit has been appointed secretary of this company, in the room of Mr. W. S. Phipps, who has retired.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, the 2nd inst., was the anniversary of the foundation of this Institution, which was founded in 1818 and incorporated in 1828. The Institution consists of three classes—members who must have occupied responsible professional positions for at least five years; associates, not necessarily engineers; and honorary members and students. Of each class there are 882, 1608, 14, and 433 respectively, making a total of 2937.

RATING OF THE EXETER WATER COMPANY.—At a special sessions held at Exeter last week, for hearing appeals against the poor-rate, the Exeter Water Company made two appeals against the increased rating of their property in Trinity and St. Mary Major's parishes. Mr. Buckingham, their solicitor, said the company had lately been assessed at a much higher rate in Trinity parish, but it had been found to be an error. He had gone thoroughly into the matter with the overseers and churchwardens of that parish, and the latter were willing to let the rate be reduced from £513 gross and £487 net, to £260 gross and £245 net. The churchwardens, admitted the error, and the Bench allowed the reduction.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXIV.

MAIN-PIPES (*continued*).

We come now to treat of spigot and socket, or, as some prefer to style them, spigot and faucet joints. This is the class of joint, in one form or another, most commonly in use for gas-mains; and, taking into account the various advantages it offers over others in point of cheapness, facility in connecting, and permanent durability when well made, it may with confidence be pronounced the most suitable for adoption.

There are two distinctive kinds of this description of joint—viz., the open, and the bored and turned. It is of the former that we shall first speak. Pipes so manufactured have the inner diameter of the socket larger than the outer diameter of the spigot; the latter, consequently, fits loosely into the former. For cast-iron mains of the smallest size up to 8 inches in diameter, this open jointing space is three-eighths of an inch, and for larger diameters half an inch wide all round. The following are the usual depths of the socket, inside measure, for the various sizes of open-jointed gas-pipes, plugged with yarn and lead:—

Diameter.	Depth of Socket.
Up to 3 inches	= 3 inches.
4 to 8 "	= 4 "
9 to 20 "	= 4½ "
21 to 30 "	= 5 "
32 " and upwards	= 6 "

For open-jointed pipes intended to be caulked with lead, the throat of the socket is cast with a slightly thicker body of metal than the rest of the pipe. This is necessary in order to enable it to resist the tendency to splitting in the setting up of the joint.

The spigot end of the pipe may be either plain throughout its length, as in fig. 16, or it may have a bead cast on, as shown in fig. 17.

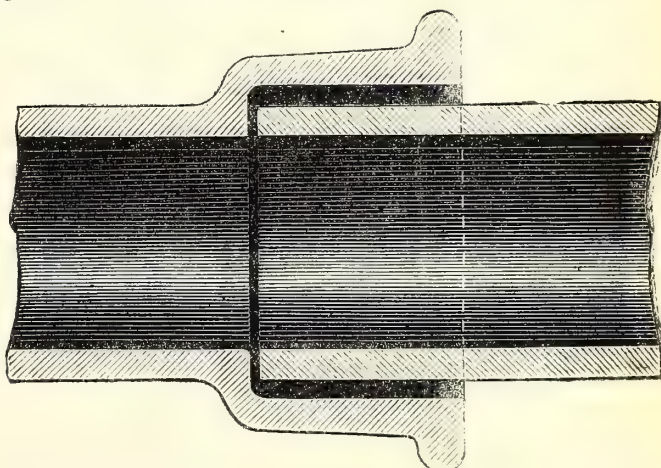


FIG. 16.

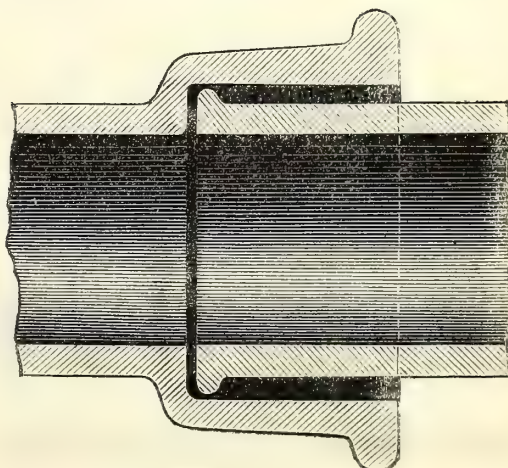


FIG. 17.

Some engineers prefer the former, stating, as their reason for the preference, that the end being plain admits of the full action of expansion and contraction without risk of the "drawing" of the lead, which they assert occurs with the beaded spigot. We do not share this view, as our experience justifies the assertion that whatever drawing of the lead may occur is due to quite another cause. In making this joint, the spigot having been inserted into the socket, a double fold of twined gasket is placed round the pipe, and, by means of a caulking iron, is driven within the open space; this is repeated three or four times, or oftener, according to the size of the mains being laid, the packing being well caulked all round, until, for a pipe say of 8 inches in diameter, the depth of the gasket is about 2 inches; the bead on the spigot prevents the packing getting beyond the pipe end. Instead of dry hemp, a packing of tarred yarn is frequently

employed. Our preference is for the former. The yarn of which it is made is usually of better quality than the other, and in absorbing the moisture which is present in the mains, it is swollen to a degree of tightness not attained in the other case. The hemp plugging not only prevents the molten lead from entering the pipe, but it allows a certain degree of play to the joint in the direction of its length, in becoming compressed by the contractile action of the metal of the pipe when submitted to a low temperature in the ground.

The packing of gasket having been inserted and properly caulked, a piece of good tough clay, formed into a roll of the required length, is passed round the pipe, and pressed close up against the face of the socket, thus forming a fence to prevent the escape of the molten lead, which is now poured in through an opening or lip, formed on the upper side of the pipe, where the two ends of the clay meet. The socket being entirely filled, the clay is removed, and the operation repeated with the other joints. The lead, after being allowed to cool, is set up all round by means of a blunt caulking tool and hammer, the superfluous lead left in the lip of the clay being cut off with a cold chisel.

When the pipes that are being laid are of large diameter, a fence of iron, which is more convenient, may be substituted for the clay roll. This is made of flat iron, $1\frac{1}{2}$ inch in width, by 5-16ths inch thick, bent to fit the outer diameter of the pipe in two half circles, like a pair of calipers, and hinged underneath, the ends meeting at the top being formed into a pouring gate for the lead. The instrument is clipped round the pipe against the face of the socket, and a thin luting of clay rubbed on the edges suffices to make it tight.

It is of importance, in making lead joints, that the ladle, out of which the molten metal is poured, should be of size sufficient to contain as much as will fill the socket at one continuous pouring. If this is not convenient, owing to the large size of the joint, then two men, each having a ladle, should pour the metal simultaneously, or other means should be employed to ensure the same result. It is clear that if the lead, instead of being allowed to flow into the socket in an unbroken stream, is poured in a fragmentary way, the joint, when completed, will be less homogeneous and perfect.

TABLE
Giving the Weight of Lead in Pounds Required for Jointing
Cast-Iron Mains.

Diameter of Pipe in Inches.	Weight of Lead in Pounds.	Depth of Lead in Inches.	Diameter of Pipe in Inches.	Weight of Lead in Pounds.	Depth of Lead in Inches.
$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	11	$16\frac{1}{2}$	$2\frac{1}{2}$
2	$1\frac{3}{4}$	$1\frac{3}{4}$	12	$18\frac{1}{2}$	$2\frac{3}{4}$
$2\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{3}{4}$	13	21	$2\frac{3}{4}$
3	$2\frac{3}{4}$	$1\frac{3}{4}$	14	$23\frac{1}{2}$	$2\frac{3}{4}$
4	4	$1\frac{3}{4}$	15	26	$2\frac{1}{2}$
5	$5\frac{1}{2}$	$1\frac{3}{4}$	16	$28\frac{1}{2}$	$2\frac{1}{2}$
6	7	2	17	31	$2\frac{1}{2}$
7	$8\frac{3}{4}$	2	18	$32\frac{1}{2}$	$2\frac{1}{2}$
8	$10\frac{1}{2}$	$2\frac{1}{4}$	19	34	$2\frac{1}{2}$
9	$12\frac{1}{2}$	$2\frac{1}{4}$	20	$35\frac{1}{2}$	$2\frac{1}{2}$
10	$14\frac{1}{2}$	$2\frac{1}{4}$	24	48	3

For pipes $1\frac{1}{2}$ to 8 inches in diameter the lead is assumed to be about three-eighths of an inch thick; and in pipes 9 inches in diameter and upwards, half an inch thick.

The lead employed should be pure, without any admixture of tin, antimony, or zinc. We know that managers of gas-works, in laying mains, are naturally disposed to utilize the scrap composition-pipes of the store-room, and even old meter cylinders melted up together, for this purpose, with the laudable object of economizing the expenses. This is a mistake, as the more granular and brittle texture of the metals named militates against the soundness of the work.

The joint, to be as perfect as possible, should have an equal thickness of lead all round, and to ensure this being so, the spigot should be concentric with the rim of the socket. The bead on the pipe end, if of the proper size, admits of this being accomplished without difficulty, and without the necessity of temporarily wedging the pipe, though the same end is attained with plain pipes, by having the throat of the socket cast in the form shown in fig. 18.

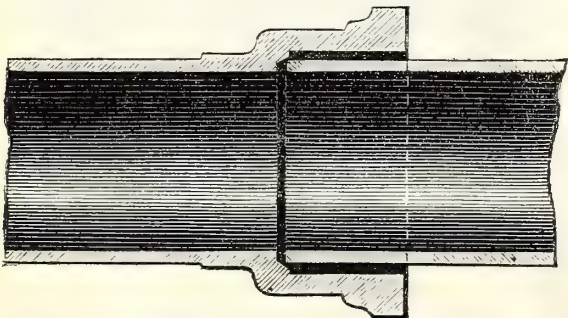


FIG. 18.

In making a lead joint, there is more likely to be oversight and neglect than in any other. Careless workmen are apt to omit the proper caulking of the lead round the under side of the pipe, which is the most difficult of access, and where bad workmanship is not so readily observed by the manager or inspector; hence the reason of the frequent escapes of gas that are found to proceed from that part of the joint.

The work, also, is in danger of being slighted from other causes. In the streets of towns, through which heavy traffic has to pass, the opening of a trench is always a source of annoyance and obstruction;

and, in the anxiety to complete the work, this is sometimes hurried to a degree which is incompatible with the making of good lead joints. In loose soils, also, the workmen are under the necessity, if the joint is to be well finished, of having to make a wide cutting in its vicinity, unless shoring is resorted to, to prevent the sides of the trench from slipping. These various causes operate to place the system of the ordinary jointing by means of lead at a disadvantage, and tend in the long run to augment the leakage account.

The principal advantage claimed by the advocates of the lead joint over the turned and bored, is the superior elasticity of the former, whereby it is enabled to adapt itself to the exigencies of settlement or subsidence in unstable ground, with less risk of leakage. Whilst admitting this to some small extent, we still believe that the alleged advantage is more fanciful than real. Wherever a depression of the ground takes place by which the pipes are carried down with the movement, a leakage, or leakages, inevitably occur. This is found to be the case whether lead or turned and bored joints are employed, with this difference, however, that with the lead the gross leakage is distributed over a number of joints, and is less readily detected; whereas, with the turned and bored, it is generally either confined to one or two, or a fracture occurs at the weakest part in the line of mains, the concentrated nature of the escape (so to speak) ensuring its speedy discovery and remedy.

For our own part, then, supposing there to be no alternative, we prefer the more rigid joint, even for treacherous ground, taking the precaution, however, to have the pipes made considerably stronger than under ordinary circumstances is necessary. We have said "supposing there to be no alternative;" such, however there is, as we shall endeavour to show in a future article.

In a report to the New River Company, by Mr. Thomas Spencer, published in this JOURNAL in September, 1860, the principal objections to the lead joint when used for gas-mains are thus stated:—"Take the joint of a gas-main that has been laid during warm weather, when its diameter and length are at their maximum. As soon as the coldest weather sets in, the size of this main, including its joint, will have reached its minimum. But in its progress from the one extreme to the other, it is evident that the joint must undergo disturbance, even though the lead and iron should expand and contract in an equal ratio. Unfortunately, this is far from being so, for the differential rate of expansion between cast iron and lead is as 9 to $3\frac{1}{2}$. In other words, the temperature necessary to increase a given length of cast iron 9 inches, will increase a similar length of lead only $3\frac{1}{2}$ inches. It will now be obvious that a chief defect of the lead and iron joint for gas-mains arises from the important physical difference in the nature of the two metals. Notwithstanding the disturbance to which this joint is subjected by changes of temperature, it is clear that if the metals composing it contracted and expanded in equal ratio, less injury would arise in practice. We see, however, that the lead and iron are each contracted to a minimum in winter; but as the contractile power of the lead is not equal to that of iron, it is obvious the latter, in contracting, will press the softer metal into a less diameter than it would have assumed naturally. On the return of warm weather, when the iron portion of the joint becomes expanded to its original diameter, *that originally belonging to the lead is never recovered*. Consequently space is left, between the iron and the lead, sufficiently large to allow of the constant escape of which we complain."

We entirely concur in these remarks, borne out as they are by every-day experience and observation.

Instead of lead, iron cement is frequently employed in plugging open-jointed mains. This is slightly more expensive than the lead, owing to its occupying more time in the manipulation; but in point of permanent efficiency it surpasses the other. The cement is prepared as follows:—

98 parts fine cast-iron borings.

1 part flowers of sulphur.

1 part sal ammoniac.

When required for use, mix with boiling water. This cement sets quickly. If required to set slowly, which makes the better joint, let the ingredients be in the following proportion:—

197 parts fine cast-iron borings.

1 part flowers of sulphur.

2 parts sal ammoniac.

Mix the whole together thoroughly by pounding, and keep dry. When required for use, add hot water till the cement is of the consistency of mortar. The iron borings should be perfectly free from oil or grease.

Russian tallow and beeswax, melted and poured in between two gasket coils, have been tried as a substitute for lead, but with no very satisfactory result.

(To be continued.)

PRICE OF GAS AT PRESTON.—At the Preston Town Council meeting on the 1st inst., Mr. Dobson stated that, until a few months ago, the price of gas in that town was about the lowest in Lancashire, and the gas company allowed a discount of 5 per cent. more than was fixed by Act of Parliament. The quality of the gas supplied, too, had been from $1\frac{1}{2}$ to 2 candles more of illuminating power than was fixed by the Act, which was 18 candles. He was glad to state that the gas company had now resolved on making an immediate reduction even in the present price. The charge had hitherto been 4s. 2d. per 1000 cubic feet, and an allowance of 15 per cent. was made to the smallest consumers, and one of 20 per cent. to the largest consumers, making the net price 3s. 6 $\frac{1}{2}$ d. per 1000 feet for the former and 3s. 4d. to the latter. But the company had now reduced the price to 3s. 9d. per 1000 feet, gross charge, which, with the allowance of discounts as before, would reduce the net charge to 3s. 2 $\frac{1}{2}$ d. to small consumers, and 3s. to large consumers.

FRENCH PRACTICE IN THE CONSTRUCTION OF GASHOLDERS.

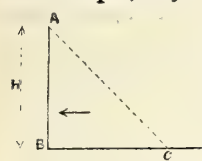
By M. ARSON, Engineer-in-Chief of the Paris Gas Company.

[Translated expressly for this JOURNAL by Dr. W. POLE, F.R.S., Mem. Inst. C.E.]

(Continued from page 13.)

Pressure of the Water.

The pressure of the water on the inside of the tank is found by well-known rules. Taking an elementary vertical strip of the internal surface, whose width is $= dz$, and height $= H$, supposing the tank full, this strip will sustain a horizontal pressure $= 1000 \frac{H^2}{2} dz$ kilograms. To find the tendency of this pressure to tilt over the corresponding elementary piece of the tank wall, it must be recollected that the pressure of the water, varying in proportion to the depth, may be represented by a right-angled triangle thus—



and that the whole may be considered as acting at the centre of gravity of the triangle—i.e.,

at one-third the height $= \frac{H}{3}$. Hence the moment of the pressure tending to overturn the elementary piece of tank wall about the point B will be (where S is the weight of a cubic unit of water)

$$= S \frac{H^2}{2} dz \times \frac{H}{3} = S \frac{H^3}{6} dz$$

Summing up, now, the whole of these forces considered as acting parallel to each other along one diameter of the tank, oz , and making D = the internal diameter, we have, for the total force of the water—

$$= SD \frac{H^3}{6} \quad (1)$$

The resistance opposed to this is three-fold—that of the rammed-earth backing, that of the weight of the masonry, and that of the cohesion.

Resistance of the Earth Backing.

It has been found, in the preceding section, that this will furnish, according to its nature and preparation, a resistance varying from 4400 kilogrammes to 10,000 kilogrammes per square metre, at any depth desired.

If this resistance be represented by C , its total amount projected on the axis, oz , will be $= CD^2 H$, D^1 being the external diameter of the masonry.

If the backing were loose, the point of application of its resistance would be at one-third its height; but the effect of ramming will be to lead to an equality of pressure in the layers at all heights; hence the resultant point of application will be at half the height, and the moment of resistance of this element will be

$$= CD^1 \frac{H^2}{2} \quad (2)$$

Resistance of the Weight of the Masonry.

If P represent the weight of a cubic unit of the masonry, and E the thickness of the wall, then the weight of a unit length of the wall will be $= PHE$. The moment of this round its outside edge will be $= \frac{PHE^2}{2}$ and this is the resistance it will offer to a horizontal force tending to tilt it over. Summing this up for the whole diameter, D^1 , the resistance from this will then be

$$= \frac{PE^2 D^1 H}{2} \quad (3)$$

Resistance due to Cohesion.

To crack the tank into two halves, two areas of wall, each equal to HE , must be severed. If, then, K = the cohesive force per square unit, the resistance to severance will be $= 2 KHE$; and as this may be assumed to act at half the height to prevent overturning, the moment of resistance due to this element will be

$$= KH^2 E \quad (4)$$

Adding these together, the combined resistance from the three sources will be (2, 3, and 4)

$$CD^1 \frac{H^2}{2} + \frac{PE^2 D^1 H}{2} + KH^2 E$$

And to produce stability of the tank these must be greater than the effect of the pressure of the water—

$$SD \frac{H^3}{6}$$

With respect to the values of the various quantities contained in the equations, the weight of a cubic metre of masonry is approximately—

For brickwork 1800 kil.
„ rubble 2200 „

The force of cohesion will be treated of under the next head. In the meantime, it may be taken at about 150,000 kilogrammes per square metre.

S , in French measure, = 1000. The value of C has already been explained.

The internal diameter, D , and the height, H , are usually settled beforehand. The thickness of the wall, E , is generally determined at first by other considerations of design, but this is the

element to be tested by the formulæ. The external diameter, $D^1 = D + 2E$.

The constants, therefore, used in the equations will stand as follows. In French measure, the dimensions must be taken in mètres, and the weights in kilogrammes; in English, the dimensions must be in feet and decimals, and the weights in pounds:—

	French Measure.	English Measure.
$S =$	1,000	62.5
$C =$ { Sand	10,000	2,050.0
Earth, with gravel	4,400	900.0
$P =$ { Brick	1,800	112.0
Stone rubble	2,200	137.0
$K =$	150,000	30,700.0

Example.—The following shows the application of these formulæ to the tank of the gasholder No. 13 at the works at Villette. The dimensions are—

	Mètres.	Feet.
$D =$	56.00	184.0
$E =$	1.38	4.5
$D^1 =$	58.76	193.0
$H =$	12.70	42.0

The masonry is rubble stone; the earth filling is punned sand.

Working out the various equations with these constants in French measures, the following results are obtained:—

(1) Effect of the pressure of the water	19,114,000
(2) Resistance of the earth backing .	47,387,000
(3) Resistance of the weight of the masonry	1,560,000
(4) Resistance of the cohesion of the masonry	33,609,000
Total resistance	82,556,000

So that the elements of resistance are four times as great as are necessary, and the structure has an ample margin of strength.

[It is an instructive modification of the foregoing calculation to estimate separately—

A, the resistance of the masonry and backing to the outward pressure of the water; and

B, the cohesive resistance of the wall of the tank to the force tending to burst it open (like that of the steam in a cylindrical boiler).

A. For the former, the moment of outward water pressure on a unit of length of wall will be $= \frac{SH^2}{3}$; and the resistance due to the masonry and backing will be $PE^2 + CH$. If these exceed the pressure, the wall will be stable independently of any aid from the cohesion.

In the Villette case, using English measures—

$$\frac{SH^2}{3} = 37,000$$

$$PE^2 + CH = 89,000$$

showing a good margin of safety.

B. The force tending to burst the tank open increases with the depth. At any depth h , the bursting force will be, on a unit of height $= S h D$.

This will be resisted by the cohesion of the two walls, which, per unit of height, will be $= 2KE$.

In the Villette case, at the bottom of the tank ($h = H$)—

$$SHD = 490,000$$

$$2KE = 276,000$$

showing that in a masonry tank the cohesive force alone would not be sufficient to resist the bursting force of the water. The real element of resistance is the earth backing, to which the weight and cohesion of the masonry are only adjuncts of minor importance.

The cohesive force of brickwork, or of coursed masonry, is very much increased by the plan, common in this country, of inserting layers of hoop-iron bond.

In the case of iron tanks above ground, this latter calculation becomes the important one, as the structure depends on the cohesive resistance for its strength and stability.—TRANS.]

III.

THE CEMENT TANK-LINING, AND CEMENTS AND MORTARS IN GENERAL.

The foregoing calculations will establish the stability of the wall of a gasholder-tank; but, in addition to this, it must satisfy a second condition not less important; it must be perfectly water-tight.

This condition is obtained by a coating or lining of cement applied over the interior. The masonry itself would not suffice, alone, to retain the water; the stones are not sufficiently regular, nor are the interstices filled with sufficient perfection. Hence the necessity of the cement coating.*

The coating is executed with a composition made of Vassy quick-setting cement, in the proportions of one volume of sand to one of cement. It is spread over the whole interior of the tank, and smoothed down on the surface.

It will be interesting to explain the processes employed (A) for

* It is singular that no allusion is made here to *clay puddle*, the most common mode adopted in England for making earth and masonry structures water-tight. We must assume it is not in frequent use in Paris. Probably the clay is difficult to obtain.—TRANS.

testing the quality of the cements, (B) for the preparation of the coating composition.

A.—Cements in General.

[Here follow details as to various kinds of cements manufactured in France. It is unnecessary to give these in full; it will suffice to make a few extracts.]

The Portland cement made at Pouilly, in Burgundy, contains 61 per cent. of lime, of which 2 per cent. is in a free state, the remainder being combined with the clay. It is slow-setting, the maximum tenacity is obtained in that which sets completely under water after six or eight months. The following examples are given of its strength:—

A *briquette* of pure cement, kept under water six weeks after being made, broke with 12 kilogrammes per square centimètre (170 lbs. per square inch). A similar one, kept eight months under water, broke with 31 kilogrammes (440 lbs.).

Mortars made of cement harden quicker in the sun and in the free air than under the action of moisture. Thus the internal coating of a gasholder has already acquired great hardness, while the interior of the masonry is not yet set, and will easily break under the hand. But the rapidity of setting always detracts from the final strength and impermeability. This is one of the reasons why the interior surface of the masonry ought to be protected from the sun, and constantly kept watered till it receives the coating.

The degree of pulverization also influences the rapidity of setting.

The weight of the best cements varies between 1350 and 1550 kilogrammes per cubic mètre (84 to 97 lbs. per cubic foot); it will sometimes reach 1600 kilogrammes.

Cement Mortars.—The following precautions are used in the preparation and use of the mortars:—

The proportion arrived at is three of fine sand to one of Portland cement.

The mortar is mixed with an excess of water, and then left on a smooth floor before use, during a time varying from one to four hours, according to the age of the cement employed. On this it rejects its excess of water, for which a discharge must be provided. The mortar gradually assumes consistence, and when it has become pasty it is fit for use.

This condition is essential for obtaining masonry well bound together, and approaching as much as possible the state of solid stone. In certain constructions, where the mortar had been used too fresh, and, consequently, too tender, it did not resist the pressure of the stones upon it, and the joints were found bare.

Every stone must be wet immediately before being fixed.

Quick-Setting Cement.—This, made at Vassy, contains 58 per cent. of lime, of which none is free. It weighs 800 to 1200 kilogrammes per cubic mètre (50 lbs. to 75 lbs. per cubic foot); 1000 kilogrammes is considered satisfactory.

Tests of Cement.—In order to test the permeability of cement, circular plates are made of a thickness corresponding to the coating they represent—say from 2 to 10 centimètres. They are placed in frames having a connexion with a hydraulic press, by which water is forced with a known pressure against one face of the plate; the other face is open to observation, so as to watch the penetration of the water through the mass. These trials are chiefly made with the quick-setting cements which are most generally used for lining the tanks.

The tests for strength are chiefly applied to the slow-setting cement. *Briques* are made, having a section 4 centimètres ($1\frac{1}{2}$ inch) square, and enlarged at the ends; these are pulled asunder by a weighted lever in the usual way.

The particulars and results of many experiments under different circumstances on both these data are stated in the paper.

Proportion of Sand.—Experience has led, for quick-setting cement, to equal volumes of cement and sand. This is the mixture which gives the strongest result—namely, 14 kilogrammes per square centimètre (200 lbs. per square inch). Pure cement is weaker, about 10 kilogrammes (142 lbs.).

For the Portland, or slow-setting cement, more sand is used. Equal volumes give a tenacity of 30 kilogrammes (428 lbs.); two of sand to one of cement gives 19 kilogrammes (271 lbs.); and three of sand to one of cement gives 10 to 12 kilogrammes. This latter is sufficient for massive work, and, consequently, the proportion of three to one is adopted for the mortar for gasholder-tank walls. [The strength adopted in the theoretical calculations is 15 kilogrammes per square centimètre, equal about 215 lbs. per square inch, or 30,700 lbs. per square foot, as previously given.]

B.—Cement Coating.

This is the most delicate part of the work, and is very important for the perfection of the tank.

The coating is made from quick-setting cement, with an equal volume of sand.

Its thickness should vary according to the pressure of the water. For large gasholders, which are 13 mètres (43 feet) deep, it should be 8 centimètres ($3\frac{1}{8}$ inches) thick at the bottom, diminishing to 3 centimètres (one inch and 3-16ths) at the top.

In order to keep the finished surface vertical, the main wall is made to overhang a little, to make up this difference in thickness.

The bottom of the tank is also laid with masonry, forming a sloping apron, and this is coated with cement in the same manner as the sides.

When the lower part of the excavation contains springs, which cannot be all blinded, their waters must be re-united in a small drain tank, and pumped out during the whole time of construction. (This was done at the gasholders of Les Ternes and Passy.) It is very important to maintain constantly the level of these waters below the

upper surface of the apron, otherwise they may cause the cement coating to blow.

The drain tank above mentioned is built in masonry and cemented all round, the cement being united to that of the apron. A cast-iron pipe is laid in the well, and concreted round, so that the water of the springs can have no other issue than through the pipe. It is terminated by a planed surface, on which a flap-valve is fitted. When the tank is to be filled, the water of the springs issues at first into the tank, but when the water has risen in this to such a height as to balance the pressure from the springs, the flap-valve shuts. The filling is then continued from the exterior, and the tank water becomes completely isolated from the subsoil. If the cement coatings are sound, and the valve is tight, there need be no leak. The operation was successfully performed in both the cases cited.

The coating composition is thrown by the plasterers upon the surface of the masonry; its adherence is effected partly by the "keys" arising from the roughness of the masonry, and partly from the peculiar way in which it is applied.

The coating is executed in circular areas upon the apron, and in successive rings upon the cylinder, each 1.50 mètre (5 feet) in height. The junction between the apron and the wall presents a throat or gusset, with the angle filled in.

The junctions or solderings (*soudures*) of the parts of the coating successively laid on are effected as follows:—The upper part of the ring already done is sloped off to an inclined plane. The surface thus prepared is carefully brushed, in order to remove all dust or foreign substances; it is then washed, and the composition is thrown upon it to commence the following ring.

As the coating is executed, the plasterers work the surface perfectly smooth. It is found by experience that this operation contributes incontestably to rendering it water-tight, for in some of the testings the water penetrated through the body of the cement, but was stopped at the smooth surface. If the junctions are well executed, there ought to be no danger of leakage.

There are, however, some weak points that require attention. Leaks, for example, may take place where the guides are cramped into the masonry. In order to avoid this as much as possible, the cramping is executed in stone, set in cement, the same as used for the coating. The whole line of guides is first applied in one length, in its definitive position, according to a previous equal division of the circumference into as many parts as there are guides. These are then fixed and cramped in their places before the coating is laid on. The cavities left in the masonry, to receive the cramps, are filled with fragments of stone and cement, in such a way as to form a solid mass, in which the support of the guide is buried. It must be recollected that the cement does not unite well with iron, and, moreover, if the union were perfect at first, there is always danger of subsequent disturbance by vibration.

In all other places the cement coating must be made to cover everything, and no joint of the coating ought to correspond with the edges of any cavity that has been filled.

Finally, the stone blocks or "dies," which are disposed on the apron, to support the scaffolds, and the guides, constitute also weak points in regard to leakage; and, accordingly, in them also, great care must be taken to unite perfectly the cement coating with the vertical surface of the stones.

IV.

THE BELL AND ITS GUIDE-ROLLERS.

A.—For an Ordinary Single Gasholder.

The bell of an ordinary gasholder is formed by a cylinder, closed at its upper end by a spherical segment or crown.

Crown.—The form of this latter portion is useful to allow the rain to drain off, but it is indispensable in order to diminish the tearing force on the rivetted joint which unites the last row of crown plates to the angle-iron ring (*cornière*). When it is considered that this joint must transmit to the cylindrical sides the pressure under the crown which supports the weight of the cylinder, it will be seen that these plates ought to have as great an inclination as possible.

It is obviously also desirable to give to the first row of crown plates a thickness greater than the rest, and to make the external joint exceptionally strong, which is done by using two rows of rivets rivetted hot. The condition of rivetting hot is solely due to the size of the rivets, which would render them difficult to rivet cold; but it is not favourable to good work, rather the contrary. The rivet fixed hot cools quickly in every part which is in contact with the plate; the portion which projects, and which ought to form the rivetting, keeps relatively hotter; it is even heated by the hammering, and it supports all the mechanical battering action. It expands under the hammer, while the body of the rivet resists, whence it happens that the rivet fixed hot does not easily fill the hole in the plate, while the rivet fixed cold swells out within it, and produces a more perfect closing.

Cylindrical Sides.—The upper row of side-plates is also thicker than those below, not only in order to give a stronger attachment to the junction angle-iron ring, but to form a more substantial base for the attachment of the guide-rollers.

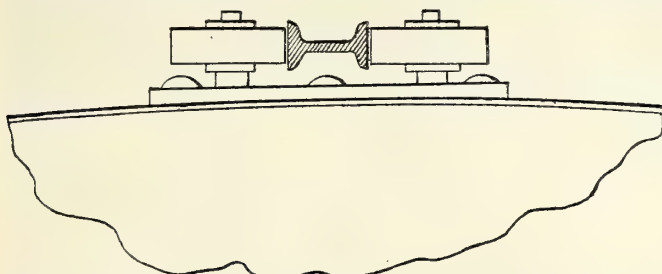
The same applies also to the bottom row of plates, and this is the more necessary here, because this row cannot be painted, being always immersed in the water.

The base of the bell must further be strengthened by some feature which will keep it in shape. If the bell encounters an obstacle to its motion in any point of its circumference, it tends to continue its movement, and will be deformed. The rollers may then escape from the guides, and the bell assume an oblique position. This can only be prevented by strengthening the lower part of the cylinder.

With this view it is customary to apply to the interior a stiffening ring, which fulfils, in regard to this portion, the same office as the roof does to the upper end.

In the gasholder No. 13, at Villette, this stiffening ring is formed by two horizontal plates, 2 mètres (6·6 ft.) wide, and 7 millimètres ($\frac{1}{4}$ in.) thick, united by a third plate, 1 mètre high, forming a vertical cylinder concentric with that of the bell. The horizontal plates are pierced with large openings, by which the water enters and discharges during the displacement of the bell, which is very slow.

Guide-Rollers.—[It should be explained that the system of guide-rollers adopted in the French gasholders differs materially from that common in England, being what is called the "tangential" system. Instead of one roller, placed in a radial plane, and bearing outwards on the guide-bar, there are two rollers, placed in a tangential plane, and bearing laterally, one on each side of the guide-bar, thus—

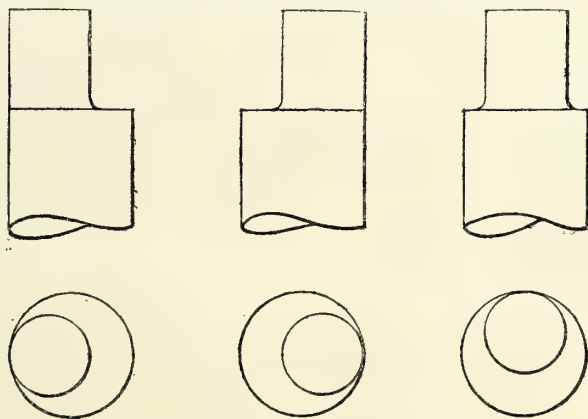


This plan, while it gives equally efficient guiding to the bell, brings the strains on the guide-bars in a direction which, from the disposition of the bracing, they are better calculated to withstand. I find the preference for this plan very strong among the French engineers.—TRANS.]

The guide-rollers, which are applied at the top of the bell, are fixed on the cylindrical side, and not on the crown. This position, on an inflexible body, allows of their being mounted during the construction, and ensures a fixedness that would not be obtained on the spherical roof surface, which alters its shape according as the gasholder is or is not under pressure.

These rollers ought to be constructed and fixed with a strength which will enable them to transmit from the bell to the guides the enormous pressures which the bell receives from the wind. Cast iron and bolts ought, as much as possible, to be excluded from these constructions; cast iron because of its brittleness, and bolts because they do not give, on the thin plate, attachments sufficiently strong and tight.

The support common to two tangential guide-rollers, as in the Villette gasholder, No. 13, is constructed of plate and angle iron, and is of such dimensions as to call into action the resistance of a large surface of plate. The axles of the rollers are of wrought iron, and of a sufficient diameter to transmit safely the pressure to the guides. These axles are formed of two cylinders of different diameters, formed in one piece of iron, but placed eccentrically, so that, in fixing them, it is possible to vary the distance between the rollers and the guides without being bound by the fixedness of the supports. They are shown in the following figures:—



They may be fixed beforehand, without caring about the exact position which they are finally to occupy.

The rollers may be dismantled and their axles removed and replaced, if necessary, while the gasholder is in action. The supports rivetted to the bell are alone immovable.

Angle between the Cylindrical Sides and the Slope of the Edge of the Crown.—The angle iron which unites the side plates with the spherical crown of the bell ought to satisfy certain conditions of strength which it is useful to analyze, in order to determine the dimensions at this point, of the angle iron, the sheet iron, and the rivets.

If we consider the state of equilibrium of the bell while it is held up by the pressure of the gas, we shall see, in the first place, that the weight, P , of the entire bell is equal to the total pressure of the gas vertically upwards; or, in other words, equal to the pressure of the gas per square unit, multiplied into the transverse sectional area of the cylinder.

Moreover, the total weight of the bell, P , is equal to the sum of the weights, $P' + P''$, of the crown and of the sides.

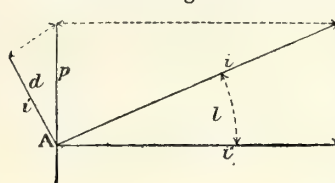
The weight, P' , of the top is supported by a portion of the total upward gas pressure, the remainder of which goes to support the

weight, P'' , of the sides. Consequently, the angle iron, uniting these parts will only have to transmit from the crown to the sides the forces necessary to generate a vertical component equal to this weight. It thus becomes necessary to submit the connexion of these parts to an examination, based on the conditions of strength which they should present.

The part which concerns the sides may be neglected, for the rivets here are only subject to a shearing stress, and it can scarcely happen that the weight of the sides is sufficient to cause any apprehension as to the strength in this direction.

But it is different with the junction of the crown with the angle iron, on account of the great obliquity of the forces in action.

Let α be the angle which the slope of the crown makes at A



with the horizontal. Let p represent the vertical component, equal to the portion of weight of the sides which corresponds with a unit of the circumference.

Then the tension, t , on the sheet iron will be—

$$t = \frac{p}{\sin \alpha} \quad (1)$$

and this value, t , will express at the same time the force which tends to shear the rivets.

The tensile stress acting on the rivets in the direction of their length will be—

$$t' = p \cos \alpha \quad (2)$$

The horizontal component will be—

$$t'' = t \cos \alpha = \frac{p}{\tan \alpha}$$

This force has no value in a vertical direction; it is an elementary component which must be integrated to find its value and operation.

The expressions, t , t' , and t'' , enable us to ascertain whether the dimensions of the parts are sufficiently strong. Their values are deduced from the dimensions of the bell, and the pressure of the gas above the atmosphere, h .

The elementary weight, p , is equal to the weight P'' of the sides, divided by the circumference; or, if D = diameter—

$$p = \frac{P''}{\pi D}$$

Consequently, the equations (1), (2), and (3) become—

$$t = \frac{P''}{\pi D \sin \alpha}$$

$$t' = \frac{P''}{\pi D} \cos \alpha$$

$$t'' = \frac{P''}{\pi D \tan \alpha}$$

These equations will clearly show the importance of the angle of inclination, α , which the exterior ring of the crown makes with the sides. If the line of the roof were horizontal, so that $\alpha = 0$, the tension on the crown plates would be theoretically infinite. For this reason, the angle should not be made too small; and several unfortunate examples have shown the desirability of giving it as large a value as possible.

At the request of the Parisian Company, the forges of Chatillon and Commeny have provided rolls which will produce angle iron of large size, 0·13 m. ($5\frac{1}{2} \times 5\frac{1}{2}$ inch), formed with an angle not of 90° as usual, but of 104°, which gives $\alpha = 14^\circ$.

With this angle, $\sin \alpha = 0\cdot24192$, and $t = 4\cdot13 \frac{P''}{\pi D}$

The component, t'' , is exerted in the direction of the radius, and is not of immediate importance; but the summation of its elementary values will determine the compressive force exercised on the transverse section of the metal. This will be $= t'' D = \frac{P''}{\pi \tan \alpha}$

Application to the Gasholder No. 13 of the Villette Works.

As an example of the use of these formulæ, they may be applied to test whether the dimensions given to the parts in question in this gasholder are sufficient.

Tension on the Iron of the First Tier of Plates of the Crown.—The weight P'' of the sides is 139,974 kil. (say, 140 tons), and its diameter is 55 mètres (180 feet). Thus—

$$t = 4\cdot13 \frac{139,974}{3\cdot14 \times 55} = 3347 \text{ kil. } (= 3\frac{1}{2} \text{ tons.})$$

Now the sheet iron has a thickness of 8 m.m. (0·315 inch); it is rivetted to the angle iron by two rows, each of 12 rivets (in the mètre—i.e., 3·3 inches apart). These rivets, which have a diameter of 0·018 (0·71 inch), leave between them a width of solid plate per mètre = 0·784 (31 inches), so that the sectional area of resistance is 6272 square millimètres (9·8 square inches); and as each millimètre may support with safety 7 kil. (= $4\frac{1}{2}$ tons per square inch), the total disposable resistance is 43,904 kil. (44 tons), which gives a large margin of safety.

Shearing of the Rivets.—The rivets will resist a shearing stress equal to 8-10ths of the stress capable of breaking them by tension.*

* The ordinary English rule is that the shearing strength is equal to the tensile strength.—See Pole on "Iron as a Material of Construction," Art. 88. The French rule is, of course, safer.

Each mètre of the angle iron is connected to the plates by 24 rivets as above described, the combined area of which is 0.00613 square mètres (9.5 square inches), and the safe strength will be $= 6103 \times 7 \times 0.8 = 34,176$ kil. (34 tons) as opposed to a stress of 3347, which is amply strong.

Rupture of the Rivets by Tension.—The strength of the rivets will be, as just given, $= 6103 \times 7 = 42,721$ kil. (42 tons).

The tension on them, found by equation (2), will be—

$$t' = \frac{139,974}{3.14 \times 55} 0.97 = 786 \text{ kil. } (\frac{3}{4} \text{ ton.})$$

very much below the safe strength.

Strength of the Angle Iron to Resist Crushing.—By equation (3) the crushing force is calculated to be 180,000 kil., and it is spread over the entire section of the bell made by a vertical plane passing through the axis. But the sides should be excluded from effective resisting area, leaving only the section of the crown and angle irons. These two amount to 344,560 square millimètres, which gives a stress of 0.536 kil. per square millimètre ($\frac{1}{2}$ -ton per square inch). The angle iron alone would offer a section almost strong enough to resist this pressure without deformation.

[The above equations may be simplified. The angle, α , will be in any case so small that we may assume, without any great error, the sine and tangent to be equal to the arc, and the cosine = 1. Hence the equations become—

$$t = t' = \frac{P''}{\pi D \alpha}$$

$$t' = \frac{P''}{\pi D}$$

Or, putting α in degrees, and giving the numerical value to π , we have the following rules:—

Let P'' = weight of the sides in tons.

„ D = diameter of the gasholder in feet.

α = angle which the edge of the roof makes with the horizontal, expressed in degrees. Then—

1. The tensile stress on each foot of length of the top plate of the sides will be, in tons, $= \frac{P''}{3.14 D}$

This will also be the stress tending to shear the rivets in one foot of length, attaching the side plates to the angle-iron ring.

2. The tensile stress on each foot length of the external plate of the roof will be, in tons, $= 18.3 \frac{P''}{D \alpha}$, which will also express the force tending to shear the rivets in each foot of length attaching the roof plates to the angle iron.

This clearly shows the disadvantage of giving too small a value to the angle, α .

3. The tensile stress tending to pull asunder the last-named rivets in each foot of length will be, in tons, $= \frac{P''}{3.14 D}$

4. In regard to the strength of this part to resist crushing, or rather buckling (for it would buckle before it would crush), the French paper takes the whole crown to be effective in resisting the compressing force; but on account of the thinness of the plates, and their liability to buckle, it would be safer to rely on the angle piece only. The compressive force on this will be—

$$= t'' D = 18.3 \frac{P''}{\alpha}$$

—TRANS.]

(To be continued.)

Correspondence.

STRUCTURE OF RETORTS.

SIR,—I endorse, from long experience, the views of your “snappish” correspondent, that it is not good to minimize the quantity of brickwork in a setting of clay retorts, either on the score of economy in fuel, or of the producing power and durability of the retorts.

There is another fallacy with regard to the retorts themselves, that, for the sake of the facts, and also for the sake of the gas engineering profession, needs exposing. It has been asserted that the substance or structure of clay retorts is not porous, but cellular. It is surprising to observe how the dictum of a writer or a speaker, if only it be given with a degree of self-assertion, will often be accepted without question, and for a time be received as a matter of faith by many, without the slightest examination on their part. The assertion of the cellularity of retorts is one of those dicta, for which there is no foundation in fact. If any one will take the trouble to examine the structure of a well-made retort, he will see at once the fallacy of the statement; and if he will consider the question he will soon further perceive that there is not only no necessity for this alleged cellularity, but that the presence of any visible interstices in the structure of a retort is a positive disadvantage.

On the other hand, there can be no doubt whatever of the porosity of the substance of which retorts are made—whether they be clay or iron. The only question is as to the closeness of the pores. To test the truth of this, it is only necessary to apply the requisite hydrostatic pressure, when the outer surface of the retort will be found beaded with the moisture that has been forced through the pores from the inside. This porosity is in no way inimical to the production of the gas. The pressure inside a retort in ordinary working is never such as to cause leakage through the pores.

But it may be asked, “How is it that the more friable a retort the better?” We do not admit the truth of the proposition which alleges that the more friable a retort is, the better. The more granular the

structure of the substance of a retort, the better; and the more solid this granular structure the better still.

The friability of retorts, as at present generally made, is due to the imperfections in the method of manufacture; the pressure to which the material is subjected not being sufficient to consolidate its texture. It is only by the aid of machinery that the advantages of granularity with solidity of structure can be obtained.

Oh! but say the advocates of extreme friability, “If the substance of the retort is solidified to a greater extent than it is at present, there will be a contraction or an expansion (both assertions are made indiscriminately) in the material, which, when it has got to work in the oven, will lead to cracking.” Both experience and common sense are opposed to this conclusion. If a retort has been thoroughly well fired or burnt, as all good retorts are, at the manufactory, no cracking of any moment will afterwards ensue on the application of heat. We have the testimony of Mr. Morton, of the London Gas Company, given in his presidential address to the last meeting of the Gas Managers’ Association, that he had set 4000 feet of machine-made retorts. These had mostly been in use for 15 months, giving good satisfaction, and, as might naturally be expected, the heating had little or no effect upon them as regards expansion. This, I venture to say, is the experience of all who have tried retorts so manufactured. X.

QUANTITY OF BRICKWORK IN RETORT-SETTINGS.

SIR,—Your correspondent, “S. N. A. P.,” might have been a whit less severe in his strictures; nevertheless, I agree with him as to the sophistical nature of the arguments advanced in favour of a minimum quantity of brickwork in a setting of retorts, and as to the desirability and economy of erring rather in the opposite direction.

The perfection of a retort-setting, according to the theory of some, would be to dispense with all brickwork except what might be required to support the clay retorts at the two extremities, supposing that retorts could be obtained capable of standing with only this amount of support. It would be found, however, that the temperature of the air escaping by the flue from such a setting would be greatly in excess of that from another setting having a moderate quantity of brickwork in the shape of supporting transverse walls or otherwise. This is clearly demonstrated by the construction and action of the regenerative furnace, in which a large area of brickwork is placed with the sole object of arresting and storing the heat passing through the oven.

There is no analogy, as has been shown, between the process of the production of steam in a boiler and that of gas in a retort. The regularity of the one, and the fluctuating character of the other—the thin iron plate, a good conductor of heat, in the one case, and the comparatively thick (even if only 2 or 2½ inches) retort in the other, make all the difference possible as to the desirability or otherwise of the proximity of a considerable amount of heated brickwork.

It is a common practice of some writers to set up a theory that nobody has ever broached, just that they may exhibit their skill in trying to demolish it. The argument against an excess of brickwork is a case in point. An excess is clearly unnecessary, and no one that I ever heard of advocates such a thing. ZENO.

SIR,—Your correspondent, “S. N. A. P.,” does not believe in what he chooses to call “some unheard-of Belgian retorts,” and asks the names of the makers of the retorts which, being supported only at the extremities, will remain intact for two or three years!

Without having seen or heard of retorts which performed such feats as this, I can inform your correspondent that there certainly are retorts made in Belgium which are amongst the most perfect in the world as regards enduring quality and finish of manufacture.

I have now before me the official report on the pottery and earthenware productions exhibited at the Vienna Exhibition of 1873, and in the section on fire-clay articles the names of two Belgian manufacturers are given, whose retorts were unquestionably the best and the cheapest exhibited. There appears to me no reason why their names should not be made known for the benefit of those who, not being afflicted with the incredulity of your correspondent, may feel inclined to make trial of their retorts. They are the “Société de Produits Réfractaires de Saint Ghislain,” and the “Société anonyme de Terres Plastiques et Produits Réfractaires d’Andenne.”

Having managed gas-works on the Continent, I can bear testimony in favour of dispensing with all really unnecessary brickwork in retort-settings. The cross-walls usually set with only 9 inch spaces in English settings, and carried up nearly to the arch, are universally condemned amongst continental engineers, who, it must be confessed, have given this subject much more study than has been devoted to it by English managers, and have consequently more definitely settled the principles upon which retort-settings should be constructed. The system followed is that of supporting the retorts thoroughly from beneath, while avoiding as much as possible to pile up weight on the top of them, and of leaving the sides of the retorts as far as practicable free, thus ensuring the uniform distribution of heat in the setting, and avoiding the prejudicial tearing asunder of the retorts lengthwise, which invariably occurs in consequence of the unequal expansion and contraction which ensue if the retorts are built in by numerous cross-walls.

Your correspondent evidently has in view a paper read at the meeting of gas managers in June last year, and the drawing which was exhibited on that occasion.

Without recommending the setting so exhibited, which I think very poorly represented continental practice in this particular, I feel convinced that the agitation of the question was a step in the right direction, having regard to the desirability of more definite knowledge as to what brickwork is, and what is not, necessary in setting retorts.

Belgian retorts may not be, and probably are, not better than English, but let us prove it. From my own experience I can say that continental retorts do not require all that propping up that, in the majority of cases, we give ours, and they are the better without it. I found no difficulty in obtaining 5000 feet per mouthpiece when abroad, my retorts being set with as little internal brickwork as possible, but with a front wall 1 foot thick. The statement that English or Scotch clay-retorts produce 5000 to 6000 feet per mouthpiece, with an expenditure of less than 20 per cent. of fuel, appears exaggerated, and I venture to think

it is only very rarely that an average of over 4000 feet per monthpiece per diem is realized, and in such cases the fuel account may be considered very good which does not exceed 26 per cent. per ton of coal carbonized. G. E. S.

WET LIME PURIFICATION.

SIR,—In your last number you intimated that the wet lime system of purification “caused far worse smells than could possibly be experienced from the emptying of dry lime purifiers.” Now this is not the fact. Under the wet lime system no smell was caused during the changing of the purifiers. It was all done in close vessels, and, as a rule, by merely running the charge from one purifier into another. The great difficulty was in getting rid of the “blue billy,” as it was called. But even this I know was easily done at the Horseferry Road works of the Chartered Company, where a series of settling-tanks was provided, in which the thick stuff was allowed to settle down into a pasty condition. This was then burnt in a close oven, and the lime used again, while the clear liquid was burnt, or evaporated under the furnaces. I believe, with our present knowledge and means of overcoming pressure by exhausters, the wet lime process may have a chance again. A bushel of lime used in the wet state will purify double the quantity of gas that dry lime will do, and as we now take out all the ammonia from the gas before it reaches the lime, there should be no smell whatever. However, there is no doubt that oxide of iron is the cheapest and cleanest system of purification. X. Y. Z.

Legal Intelligence.

DEVON EPIPHANY SESSIONS.—THURSDAY, JAN. 4.

(Before the EARL OF DEVON, Chairman, and Messrs. HALLIDAY and TOMS.)
ALLEGED NUISANCE AT THE EAST BUDLEIGH GAS-WORKS.

The indictment in this case contained seven counts, which charged the company with creating noisome, offensive, and unwholesome smells; with neglecting to take reasonable and proper care, and using proper skill and precaution in carrying on their works; with using the works in a way that was neither proper nor careful; with allowing to escape thick and unwholesome smoke; with keeping on the works a quantity of spent lime, from which smells were continually emitted; with keeping a large quantity of ammoniacal liquor and gas refuse; and with allowing this liquid to flow on the highway. On each count they were charged with causing a nuisance injurious to health, from March, 1876, up to the present time.

Mr. LEWIS appeared to prosecute, and Mr. CLARK and Mr. FOOTE for the defence.

The secretary of the company not being present, through illness, the Court intimated that they would be prepared to hear any one who appeared on their behalf, and it having been proved that Mr. Toby, the company's solicitor, had been verbally authorized at a board meeting to represent them, he was allowed to do so.

At the request of Mr. LEWIS, however, the Court took a note of his formal protest that Mr. Toby ought to have appeared under the common seal of the board.

Mr. CLARK said the company had not the slightest objection to plead to the indictment if they had power to plead, but they believed their plea here would be void. The legal and proper course for the prosecution would have been, after the indictment was found at the last quarter sessions, to have removed it to the Queen's Bench by a writ of *certiorari*, when it would have been sent down in due course to be tried on the civil side at the assizes.

Mr. LEWIS pointed out that his friend had put himself in an anomalous position, for he had first called a gentleman to appear for the company, by attorney, and then he came forward and said the company did not appear at all. He submitted that this case was similar to indictments for the repair of highways, which were usually tried at quarter sessions. In such cases they could not bring up a whole parish, but they did bring some one. For himself he did not care where the case was tried, whether it was removed by writ of *certiorari*, or whether it was tried at the assizes—all that he wanted was to get the company to appear.

After retiring to consider, the Court announced that they were not prepared to give an opinion, and thought it would be better to hear the arguments of counsel as to the distinction between this case and an indictment of a parish for the repair of highways.

Mr. LEWIS, on behalf of the prosecution, said he should be very sorry to allow the Court to try a matter if there was a shadow of doubt about it. If the matter was decided in their favour, and they had to take out a distress, they might be met by an action for trespass, and it might end in the House of Lords. That there should be no difficulty in the matter, he would be willing to have the indictment adjourned, and he would take out a writ of *certiorari*.

The CHAIRMAN said he fell in with this view, that the case should be tried by a writ of *certiorari*.

Mr. LEWIS asked for the case to be adjourned till the next sessions, in order that the indictment might be kept alive.

This was agreed to, and the case, in that stage, terminated.

WIGAN BOROUGH POLICE COURT.—THURSDAY, JAN. 4.

(Before Messrs. WALL and BRYHAM.)

PROSECUTIONS BY THE WIGAN CORPORATION UNDER THE CONSPIRACY AND PROTECTION OF PROPERTY ACT.

Michael Foy, stoker at the corporation gas-works, was charged under the Conspiracy and Protection of Property Act, 1875, with breaking a certain contract entered into between him and the corporation, by leaving his work, knowing that the probable consequences of his so doing would be to deprive the inhabitants of the borough of their supply of gas.

Defendant pleaded that he left in consequence of illness.

Mr. BELL prosecuted, and said the defendant was an experienced stoker, and had been employed at the gas-works since and before the corporation bought them. His last engagement commenced about a month ago, and at that time Mr. Hawkins hired him on the understanding that a seven days notice was to be given on either side in the event of either party wishing to terminate the engagement. On the previous Saturday night, defendant came to his work for the night shift at nine o'clock, and ought to have continued at his post till five o'clock on the following morning. However, at half-past ten o'clock he refused to work any longer. Mr. Hawkins explained to him the great inconvenience his going away would cause, and how it would be difficult to maintain the requisite supply of gas; but, in spite of this, defendant put on his coat and left the works, and the consequence was that 14 retorts had to stand idle. Defendant chose the very worst time to absent himself from his work, and he (Mr. Bell) had no doubt he took advantage of it. He had been paid up to the previous Thursday, so that he thus actually left in the middle of a week.

Mr. Hawkins, manager of the gas-works, bore out Mr. Bell's statement, and said that defendant when he left his work said his “mate was no good,” and that he would not work. He had never heard of defendant being ill until now; in fact, defendant came to the gas-works at five o'clock next morning to do another man's shift.

Mr. ELLIS (magistrate's clerk) said before the magistrates could convict in this case it would have to be proved that defendant “wilfully and maliciously” broke his contract, with the intention of depriving the inhabitants of their supply of gas. There was a difference between the Master and Servants Act and the Conspiracy Act, in so far as the words “wilfully and maliciously” were inserted in the latter, while the former only contained the word “wilfully.” It would, however, be for the magistrates to say whether defendant left work “wilfully or maliciously.”

Mr. BELL said the defendant was an experienced stoker, and knew well the consequences that would result from his leaving work in the way he did.

Mr. WALL said the offence was a most serious one, and the prisoner was liable to be sent to gaol for three months for committing it, but as this was the first case of the kind that had come before the Bench, defendant would be let off on payment of 10s. and costs.

Martin Grady, coke wheeler, was charged with a similar offence committed the same night.

Mr. Hawkins said several of the coke wheelers had left their work on Saturday night, and defendant told him he could not do the work himself, but he (Mr. Hawkins) persuaded him to remain on and do as much as he could. It seemed, however, that as soon as he turned his back defendant left the works.

Fined 10s. and costs.

WANDSWORTH POLICE COURT.—SATURDAY, JAN. 6.

(Before Mr. BRIDGE.)

CHARGE UNDER THE EMPLOYERS AND WORKMEN ACT.

George Gibbs and George Emmett, foremen in the service of the Wandsworth and Putney Gas Company, were summoned to show cause why they should not be ordered to pay compensation for damages caused through their neglect.

Mr. H. KIMBER appeared in support of the summonses.

Mr. Henry Freeman, engineer of the company, said that on the night of the 23rd ult. he observed the lights in Wandsworth getting very small. He ran to the works as rapidly as he could, and found both holders “landed,” being empty of gas. He went to the retort-house and sent for Gibbs, the night foreman. He could not hear of him, but when he saw him he found that he was very drunk. He also found eight out of twelve men at work drunk, but they would have been able to do their work if properly looked after. It was the duty of the defendant to attend to the pressure and supply gas for the night for the whole district. By his neglect the district was in imminent danger of being put in darkness. Witness sent for Emmett, the day foreman, who arrived quickly, but he was so drunk that he found he was of no use at all.

The defendant Gibbs, in answer to the complaint, said he was not drunk, but when he heard that his lights were out he reeled from surprise. Being a rough night, people delayed their purchases, causing shopkeepers to burn more gas, deceiving him in his calculations. He could prove by the men that they all went to work fifteen minutes before the time.

Mr. Freeman, in reply to a question, said that when Gibbs found the pressure being reduced, it was his duty to check the supply, but he did the best he could under the circumstances. He added that the defendant had previously given satisfaction in his work, and bore a good character. It also appeared that both defendants had been discharged.

Mr. BRIDGE said Gibbs had shown, by his intelligence, that he must have had his wits about him. After the explanation, he advised the company to withdraw the summonses.

Mr. KIMBER, in acceding to the suggestion, said the company felt bound to take the proceedings.

Mr. BRIDGE said they were quite right to institute the inquiry.

Two other summonses were also withdrawn.

INDICTMENT OF THE COLNE VALLEY GAS COMPANY.—At the last quarter sessions, which were held at Wakefield, an indictment was preferred against the directors of the Colne Valley Gas Company for breaking up the highways in Longwood and Golcar, and a true bill was found. The case was expected to be heard at the sessions, held at Leeds, and several persons had been served with notices, but the case has, we have been told, been removed to the Queen's Bench Division by a writ of *certiorari*. The Longwood Gas Company has been constructing a new tank for increasing the supply of its gas, but at the instance of Messrs. Hirst, Hanson, and Sons, who are large shareholders in the Colne Valley Gas Company, an injunction has been granted by the Chancery Division of the High Court of Justice against the Longwood Company and against the contractor who is doing the work, so that now the work is at a standstill. Nothing, however, seems to damp the courage of the rival companies, for whilst the Longwood Company is spending large sums in increasing its supply of gas, the Colne Valley Company has resolved to increase its capital and to build a logwood mill upon its grounds, and it has also in contemplation the erection of a large woollen mill close to its works. This week a true bill has been found by the grand jury at Leeds against the Colne Valley Company, for further breakings into the roads of Longwood and Golcar. —Huddersfield Examiner.

ANDOVER WATER SUPPLY.—There has been some misunderstanding recently as to the purposes for which water was to be supplied to the Andover Corporation by the water-works company, the former body contending that the supply contracted for, at £50 per annum, included water for sanitary purposes (watering the streets, flushing the sewers, &c.) and the latter body maintaining that the contract was only for water required at fires. A special meeting of the Town Council was held lately, to confer with the representatives of the water-works company on the subject, and after some consideration, it was resolved to pay the company £100 per annum for a supply of water for all purposes, the agreement to be terminable by six months notice.

GOVERNMENT INQUIRY AT ST. HELEN'S (LANCASHIRE).—The corporation of St. Helen's having applied to the Local Government Board to increase their borrowing powers from £100,000 to £250,000, for the purpose of carrying out the purchase of the water and gas undertakings, together with the several improvements authorized by the Act of Incorporation, Mr. C. N. Dalton, one of the inspectors of the board, held a court at the St. Helen's Town Hall, on the 3rd inst., for the purpose of receiving evidence in connexion with the said applications. Mr. T. Beasley, clerk to the Widnes Local Board, asked that the corporation should be restrained from carrying out their project of sinking additional wells at Cronton, that being in the limits of the Widnes water supply. The mayor, Alderman Gamble, and the town clerk disclaimed any intention by the corporation of seeking to make any new water-works under the provisional order they were now applying for. The commissioner promised that he would so frame his recommendation to the Local Government Board as to afford the Widnes Local Board the protection sought for.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

Abstract of the Report of Professor Williamson, Chief Gas Examiner to the Metropolitan Board of Works, on the Results of the Daily Testings of the Gas supplied by The Gaslight and Coke Company and the South Metropolitan Gas Company, during the Quarter ending Dec. 31, 1876.

In the report for the quarter ending Sept. 30, 1876, it was stated that appeals had been made by The Gaslight and Coke Company in relation to the excess of sulphur found in the gas made at Fulham during the months of August and September last, but that sufficient evidence had not been received to decide the case. It has since been shown that, the excess of sulphur was due, on most of the occasions in question, to the fact of the purifying appliances at the Fulham works being inadequate, and that the difficulty of purifying the gas had been increased by the excessive heat of the weather. It was stated by the company's engineer that new purifiers were in course of construction.

Illuminating Power for the Past Quarter, in Standard Sperm Candles.

Description of Gas and Testing-Place.	Max.	Min.	Aver.
The Gaslight and Coke Company—			
Common gas, Beckton	18.6	15.5	17.2
" Ladbroke Grove	18.4	15.5	16.9
Cannel gas, Millbank Street	23.2	20.0	21.0
Common gas, Devon's Road	18.3	16.1	17.0
" Carlyle Square	19.8	16.3	17.9
" Camden Street	17.6	15.9	16.7
" Graham Road	19.9	16.0	17.9
South Metropolitan Gas Company—			
Common gas, Hill Street	18.0	16.0	17.1

At most of the testing-stations the illuminating power has been invariably above that required by the Acts of Parliament.

An appeal was made by The Gaslight and Coke Company with reference to the return of 15.5-candle power in the gas tested at Beckton on the 14th of November last. It was stated by the company's engineer that the result obtained by their own gas examiner on that occasion was 15.95-candle power. Evidence was produced which led to the decision being given in favour of the official examiner.

Sulphuretted hydrogen has been present in the gas made at Beckton on the 24th, 25th, and 27th of November last, and in the gas made at Fulham on the 14th of December; but has been uniformly absent in the gas made at the other works. The Gaslight and Coke Company made an appeal with regard to the presence of sulphuretted hydrogen returned in the Beckton gas on the 27th of November, with the view of showing that the impurity in question had only been present in a very infinitesimal trace; but the official gas examiner produced a piece of test-paper which showed a very distinct indication that sulphuretted hydrogen had been present in the gas on that occasion. The Gaslight and Coke Company have shown that the presence of sulphuretted hydrogen in the gas made at Fulham on the 14th of December was due to the accidental leakage of a valve in a purifier.

Proportions of Sulphur, in other Forms than Sulphuretted Hydrogen, in Grains per 100 Cubic Feet of Gas.

Description of Gas and Testing-Place.	Max.	Min.	Aver.
The Gaslight and Coke Company—			
Common gas, Beckton	19.6	5.9	12.6
" Ladbroke Grove	16.7	11.6	14.1
Cannel gas, Millbank Street	24.6	14.0	19.0
Common gas, Devon's Road	21.6	6.2	12.7
" Carlyle Square	23.6	9.7	14.1
" Camden Street	25.3	10.1	14.7
" Graham Road	16.1	10.0	13.9
South Metropolitan Gas Company—			
Common gas, Hill Street	24.3	12.3	17.7

At all the testing-stations the average of sulphur present in the gas has been considerably below the amount permitted by the Acts of Parliament. Only on one or two occasions at Devon's Road and Camden Street has the quantity present slightly exceeded that amount.

Ammonia has been present at all the stations in greater or less quantity during the past quarter. At Devon's Road, Millbank Street, Ladbroke Grove, and Carlyle Square, it has occurred only occasionally, and in small quantity. At Beckton and Camden Street it has been almost constantly present, but only in small quantity. At Graham Road the ammonia present in the gas has steadily diminished in quantity during the months of October and November, and it has been almost uniformly absent throughout December. At Hill Street the quantity of ammonia has been considerably greater than at any other of the testing-stations, and on one occasion it exceeded the maximum allowed by the Act of Parliament.

University College, London, Jan. 8, 1877.

Dr. Stevenson's report on the gas supplied by The Gaslight and Coke Company to the vestry of St. Pancras, during the month of December, 1876:—Maximum light, estimated by sperm candles, according to the Act—17.5. Minimum light, sperm candles—15.8. Average light, sperm candles—16.6. Traces of ammonia, indicated by turmeric test-paper—traces always. Traces of sulphuretted hydrogen, indicated by lead test-paper—none. Sulphur—9.02 grains per 100 cubic feet.

SALFORD CORPORATION GAS-WORKS.

A Special Meeting of the Salford Town Council was held on Wednesday, the 3rd inst.—the Mayor (Alderman Walmsley) in the chair.

The General Gas Committee presented the following report:—

Your committee beg to report that during the past 12 months the question as to the quality, capacity, or power and suitability for the economical working of the present gas-works and apparatus has engaged their serious attention. A voluminous report and elaborate statistics, together with plans showing existing works and proposed extensions have been prepared by Mr. Hunter, the gas engineer. These show numerous serious defects, or deficiencies in the existing works, to remedy which a considerable outlay would be required, and a large and continuous increase in the consumption will also make it necessary to provide additional apparatus and buildings.

Your committee have arrived at the following conclusions, which they recommend for adoption, subject to the advice of the town-clerk as to the powers of the corporation under their local Acts, viz.:—

1. That the existing works are not good in quality or well arranged for economical working; they are not proportionate in their different parts, and are inadequate to meet present requirements. The deficiencies are principally in the condensing and purifying portions of the apparatus, which are not equal to more than one-half of the present make of gas.

2. It is not only desirable but imperative to make good these deficiencies, and for that purpose the following extensions are necessary:—

At Lamb Lane.—Additional condensers, scrubbers, or new washers, exhausters, purifiers, buildings, and storage for tar and liquor.

At Regent Road.—Re-arrangement of works, additional condensers, scrubbers, or new washers, purifiers, buildings, and storage for tar and liquor.

At Liverpool Street.—The condition of the retort-house and fittings requires further consideration, new stables, and tar and ammoniacal liquor tanks.

3. Your committee are of opinion that the cost of remedying the present defects, exclusive of Liverpool Street retort-houses, will amount to about £30,000, and that when they are rectified the works will be capable of manufacturing, purifying, and storing about 3½ to 3¾ million cubic feet per diem. Your committee strongly advise that as much as possible of this work should be done between Jan. and Sept., 1877.

4. Your committee have considered the necessity for a further extension of the works, and in proof of such necessity desire to lay before you the following figures, viz.:—In the year 1856 the gas made was 133,539,000 cubic feet, in 1866 it was 289,356,000, and in 1876 it was 583,470,000, showing that in every nine or ten years the consumption of gas is doubled.

5. The increase of the population, and the continued increase in the consumption of gas, warrant your committee in assuming that the make of gas will increase from 583 million in 1876 to 1000 million in 1884, and, in order to provide the additional plant required to meet the wants of the consumers, your committee recommend the following further extensions, viz.:—

At Lamb Lane.—Increase in number of retorts; alteration in retorts, fittings, and buildings; additional condensers, exhausters, scrubbers, washers, and other purifying apparatus; additional buildings and tar and liquor tanks. The works to be equal to a make of 1 to 1½ million cubic feet per diem, and the storage, as now, to 904,000 cubic feet.

At Regent Road.—Extension of retort-house, and increase in number of retorts; necessary condensing and purifying apparatus; additional buildings and tar and liquor tanks, except in gasholder storage, which will remain as now. The works to be equal to a make of 2½ million cubic feet per diem.

At Liverpool Street (where at present there is no condensing or purifying apparatus).—Alteration or extension of retort-house and fittings; new condensers, exhausters, scrubbers, washers, purifiers, meters, gasholders and tanks, tar and ammoniacal liquor tanks, governors, and all necessary buildings. The works to be equal to a make of 2½ to 2¾ million cubic feet per diem, and storage to 3 million cubic feet.

6. The cost of the above work will amount to a further sum of about £130,000, which does not include the cost of rebuilding any of the present retort-stacks and removal of the fittings. The whole of the ground now in possession of the Gas Committee will then be covered, and for further extensions additional land will be required. The capacity or power of the works will be equal to a supply of 6 million cubic feet per diem, which will meet the requirements of the consumers to the close of the winter of 1883-4.

Your committee are desirous of carrying out this work during the years 1877-8-9, 1880-1-2, and 1883, and as near as practicable in sections, or at a rate proportionate to the increased consumption of gas; as, by so doing, the capital expended will be less burdensome. The increase in the business will allow an expenditure of from £25,000 to £30,000 per annum.

It only now remains to be stated that, with a full consciousness of the importance of this report, they unanimously recommend its adoption, and ask you to resolve that the work shall be carried out. As previously stated, the subject has been before your committee during the past 12 months; and they have given most careful attention during that period to the very elaborate plans and statistics which were prepared by Mr. Hunter, fully illustrating the present condition of the three stations, and the extensions proposed by him.

Your committee, before approving of the whole scheme, and acting on the suggestion of Mr. Hunter himself, decided to call in the advice of an eminent gas engineer. The names of six gentlemen (considered to be best in the profession) were submitted, and your committee selected Mr. George Livesey, C.E., a gentleman who has lately advised the Manchester Corporation, and who is considered one of the, if not the, most economical engineer, and most successful gas manager in London.

As requested by Mr. Hunter, the whole of the plans, reports, and estimates were placed in the hands of Mr. Livesey, with a request that he would advise the corporation thereon. Mr. Livesey has now presented his report, and we are happy to say that he entirely concurs with Mr. Hunter in the necessity for the work referred to in this report, and has endorsed that the designs and mode of erecting it proposed by Mr. Hunter cannot be improved upon, and should be adopted. This thorough approval of the scheme is a confirmation of the skill and care bestowed upon it by Mr. Hunter, and is highly satisfactory to your committee.

Mr. W. SHARP, chairman of the Gas Committee, moved:—"That the report of the general Gas Committee as to the proposed alterations of the gas-works now read be adopted, and that the general Gas Committee be authorized to carry out the same." He was not aware that it had been usual to submit to the council such a comprehensive scheme, requiring so many years to execute, but the Gas Committee had come to the conclusion that hand-to-hand extensions, without an eye to the future and calculations as to results, must terminate, and the opinion held was that the truest economy, and the best way of meeting the wants of consumers, was the broad basis upon which the committee were now acting. The report set forth or referred to existing works, their condition and capacity, the deficiencies and what was wanted to bring them up to the required standard to enable the committee to turn out pure gas, and work with greater economy. It entered fully into the probable increase, and what was wanted, and how the committee proposed to meet an increase which was so very large and continuous. It gave the cost and an idea of the work which would be done for the money. At the present time the purifying power at the gas-works was ridiculously small. There was certainly a large amount of carbonizing power which could be used; but it was not fair to the consumers to turn out impure gas, which they were obliged to do unless they had the purifying power increased. If the report were approved, the council would be asked from time to time to confirm contracts as they were entered into. Instead of leading the council step by step, the committee considered it best to give them a fair, and, as far as possible, a full idea of what was intended for some time to come. The committee were satisfied that as they had exercised so much care and caution before coming to the council, that they (the council) would not hesitate to approve the report, especially as it was absolutely necessary to commence the work immediately. So far as he (Mr. Sharp) was personally concerned, he might say that the subject had been discussed between himself and Mr. Hunter, the gas engineer, over and over again during the past 12 months, and feeling his responsibility, he (Mr. Sharp) had made it his business to satisfy himself first, whether the work was necessary; second, how much was necessary; third, whether the plans proposed carried out the work in an economical manner. Certainly his own experience was insufficient to warrant him in speaking in the most positive terms, but the whole of the committee were fully satisfied upon every point. Mr. Hunter had shown considerable anxiety about the matter; if any faults could be found or improvements suggested, his great desire had been to find them out before any money was spent, and not in the useless hereafter. To show his confidence in his own plans and his willingness for them to be improved upon, and further that the committee might be strengthened in coming before the council and as a satisfaction to the public, Mr. Hunter said, "Take my plans, but don't trust to your own judgment. Call in one or more of the best engineers you can find, let them advise you whether my proposals are right or wrong, for it is better to be put right at the beginning than spend money in a wrong way." Mr. Hunter refused to recommend an engineer, and the committee—no doubt influenced by what Manchester had done in selecting Mr. Livesey, and knowing that he was noted as a first-class engineer, and selling the cheapest gas in London—took his advice, and the council had heard by the report that Mr. Livesey entirely concurred with Mr. Hunter. He (Mr. Sharp) thought it was only just to the committee's own engineer to acknowledge the skill and care displayed in the preparation of plans, and the getting up of all information necessary for the committee and for Mr. Livesey, to enable the committee to arrive at the conclusion come to. He had, thereupon, great pleasure in moving the adoption of the report.

Alderman JENKINS seconded the motion, remarking that he was of opinion that if the progress of the Gas Committee now contemplated had been made some five or six years ago, they would have saved some scores of thousands of pounds.

Alderman LEE objected to the council coming to any decision that day on the expenditure of such a large sum of money. The report of the committee ought to be printed and circulated amongst the members of the council, so that they could have proper time in which to consider the matter.

Alderman M'KERROW agreed with Alderman Lee, and was surprised,

after the experience the Gas Committee had a few months ago in the matter of their contracts, they should ask the council to approve their report that morning. He suggested that the matter should be postponed for consideration, until the next meeting of the council.

Alderman DEWHURST said it was necessary something should be done. The present gas-works would only make a certain amount of gas, and they must make provision for an increased supply, or the borough would be left in darkness. The committee had had the best advice on the subject they could get, and it was what they had heard in the report that morning. They were not responsible for the evil deeds of their predecessors, but if the works were not in a fit state to make gas as it ought to be made, he thought the best plan was to begin and mend matters. He believed the proposed undertaking was perfectly sound and feasible, and he hoped the council would support the committee in the matter.

Alderman DAVIES protested against large schemes coming before the council, and the council being asked to give a decision without due time for consideration. They would not have been in their present difficulties at the gas-works if, in days gone by, they had insisted upon something of the kind. The council ought never to be taken by surprise in voting large sums of money.

Mr. SHARP urged upon the council that the works must be started with directly, and asked if the committee could not be authorized to get forward with £30,000 worth of work. He suggested that a special meeting should be called for that day fortnight, to consider the question.

After some further discussion, on the motion of Alderman DEWHURST, seconded by Mr. J. E. MIDDLEHURST, it was resolved—"That the matter be considered at a special meeting to be called by the mayor, and that in the meantime a report be prepared under the direction of the chairman and deputy-chairman, and sent out to each member of the council."

PROPOSED PURCHASE OF THE ILKESTON GAS-WORKS.

On Friday, the 29th ult., a Public Meeting of the Ratepayers of Ilkeston, convened by the Local Board, was held in the Town Hall, to discuss the question of opposing the gas company's proposed application to Parliament next session for increased powers, and to authorize the board, under the Municipal Corporations (Borough Funds) Act, 1872, to defray the expenses of such opposition (if decided upon) out of the funds of the general district rate.

The *Nottinghamshire Guardian* states that the policy of the local board, as exhibited during the past year or so, has given rise to much controversy and provoked considerable criticism amongst the ratepayers. More particularly has this been the case within the past month, on its becoming known that the board had resolved to apply for a loan of £16,000 for the purpose of improving the water supply, and that they had resolved to make overtures for the purchase of the gas-works, which would involve an outlay of something like £20,000 more. Although the water supplied by the old company is far from being as pure as it might be, and the present works of the gas company are barely adequate to meet the existing requirements of the town, the large outlay required to transfer the control of each to the local authorities naturally aroused the usually uninterested ratepayers, some of whom saw before them visions of increased rates and burdens too intolerable to be borne. Although, therefore, the chairman of the local board, in his notice convening the meeting, confined himself to stating this to be the sole object of the meeting just referred to, it was generally understood that the much more important question of the purchase of the gas-works would occupy the attention of those present. On the strength of this impression large placards were issued on the previous day, advising the ratepayers to attend the meeting and vote against the further mortgaging of the rates. The ground on which the local board were to be opposed in their intention to purchase the gas-works may be best explained by giving a copy of the bill issued by the anti-purchase party, which was as follows:—

Ratepayers of Ilkeston! If you do not at once look after your own interests, the parish will be saddled with a debt of £40,000! To prevent the borrowing and mortgaging propensities of the local board, you should attend the meeting of ratepayers on Friday night, the 29th of December, in the town hall, at seven o'clock.

The parish is now in debt for the town-hall and sewerage purposes nearly	£5,000
Other sewerage works must soon be carried out, at a cost of about	10,000
The board have already decided to borrow for water-works,	16,000
And propose, at the meeting on Friday next, to borrow more money to buy the gas-works, the probable cost of which will be at the least another	16,000
Law expenses in opposing the gas company	300

Total £47,300

A debt of £40,000 or £50,000 on a parish like Ilkeston will be simply unbearable. Last year the board expended about £3000 of ratepayers money. Allow them to borrow another £40,000 or £50,000, and what will the rates amount to in the year? The rates of the Ilkeston Local Board are considerably higher than in most other districts. If the board buy or erect new water-works, we shall then have heavy water-rates, which will again increase all cottage-rents fearfully. If the board buy the gas-works, board gas will not be 1d. per 1000 cheaper to consumers than that supplied by the present company. The board do not manage with the works they have in hand. They have a number of high-salaried servants, but not one who can manage even the cleaning or lighting of the town lamps. How, then, will they manage a large works, with a capital of £16,000 or £20,000? Let us have no borrowing to buy private works until things are better managed. Ratepayers,—attend the meeting, and vote against borrowing money and mortgaging the rates!

It will be seen from the above that the financial view of the question is the uppermost, and although some of the statements contained in it may be rather exaggerated, the estimated cost of the water-works and gas-works is under rather than over the mark, the total cost of both amounting to between £30,000 and £40,000. Never since the adoption of the Local Government Act at Ilkeston—about 14 years ago—has a public meeting of the ratepayers been called by the local board until the one in question; still no scheme has previously occupied the attention of the board necessitating so large an outlay as the contemplated purchase of the gas and water works.

The chair at the meeting on Friday was occupied by Mr. W. Wade, the chairman of the board, and the meeting was crowded with ratepayers.

The CLERK (Mr. W. Lissett) having read the requisition to the board, upon which the meeting had been convened,

The CHAIRMAN said the question to be decided was of immense interest, not only to the ratepayers, but also to gas consumers and the shareholders of the gas company, and he trusted it would be discussed in a spirit of fairness and good feeling. He could sympathize with those who had, many years ago, invested their capital in a profitable undertaking, and he could readily understand their chagrin when they found their profits in jeopardy. When they considered the magnitude of the gas-works, and also remembered that they had hitherto been carried on by the permission of the local board, it was natural for the company to attempt to obtain some valid authority for the exercise of their calling. The local board had to consider the welfare of the whole of the ratepayers, and it was their duty to oppose an application for powers which would enable the gas company to break up new streets, independent of the ratepayers. They proposed to supply the public lamps with gas, and to levy a rate upon the inhabitants for such supply; and if the Provisional Order asked for were granted, the ratepayers would be compelled to submit to the terms of the gas company so long as they did not charge more than 5s. per 1000 feet.

If the ratepayers surrendered their rights, the shareholders of the gas company would appoint only such men for directors as would procure them the largest dividends. The local board had studied the question, and they were desirous of arriving at a just conclusion. They did not believe in the gas company being granted a monopoly and a sole right to supply gas to the parish of Ilkeston. If that were the case, they would be compelled either to pay the price asked for the gas, or go without it altogether. If any monopoly was to exist, the board thought it ought to be in the hands of the ratepayers. The board were prepared to borrow the money required for the purchase of the company's works at such a low rate of interest that they could, with the profits from the gas, pay off the whole of the principal and interest, without asking for one penny in the shape of a rate. He concluded by moving that the board oppose the application of the gas company, and that the costs of such opposition be defrayed out of the general district rate.

The proposition was seconded by Mr. W. SUDBURY, in a brief speech.

Mr. W. LISSETT, clerk to the local board, read the estimates which the board had prepared, from which it appeared that he had written to twenty different parishes respecting the profits made by the gas companies of those places, and he found that the highest was 12½ per cent., and the lowest 5 per cent. They could borrow £18,000, which he thought would be sufficient to purchase the gas-works, at 3½ per cent., and pay it back in 30 yearly instalments of £600 each. The yearly profit from the manufacture of gas would be £1350, and after paying back the proportion of the loan and the interest, there would still be money left to assist the rates. In 30 years the works would be clear, and the whole of the £1350 would be for the benefit of the ratepayers.

Mr. MELLOR wished to know what it would cost to oppose the gas company. When lawyers had a parish for their client their bills were generally long ones, and he was sure the ratepayers of Ilkeston had no money to "fool" away in law.

Mr. B. WILSON, secretary of the gas company, said the board had now four 10d. rates where there was formerly only one, and yet this was the board which promised such great boons without any guarantees.

Mr. WILLIAM SMITH supported the proposition, and was followed by others on the same side.

Eventually the motion was put to the vote, when only one hand was held up against it.

PROPOSED PURCHASE OF THE BRISTOL WATER-WORKS BY THE CORPORATION.

At the Meeting of the Bristol Town Council on the 1st inst.—the Mayor (Alderman Edwards) presiding,

The WATCH COMMITTEE presented a long report upon the question of a proposed reorganization of the fire brigade and the purchase of the works of the Bristol Water Company. With reference to the latter point, they remarked that "it has occurred to your committee that this report presents a favourable opportunity to consider whether some of the existing difficulties may not be removed, and further advantages, which will suggest themselves to the council, secured to the city, if the corporation were to acquire the undertaking of the water-works company, provided equitable terms for the purchase can be arranged. It is believed that the Local Government Board favourably regard the transfers of such undertakings to municipal authorities, and provisions for the purpose will be found in the Public Health Act, 1875. The transfer of the works and liabilities of the company, which extend into many of the suburban districts, might require special legislation; but on this point, as well as on the previous question, your committee offer no opinion. It is necessary to add that this suggestion is not made with the consent or knowledge of the directors of the water-works company."

Alderman JONES said the proposition as to the city acquiring the undertaking of the water-works company he considered a very important matter, and he took upon himself the responsibility of bringing it before the council, and asking whether or not the city should have the control of its own water supply. This not only concerned the question of quenching fires, but it had reference—it might be—to the saving of life and a large extent of property, while the whole of their sanitary arrangements and the health of the city depended upon the efficient working of the water supply. As they would see by the report, it was stated that the Local Government Board favoured the idea of towns obtaining possession of their own water supply, and he had in his hands a list of 110 towns which now had control of their water supply. In that list there were 19 towns, chiefly very large ones, which had only lately obtained control of such works. Amongst these were the big towns of Birmingham, Birkenhead, Bolton, Bradford in Yorkshire, Brighton, Chester, Glasgow, Leeds, Liverpool, Manchester, Oldham, and Rochdale. These were large towns whose inhabitants well knew what their interest was. It had been argued, he knew, that the management of such a concern as that could not be well undertaken by the council. But he must demur to that argument. He did not think gentlemen would be inclined to admit that they were not as capable of conducting such an undertaking as the inhabitants of those large northern towns. He took it that they would not do so much discredit to themselves. He believed they could manage the work properly, and he should like to see them doing so. There was no disguising the fact that the amount involved was a large one, but the longer the matter was delayed, the greater the amount would be. He thought a large population like that should not fear to undertake such an outlay. Reminding them of what they had accomplished with the docks, and how those docks had increased since they came into the possession of the city, after an arduous fight twenty-eight years ago, he said he had not one word to say in disparagement of the management of the water-works company. He believed that, upon the whole, the works had been managed extremely well, and that Bristol was very much beholden to the company for having established the water-works. They took the initiative; they had had a long and arduous and very uphill fight, and they had at last achieved a great success, as was shown by the large dividends they had lately given their shareholders, and by the value of the shares at the present time in the market. They had done so much for Bristol that he thought they were entitled to be treated most liberally, as Bristol would never have attained the position it had reached if it had not had a water supply well worked as it had been by the present company, while modern Clifton could not have come into existence at all. Many of them would remember how old Clifton—or a large part of old Clifton—used to be supplied with water. It used to be hawked about from springs there, and was sold at so much the bucketful. But a different state of things prevailed now, and he thought they ought to feel extremely obliged to the water-works company for accomplishing what they had with reference to the water supply. He argued that so lucrative an undertaking as that would well be in the hands of the city. It must necessarily be a very increasingly lucrative business, and the longer they allowed its purchase to be delayed, the more they would have to pay for it, and the longer they would be deprived of the advantages they would have in its possession. The profits would necessarily be very large, and they would be devoted either to the reduction of the water-rate or to the borough-rate. In either case the city would have all the advantage, and he submitted that it was most desirable that the question should at once be entertained. He moved—"That the council is of opinion that it

will be for the interest of the city to acquire the undertaking of the Bristol Water-Works Company, providing the purchase can be effected upon equitable terms."

Alderman BAKER seconded the resolution. If it were a proposition to purchase the undertaking of the water-works company *coûte que coûte*, they, of course, would not be right in undertaking such a responsibility; but as the resolution bound them only to negotiate with the company, to ascertain the facts of the case, and to see whether advantageous terms could be arranged, he thought they certainly could not be wrong in going so far as that. He was not at all sure that corporations could manage such undertakings so well as could individuals who had a direct interest in them; and he was also aware that the labours already imposed upon the council were heavy; yet, if it could be shown that the step was an advantageous one, he did not think they should shrink from undertaking the management of that very large concern, especially if they could see that, by doing so, they would be conferring a substantial benefit upon their fellow-citizens. No doubt, if the city were to remain in its present condition, and if they were merely to purchase this concern, and take it over in its present state, and there was to be no development of it in the future, there would be very little advantage in it; but the advantage that would accrue to the corporation was that, in the future, Bristol would increase and largely develop, and, consequently, the revenue of the water-works would relatively increase, and the profits of that development and increase would go into the pockets of the citizens, directly or indirectly, instead of into the pockets of the shareholders of the company. Of course, they would have to inquire very closely into the condition of the undertaking before the negotiations went far. At present they knew nothing of the condition of the works, or whether the supply of water was adequate for future wants. Should the committee, to be appointed that day, find that the result of their inquiries was satisfactory, and that the works could be acquired upon reasonable terms, the city would do well to purchase the undertaking.

Mr. W. P. KING observed that it had been stated that the water-works undertaking was much more likely to be well managed in the hands of a private company than in the hands of the corporation; but he could hardly agree with that feeling, even if it they were an entirely free company; but it was not so, for, above a certain amount, he believed 10 per cent., the company could not pay any dividend, and they had at present arrived at the happy state when they distributed the utmost amount of dividend which they were allowed by Act of Parliament to distribute. He pointed out, too, that the officers of the company had no pecuniary interest in seeking to reduce their expenditure so that a larger revenue might accrue, as the dividend which they were enabled to pay was restricted.

Mr. W. PETHICK said the dealings of the water-works company with the city of Bristol had been spoken of in eulogistic terms, but whilst he did not wish to underrate the manifold and manifest advantages which the city had derived from the water company, he could not conceal from himself that the undertaking had been managed in a way which no corporation would manage it for the public interest. With the utmost respect for the board of directors of the water company, he could not help feeling that their treatment of the citizens had not been so liberal as to entitle them to much consideration at the hands of the council. The water company had acquired powers which were deeply to be regretted, and he thought that if the council had ever seen, to the full extent, what they were doing when they acquiesced in those powers, they would have carried their opposition to the granting of them to a very much greater degree than they did. Having obtained those powers, the company were now in a position to make cumulative charges, and there was abroad a very strong feeling that they had pressed the citizens almost to the limits of forbearance. The property had become very valuable under legislation which he characterized as altogether unfair in the interests of the city. Now that they were being attacked by a new company, when they had carried their company to the highest possible pitch of pecuniary revenue, and were paying 10 per cent., and threatening to pay back dividends, and remembering the treatment the citizens had received at their hands, he thought the time inopportune for making such a proposal. The company not only made the citizens pay for water which they had had, but they also made them pay for water when they could not supply it, and enforced all their rates. He hoped that there might be found in Bristol sufficient public spirit to bring about a competition with those gentlemen, for whilst he felt that citizens should pay a fair price for benefits conferred, at the same time he thought that they had been very hardly used by the company.

Mr. C. J. THOMAS observed that very shortly after the establishment of a water-works company was proposed, the question came up in the council whether or not they should support the establishment of such a company, and it was suggested that it would be far better that the corporation should become the owners of their own water-works. Some gentlemen, very esteemed friends of his—men who were reckoned as the longest-headed men in the council—scouted the idea, and said it would never pay. At that time, down in the lower part of the city, along the level of the river, there was not such a thing as a drop of pure water to be had, and therefore a very great boon was conferred upon the city by the establishment of the company. For ten years after he went upon the board he never received a single farthing of interest for money invested, nor a farthing for his exertions as director of the company, and he held in his hand a return of how the company paid for the next ten years. The first dividend was paid in 1856, and was 3s. 6d. on a £25 per share; in 1857 it was 4s.; 1858, 5s. 6d.; 1859, 7s.; 1860, 9s. 6d.; 1861, 11s. 6d.; 1862, 13s.; 1863, 15s. 6d.; 1864, 18s. Mr. Pethick scolded the company for taking money for that which the city did not get, but their expenses for obtaining water were going on all the time, and the rate was one which the citizens were liable to pay in advance. He thought they were not open to the heavy charges which Mr. Pethick had brought against them. His friend Mr. Wetherman, and himself, being directors of the company, would not vote either way on the question before the council; and he might say, on behalf of the company, that any proposition made to them would be dispassionately and fairly considered. The water company had, since they obtained their additional powers, trebled the supply to the city, and were now making a very heavy outlay to provide against any accident to the mains, by which the supply was brought into the city, by laying down another set of pipes, so that the supply should not be broken. If the corporation purchased the interests of the water company, he certainly did hope it would be for the advantage of the city in the future.

Mr. B. G. BURROUGHS thought the present time was particularly inopportune to attempt to negotiate with the water company. The city had in prospect the blessing of competition, and they did not know what advantage that might be.

Mr. MILLS objected to the motion as it stood, because it would bring them before the company as eager buyers of their undertaking, but he would vote for the appointment of a committee to consider the expediency of purchasing.

Mr. NASH thought the fact of another scheme for supplying the city with water having been introduced, made the present a favourable time to look into the question without delay. It might be that it would be found to be desirable that they should have one company to supply the eastern, and

the other the western portions of the city; and another question was whether it would be desirable to have the streets torn up by two companies.

Mr. E. S. ROBINSON observed that there were a number of advantages which the city would gain if it possessed the water-works. The question came up naturally and necessarily upon the consideration of the question of the fire brigade, and they could all see what an advantage it would be that the city should be enabled to make more effective arrangements for extinguishing fires. They were constantly seeing that as soon as a macadamized street was laid down, it was torn up by the water company. That was owing to the divided authority, and it was essential in the interests of civilization that they should have their streets under one authority. Having adverted to the advantage upon sanitary grounds of an adequate supply of pure water, he said a Royal Commission in 1869 reported that the public health would be very much better kept, and sanitary arrangements much better enforced, if water-works were put under the control of municipal authorities. At Birmingham in 1851 the water company were willing to sell their works to the town for £250,000. The occasion, however, was lost, but the subject came up again in 1864, when the company were willing to sell for £400,000. Those negotiations, however, resulted in nothing, and in 1875 the Corporation of Birmingham did purchase the water-works at an expense of one million. The value of the water-works property had increased £600,000 in ten years. He did not say that the water company had been as liberal as they ought to have been, but ever since they obtained their last bill, the city had had a constant supply of water. He approved of the water-works being acquired by the city if they could be obtained upon equitable terms, but those who projected the company got nothing for their outlay, nor for their attendance to its affairs, and the council must be prepared to pay a liberal price.

Mr. FOLLWELL said the matter had been before the council more or less for the last 20 years, and unfortunately it had come up now just at a time when another company was proposed to be established. If the corporation purchased the water company, the council would have to fight the battle with the new company in opposing the bill that they were promoting in the coming session of Parliament. If the existing company had to oppose the new company, and the latter obtained their bill, then the council would be in the position of having two companies to treat with. He thought it unwise for the corporation, at the present time, to have anything to do with it, but to let the water company fight their own battles.

On a division the motion was carried by 34 to 6, and a committee was appointed to negotiate with the water-works company.

A TALE OF THE NEW RIVER COMPANY.

As the citizen of London passes along Islington Green, he will see a monument to Sir Hugh Myddelton, a London citizen, whose name should be held in everlasting remembrance. It is to be questioned whether London ever had a worthier son. He was a Welshman—that, of course, he could not help—born in the year 1555. It was to his credit that he came to London, and made money as a goldsmith. It is still more to his credit that, with a view to benefit himself and his fellow-citizens, in 1606 he agreed to supply London with water from streams of the pure element in Middlesex and Hertfordshire. In 1608 he commenced the undertaking, which was considered formidable, if not impossible. Never had man born of woman a harder work. It is wonderful how he could have kept up through it all. On all sides he had opposition to encounter. On all sides difficulties were heaped in his path. Such a thing was a novelty and innovation such as John Bull had never seen before. Was not there the Thames, and what could be easier than to get water thence? If the Thames was too far, were there not Clarke Well, and Clement's Well, and Holy Well, always supplied with excellent water, and quite at one's very door? Possibly, at that time there were those who did not disdain the waters of the Fleet as they flowed from Hampstead amongst green fields and ancient woods right down to the City Gate of Lud. Mr. Myddelton, it was thought by many, had better have kept to his goldsmith's shop, which must have been a good one then, and not troubled himself with matters above him. Happily, Mr. Myddelton did not think so. He was a public-spirited man. He did not consider that a shopkeeper or a merchant comes into the city merely to make what he can in it. He thought he had duties to discharge to the City, in which he had spent his life and made his fortune, and he laboured at his self-assumed task in spite of the opposition of the landowners along the line to the new canal—in spite of the indifference and cold support of the public—in spite of that sad calamity the failure of his funds. Happily, he did not labour in vain. Happily his sanguine hopes were justified. Happily, in 1613, the work was satisfactorily completed, and the water was let into the reservoir at Islington. By the time it was done, the public had become quite aware of the real importance of the work, and Stowe gives a quaint account of the rejoicing on the occasion. London turned out in all bravery to do honour to the event. First and foremost of the company was the Lord Mayor with all his attendant suite. Besides these were sheriffs and aldermen and common councilmen, and the citizens completed the company. It is to be presumed the ladies were present, but old Stowe says nothing about them, and the art of graphic reporting had not been invented at that time. If they were not there, they ought to have been, for where does woman shine to such advantage as when she presides at the tea-table, and gracefully dispenses to her friends the cup that, as it has often been said, but never said too often, cheers but not inebriates? And where, it may be asked, would our fair tea-makers have been, had it not been for the New River water? Stowe tells us instead of "the labourers well aparaled," to the number of sixty or more, carrying the instruments of their labour, who presented themselves before the magnates of the corporation, while one of them delivered, on behalf of the rest, a speech in verse, intimating that long had they—

"Labour'd, long desired, and pray'd
For this great work's perfection, and by the aid
Of Heaven and good men's wishes 'tis at length
Happily conquer'd by cost, art, and strength."

And honouring the brave originator as only aiming at the City's good, and referring to the timely aid of royalty, that of King James I., who shortly after had a narrow escape of drowning in the canal he had assisted to form—all at once there was a change in the poetry, and the reciter turned away from the company, as he exclaimed:

"Flow forth, precious spring,
So long and dearly sought for; and now bring
Comfort to all that love thee; loudly sing,
And with thy crystal murmurs shook together
Bid all thy true well-wishers welcome hither."

And at this summons, though the rhyme was bad, and the pun was worse, the flood-gates flew open, the stream began to flow, the drums beat, the trumpets blew, the bells rang, and London's greatest want was supplied—a pure supply of the first necessary of life. Mr. Hugh Myddelton became a baronet, and never was the honour more worthily conferred or more honourably won. Yet even in honouring Sir Hugh Myddelton's public spirit and patient enterprise, we must not forget that after all he was but the right man in the right place. The idea he originated was not entirely a novelty. The Corporation of London had indeed before him felt the need of making an adequate supply of water for the citizens of London, and had gone so far in the reign of Queen Elizabeth as to obtain an Act

to enable them to cut a river to bring it to the City from any part of Middlesex or Hertfordshire. Already they had a dim perception of the truth that cleanliness was next to godliness, and that the health of the Metropolis depended upon the use of pure water, that luxury and necessity of life. In these days when we have become used to the wonders of engineering skill; when we talk of tunnelling under the Straits of Dover; when we are promised salt-water baths from Brighton at the Crystal Palace; when people talk of emptying Loch Katrine into our London reservoirs, as if Scotland was but a mile or so from town, Sir Hugh Myddelton's performance does not seem such a wonderful performance. And when we rush down by the Great Eastern Railway to Hertford, or take our summer walks abroad among the roses of Cheshunt or the hayfields of Enfield, the New River, as it sweeps along past pretty villas and trim gardens, seems as much a matter of course as the Lea itself. But in Myddelton's day it was a wonder and a triumph of engineering skill, such as England had never seen. The distance from London to Ware, as the crow flies, is about 20 miles, but Sir Hugh Myddelton's river had to wind about till it was nearly twice that length, and the expense was enormous, although labour and the materials of construction cost much less than they do now. The worthy goldsmith's capital was exhausted when he had expended about £4485. The situation was an unpleasant one. If the work stopped all that money would be wasted, and he would be a beggar. In our time the matter would have been easily arranged. We should have had a limited company formed, with an M.P. or two on the direction. *The Times* and the *Daily News* and the *Standard* would possibly have recommended the scheme, and the organs of teetotalism and the United Kingdom Alliance would have been jubilant in its praise, and the money would have been raised at once. In that day joint-stock enterprise was unknown, nor had the press yet become a power. Under these circumstances Royalty was appealed to. In our young days James I. was held to be the British Solomon; in his own time he was told to his face by his clerical flatterers that he spoke by the inspiration of God. The world does not think so highly of him now. Be that as it may, in responding to the appeal of Mr. Myddelton, King James did one of the most sensible things he ever did in his life. For the aid he rendered the work Myddelton conveyed to him one-half. Never was money better laid out or more judiciously expended. The cost of the entire undertaking appears to have been £17,000. Of this sum his majesty advanced half, and the expended capital was divided into several shares, of which half belonged to the king, and half to Myddelton. Sir Hugh parted with most of his shares at a good profit. Twenty-eight were thus placed, and lucky indeed were they who held them. It was they who formed the governors and company of the New River, brought from Amwell and Chadwell to London, formed in 1619. At first the undertaking was by no means a financial success. For 20 years the company divided no dividend, all the receipts being devoted to improving the property and developing the resources. Even after it had begun paying a dividend it had to encounter evil times, and in 1636, when King Charles I. was hard up, as even monarchs sometimes are, and when there was a talk of making a further call upon the shareholders, he parted with his shares for a guaranteed rental of £500 per year. After this the property gradually improved, and now each share yields a dividend of no less than £2000 per year. It also confers the right to the franchise in the counties of Middlesex and Hertford; and in 1711 Lord Chancellor Cowper decreed that the possessors of two or more fractional parts of an Adventurer's share, being equal to one whole Adventurer's share, might depute a person to represent them in the government of the company. It may be remarked that, under the arrangement made with the king, his majesty had nothing to do with the government of the concern.

But we have not yet described the New River. At its first formation it was 18 feet wide and 5 deep, and had a fall of about 5 feet a mile. The water is stored in reservoirs at Cheshunt, Stoke Newington, and Clerkenwell, having an area of 43½ acres. Into the reservoirs at Claremont Square, Maiden Lane, Highgate, and Hampstead, 20 millions of gallons of water are pumped up by a pumping power of 1700 horses, and thence it flows along—incredible as it may seem—620 miles of mains. In 1869 it supplied 800,000 inhabitants, living in 113,462 houses, with 23,796,667 gallons. It has now, at least, some nine rival companies in the field. Between them they supply the four millions of inhabitants of London with 35 million gallons of pure water; but the New River Company still maintain their proud pre-eminence, and calculates that, with their present powers, and with but a little extra effort in the way of engineering, they could supply as much as 35 million gallons to London's thirsty souls. Evidently, then, the company cannot be said to overtax its powers, or to have arrived at the condition when, commercially, it has ceased to be a profitable investment. It has naturally all the north of London for its own, and it is in that quarter—or rather in the suburbs bordering on it—that the rapid increase of population is most marked, and that "genteel semi-detached villas," as the advertisers term them, are most in request.

A few figures as to the value of the shares cannot fail to interest the curious reader. It is rare indeed that an original share is in the market, but during the last few years some fractions of shares have been sold by auction. The values at different times of entire shares, at the rate of which these parts were sold, are as follows—viz., In 1814, £7450; 1822, £9450; 1858, £9800; 1870, £42,360; 1873, £48,960; 1876 (February), £64,000; 1876 (July), £88,050; 1876 (November), £94,050. The shares issued in 1866 have also realized large prices at auction. The last quotation for the £100 paid up shares (which was about six months ago) was £320, and at the same time some £100 shares, with £70 paid, were sold at £280. Since then the latter have been sold at £310, which is their last and highest quotation. One-thirtieth of a "King's Share" was recently sold for £3135.

The following official statement shows the marvellous and steady increase in the receipts of the company for water supplied during the last 15 years:—1861, £189,732 12s. 4d.; 1862, £194,169 6s. 11d.; 1863, £204,750 1s. 7d.; 1864, £218,709 10s. 10d.; 1865, £225,013 4s. 8d.; 1866, £232,606 15s. 7d.; 1867, £240,934 2s. 11d.; 1868, £244,940 14s. 1d.; 1870, £258,684 3s.; 1871, £268,717 3s. 7d.; 1872, £281,434 19s. 1d.; 1873, £292,388 5s. 3d.; 1874, £308,550 6s. 9d.; 1875, £329,073 0s. 1d. Market value of King's shares, 1814 to 1876:—1814, £7450; 1822, £9450; 1858, £9800; 1870, £42,360; 1873, £48,960; 1876 (June), £64,000; 1876 (July), £88,090; 1876 (November), £95,100.

As to the future of the New River Company there is every reason to be sanguine. It has not exhausted its mission. It has not had its day. Water is more and more in demand, and water London must have, till Macaulay's celebrated New Zealander, standing on the broken arches of Westminster Bridge or Blackfriars, shall contemplate the ivied ruins of St. Paul's. Till that time the shares of the New River Company may be expected to command an increasingly high price in the market, as its income is not only derived from water-rates and water sold in bulk, but from its extensive private estates in and around London, which become more valuable as leases fall in. Altogether it is a marvellous history that of the New River Company. Of this let us give one further illustration. The King's shares parted with by Charles I. for so trifling an annuity as £500, are now valued each at £94,000. Royalty made then a very bad bargain for itself. But as others have reaped the benefit, there is not so much cause for regret after all.—*City Press*.

GAS SUPPLY FROM WORKS WITHOUT A GASHOLDER.

By M. SERVIER.

[Paper read at the last Annual Meeting of the *Société Technique de l'Industrie du Gaz en France*.]

The object of the communication I am about to make to the Society is to demonstrate the possibility of gas-works performing their functions without the aid of a gasholder. It is evident that here the question is not one of a normal supply, and though I made the experiment with it, I beg you to believe that it was not for my personal amusement. First of all, then, I will state the causes which led me to make this experiment, which was attended with perfectly successful results.

The contract for lighting the town of Metz has been but lately renewed, and the considerable reduction in price which has resulted therefrom—a reduction from 45 to 27 centimes per cubic metre (about 10s. to 6s. per 1000 feet), upon which the town authorities impose a further tax of 5 centimes, making the net price 22 centimes—has proportionately developed the consumption of gas. It has also compelled us to seek for more economical modes of manufacture.

The old gas-works at Metz, constructed at a time when the railway was not in existence, were erected on the road from Metz to Saarbrück, where the coal mines are situated; but the railway terminus was built at the other end of the town, about three miles from the gas-works. The first piece of economy to be practised in the development of the manufacture was, therefore, to move nearer to the railway terminus, and this we did by erecting a second gas station close to the line. This station was destined subsequently to replace the original works. These new works are furnished with larger retort-ovens, and so arranged as to manufacture gas more economically.

I was pledged to light the railway offices, &c., in the month of October, 1875; but, in consequence of delays, I was unable to complete the gasholder in time to be of service. Then came the frost, and, briefly, I found that the gasholder could not be brought into use till the spring. However, I wished to fulfil my engagements, and add to the receipts the amount which the lighting of the railway offices would have brought us.

It was under these circumstances that I decided on starting the works without a gasholder, and I am about to point out to you the precautions to be taken in a similar case, and to explain how, although I got very well out of the difficulty, I might have done still better than I did, had I thought sooner of another solution, which I have just applied with a different object.

I ought at once to say that the existence of the old works, with the gasholders, facilitated the service I wished to effect, by reason of the connexion existing between the two stations through the network of mains; but it will be seen that this condition is not necessary.

The day supply, as well as that which is furnished after midnight, is very regular in the majority of towns; that is to say, the hourly consumption is pretty nearly equal. This consumption being known, it is sufficient to charge the retorts with the quantity of coal absolutely necessary for the production of the amount of gas desired, sending the gas direct into the town. This is what was done during the day, and after midnight. With regard to the evening, the retorts were fully charged, and the two works being connected by the mains, I was able, by means of the governor, so to regulate the supply from the works provided with a gasholder as to leave the works unprovided with one to send out all the gas they produced. In this way the pressure on the retorts and other apparatus did not exceed the proper limits, which would not have been the case if the works without the holder had produced more gas than they were able to send out.

But this regulation of the charges during the day and night, and of the pressures during the evening, is not the only precaution to be taken in a service of this nature. You know, in fact, that the coal does not produce, during the different periods of its distillation, a uniform quantity of gas, or gas having a uniform illuminating power. The first portions of the gas produced, like those which are given off last, have a much more feeble illuminating power than the gas produced in the middle of the distillation. To remedy this serious inconvenience, the retort charges were fractionated as much as possible—that is to say, every hour a fourth of the retorts were charged, in order to obtain a gas of an average illuminating power. We even noticed that, notwithstanding this precaution, it was necessary to add a small quantity of Boghead or cannel to each charge, to improve the gas produced at the commencement of the distillation.

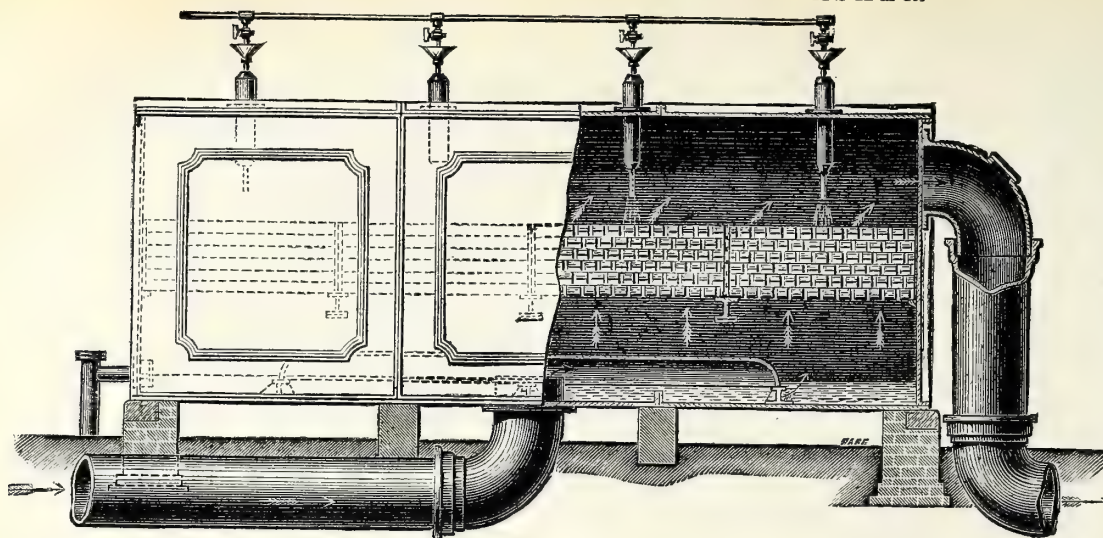
It is equally necessary, during the lighting hours, to refrain from putting into use purifiers that have just been renewed, and contain air, which acts injuriously on the illuminating power of the gas, unless the precaution be taken to expel the air by means of valves in the covers.

The same supply could be afforded by a single work which, from any circumstance whatsoever, had been deprived of its gasholder; but it would be necessary to take a fresh precaution, which would be, before sending the gas into the town, to cause it to pass through a small bell-shaped vessel suspended in water, and weighted to the maximum pressure which it was desired that the apparatus on the works should bear. This vessel would be furnished with an outlet-pipe, which would allow the gas to escape whenever the proper pressure should be exceeded. The gas so escaping might go to waste, or, better still, be conveyed into the retort-oven, and there utilized for keeping up the heat. I should add that in one case as in the other it is indispensable to entrust the service to intelligent and conscientious foremen.

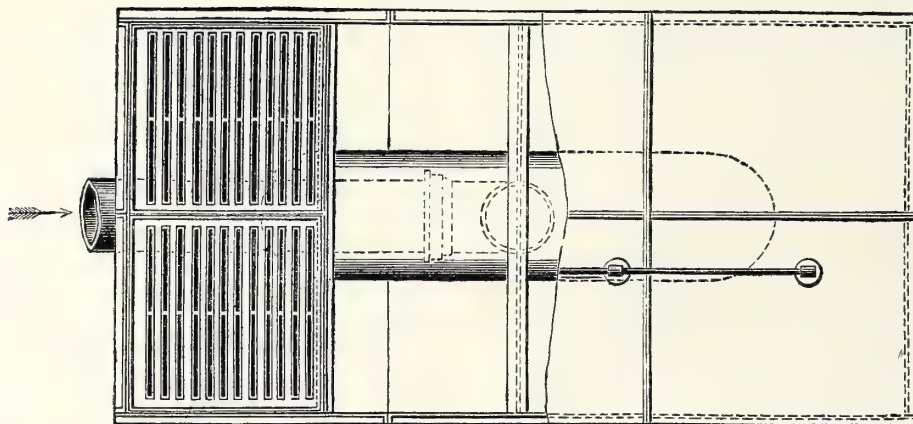
I have already said that I could have done still better if I had thought in time. This is what I am now actually doing, although the gasholder is in use, but with a different object, which I am about to indicate to you. I have remarked that the new works were capable of manufacturing gas at a lower rate than the old, consequent upon the economy effected in the transport of the coal and the employment of improved apparatus. But beyond this the old works possess extensive gasholders and large outlet-pipes. These I was desirous of utilizing, while making the gas exclusively in the new works, at least during a great portion of the year. For this purpose I connected one of the outlet-pipes at the old works, in front of the outlet-valve, with the inlet to the exhaustor. In this way the old works draw off by means of the network of mains, the gas made during the day by the new, store it in the holders, and send it out in the evening through the large outlet-pipes. I can thus draw off 150 cubic metres (about 5000 cubic feet) per hour without any inconvenience. I do not increase the leakage, as the suction of the exhaustor is so regulated that the pressure on the mains is unaltered. There is, however, a slight oscillation produced by the exhaustor, which is on Beale's system; but that is of no importance for day consumption, and moreover could be entirely suppressed by using one of Schiele's or Körting's exhaustors, the action of which is much more regular, or by interposing a governor between the main and the exhaustor. But I repeat, the oscillation is so slight that it is not even necessary to make this addition.

You see, then, that I could have saved myself the trouble of regulating the retort-charges with so much care on the works unprovided with a gasholder, by drawing off, as I now do, the gas produced there, and storing it in the holders on the second works. But we do not always think of everything, and thus an opportunity was afforded me of making an experiment which perhaps may be of some use in exceptional cases.

SAVILLE'S PATENT GAS SCRUBBER-WASHER.



ELEVATION.



PLAN.

The simplicity and efficiency of apparatus employed for the purification of gas is a paramount problem in its manufacture. Every manager of a gas-work, especially in the "full make" season, when all his apparatus is taxed up to its greatest capacity, is as anxious for the quality as he is for the quantity of the gas produced, being fully aware that public observation and the "inspector's report" deal mainly with the former of these considerations. It is comparatively easy to increase the quantity when a brisk demand occurs, such as is usually experienced in mid-winter, by "driving" the retorts; but in proportion as this is done, the whole purifying plant (especially where lime or oxide is the only means of purification employed), becomes a source of increased anxiety, labour, and cost, and, in most neighbourhoods, a most frequent nuisance. Although lime and oxide have been the prolific means employed for this purpose, it has long been felt that much greater economy may be effected, and much abatement of the nuisance of changing large open boxes charged with "loud odours" may be attained, by the extended use of water, either in washers where the gas is caused to pass through water, or in scrubbers where a large area of damp surface is obtained by the mechanical distribution of a minimum quantity of water, so that the gas, passing over such surface, may precipitate more or less of its impurities.

At the meeting of the British Association of Gas Managers, held in the rooms of the Society of Arts last June, the President (Robert Morton, Esq.), in delivering his Inaugural Address, made the following remarks in reference to "New Inventions":—"Of these there have been about the usual number relating to the manufacture, purification, measuring, carburetting, regulating, distributing, testing, and burning of gas, and I think fully the ordinary proportion will not get further than the 'provisional protection' stage.

"There are, however, some which are really valuable; time will only permit of my mentioning one or two. A 'Washer,' by Mr. G. E. Saville, of Sowerby Bridge, a diagram of which is exhibited on the wall, and by which the gas is brought into very intimate contact with the water, and that without much increase of pressure. A vessel, 8 feet square, with the working part only 20 inches high, gives 1600 lineal feet of dip, 830 superficial feet of wetted surface, and 250 square feet of water area, throwing about $1\frac{1}{2}$ -inch pressure. I am told that gas free from ammonia, and containing comparatively little CO_2 , is obtained by its use, while the water used escapes as very strong liquor, 20-ounce to 30-ounce."

At the same meeting, Mr. Charles Hunt, of Birmingham, read a paper on "Washers or Scrubbers," in which the following statement appears:—"So far as I am aware, washers have not, hitherto, been employed to any extent for the final process of removing the last traces of ammonia, although there seems to be no reason why they should not, and a few weeks ago I had an opportunity of inspecting a new form of washer, designed by Mr. Saville, of Sowerby Bridge, alluded to by the President in his opening address, which has proved efficient for this purpose."

The results of analyses give a high duty, although taken from the first of Mr. Saville's washers, fitted with wooden troughs for experimental purposes, passing half a million feet per day.

The above illustration is a scale representation of a washer 16 feet by 8 feet by only 4 feet high, capable of washing 3 million cubic feet per day. We are informed that the makers are now erecting one at the Corporation Gas-Works at Birmingham, and another at the Phoenix Gas-Works, Vauxhall, London, of the above capacity. Mr. Saville has arranged with the large and eminent firm of Messrs. Tange Brothers and Holman for the manufacture and development of his invention, and we find, by a circular issued by the firm, that patents have been secured in Great Britain, France, Belgium, Prussia, Austria, and the United States.

The mechanical arrangement is thus described:—The washer tank con-

tains a large bottom chamber, into which the gas is freely admitted through an ordinary full-way inlet-pipe, passing first under an inverted vessel, to remove any tar remaining in the gas after leaving the condenser; it then rises slowly over the whole surface, containing an area of openings equal to about eight times that of the inlet-pipe, through equidistant spaces and through a series of slightly self-sealing water troughs arranged in tiers, thus dividing itself into 960 streams of gas, each of which is passed through cleaner liquor at each tier as it rises, until it ultimately issues through nearly clean water into the large upper chamber, and from thence through the outlet main-pipe.

The washing liquid, being *clean water*, enters into the tank through the syphon inlets on the top, each having a regulating-cock to equalize the supply to each square of troughs, and these are controlled by one main cock, so that the quantity of water admitted may be exactly proportioned to the quantity of gas to be cleansed and the strength of ammoniacal liquor desired. The thorough cleansing of the gas is thus effected by simple water gravitation, and dispenses with all machinery for distributing the water or repumping the liquor, the latter being brought up to any required strength by once passing through.

It will be observed that in this admirable "scrubber-washer" the gas comes first in contact with the "*strongest liquor*" at the bottom, and is all washed six times over in one vessel, passing through weaker and cleaner liquor at each successive tier as it rises, until it issues through nearly "*clean water*" into the upper chambers. Moreover, the same gas never touches liquor of the same strength more than once, and as it issues through the last tier of troughs it meets constantly in-running streams of clean water. Thus, the true principle of the automatic purification of gas by a very simple process of *washing* appears to be very effectually and economically wrought out.

STOKE, FENTON, AND LONGTON GAS COMPANY.—The annual general meeting of the shareholders was held on Thursday last, Mr. C. M. Campbell, M.P., chairman of the board of directors, presiding. Mr. M'Millan, the secretary, presented a satisfactory report. Very extensive and important alterations have been effected in connexion with the plant, and in development of the works. Many new mains have been laid down, and an order had been given for the mains for laying on gas to Basford. The report was adopted, the usual dividend of 10 per cent. declared, and the routine business transacted.

DARLINGTON CORPORATION GAS SUPPLY.—At the annual meeting of the Darlington Town Council, on Thursday last, an animated discussion, introduced by the Mayor (Mr. Plews), took place with reference to the deficiency of street lighting, and the general lack of illuminating power about the gas. The Mayor said that the gas was not equal to that of other towns, and parties had told him that they had done away with it and used lamps and candles, a remark which Mr. Morrell confirmed in his own case. It was stated that the burners had been reduced in size for the street lamps. Mr. Foggitt said that the engineer had stated that there was a sufficient quantity of light throughout the town, and that the public lamps burned 5 feet of gas per hour. Mr. Pease thought it was rather a sharp trick if the burners had been reduced in size. Two or three gentlemen favoured the engagement of a public analyst to report upon the quality of the gas. Alderman H. Pease confirmed the testimony given as to the deficiency of the light from the public lamps. He hoped that any defect in the quality of the gas was not, as had been said, owing to a deficiency in or a smaller supply of cannel coal. The subject was referred to the Gas and Lighting Committee. The report of the gas manager was read, showing an increase in the consumption of gas last year of 1,725,600 feet.

ENTERTAINMENT TO EMPLOYEES AND THEIR FAMILIES AT THE CORNWALL WORKS, SOHO, BIRMINGHAM.

The rapid rise and growth of the great engineering establishment known as the Cornwall Works, and their continued prosperity during a period of national depression, are due, perhaps, quite as much to the broad and enlightened policy of Messrs. Tangye Brothers in regard to their workpeople as to their commercial enterprise, and the application to the trade of the most approved appliances and machinery. The conduct of extensive works like these—where nearly 1500 hands are employed—requires tact and judgment of no ordinary kind; and the fact that since the establishment of the firm 18 years ago, there has been no breach in the cordial relations subsisting between the firm and their men is an incontestable proof of the prudence and foresight of the employers. Messrs. Tangye are both advocates of temperance, and are themselves total abstainers; but while they endeavour, by the force of example, to encourage temperate habits among their artisans, they do not resort to coercion. The results are, therefore, the most permanent, and strict sobriety is the rule among their numerous employes. Understanding the importance of education, and particularly of technical education, to men employed in a skilled industry, the firm years ago commenced a night school at their works, in which not only rudimentary instruction was imparted, but in process of time the pupils were taught machine construction and drawing, mathematics, &c. As an incentive to the men towards punctuality and industry, the firm have recently decided upon awarding silver medals to those who have complied with these requirements, and have been in their employ 15 years. Already six of the hands have obtained these emblems of meritorious services, which cannot fail to be useful to them in after-life—helping them, in fact, to acquire better situations. The principle on which Messrs. Tangye have acted in this respect has been that, inasmuch as soldiers are rewarded with medals for services in warlike occupations, they thought there was even greater reason that men employed in peaceful avocations should receive similar decorations. Further, the firm have received medals from various industrial exhibitions of the world, which they highly value, and deem that their workpeople would equally treasure like tokens of appreciation. Five more medals were presented at the annual tea party given by the firm to their workmen and their wives and children on the 27th ult. Between 3000 and 4000 persons are entertained every year in this convivial manner by Messrs. Tangye, who personally enter into the proceedings with a great amount of interest. The large dining-room, in which the festive gathering was held, was handsomely decorated, and several Christmas trees were displayed, bearing an ample supply of toys and sweetmeats for distribution among the children. A striking illustration of the manner in which Messrs. Tangye retain their employes is shown in the circumstance, that of the 25 men who were in their service in 1858, no fewer than 20 are still remaining, and the aggregate number of years service rendered by the six who had previously secured medals was 105 years. In the course of an address to his workpeople last week, Mr. Richard Tangye, who has only recently returned from a tour round the world for the restoration of his health, remarked that it was a source of great satisfaction to himself and brother to be able to meet their operatives in that free and unconstrained manner, and to express their cordial interest in their individual and collective welfare. The conduct of so large a business as was carried on at those works was in itself sufficiently arduous, and full of care and anxiety, but if to these were added—what was customary among other firms—difficulties and misunderstandings with their workpeople, their task would be almost impossible. Fortunately they had always been free from such difficulties. It was the bounden duty of employer and employed to do all in their power to make their mutual relations as comfortable as possible. He was sometimes asked by manufacturers, how it was that the firm of Tangye Brothers managed to get on so well with their men, and his reply was in the words of a Quaker, that had been impressed on his mind at the time when they started business—"If you want to know how to manage your men, study human nature." Human nature was the same in the master as in the man, and what it demanded was, that a man should be treated as a man, fairly, honestly, and squarely. If a master could only succeed in convincing those with whom he had to do that such was his desire, he would have very little difficulty in dealing with them. Mr. Tangye then referred to the attempt now being made in the engineering and other trades to restore the ten hours system of working. Some of the masters attributed the present depression in trade to the introduction of the nine hours system. Two years ago, it was represented that the firm of Tangye Brothers were about to give their men an entertainment, and take the nine hours from them, but the firm had never contemplated such a contingency. In the iron trade, some of the masters thought a return to the ten hours system would lead to an improved trade, but he had never hesitated on the question of giving the nine hours; and since it had been adopted at the Cornwall Works, it had been an unqualified success, and had not failed in a single particular. The firm, instead of losing thereby, had gained pecuniarily, and they felt they had also gained the respect and good-will of their operatives, which in itself was a source of great gratification. They had given the nine hours voluntarily, having led the way in that direction, and consequently they had no old scores to rub off after they got into good working order under the new system. As was well known, the contrary was the experience of the majority of other masters. They wanted to have the concession forced upon them, which accounted in a great measure for their want of success. If he were allowed to give a word of advice, he should say the sooner they forgot old scores and set about doing the best they could under the new system, which they would never be able to reverse, the better it would be for all concerned, for he was convinced that to reverse the nine hours arrangement would be as difficult a task as that of Mrs. Partington sweeping back the Atlantic. He would not return to the old system under any consideration, and at the present moment—when 19 engineers out of 20 throughout the country were shorter of work than they had been for 20 years—the engineers in the employ of that firm had never been more fully occupied, and never had a slack day. The firm had always employed its full complement of men. From the system adopted there, when the firm made suggestions in the method of working in order to reduce cost, they were not met with suspicion, because the men knew that they did not wish them to earn less, but that they wished to show them how to cheapen production, and so enable them to offer their goods at such rates as would satisfy customers, and thus keep the men fully employed. The remarks of Mr. Tangye were frequently applauded.

At the conclusion of the address, Mr. J. HUGHES, the oldest man in the employ of the firm, proposed a vote of thanks to Messrs. Tangye Brothers for their kindness and hospitality.

The proposition was seconded by Mr. TEAGUE, second oldest hand, and carried amidst tremendous cheering and musical honours.

Mr. TANGYE acknowledged the compliment, and then proceeded to distribute the medals for punctuality and good service, and the evening was spent in a most agreeable manner.

On the following day the remainder of the workpeople were entertained at tea—Mr. G. TANGYE presiding—and addresses were delivered by the CHAIRMAN, by Mr. S. HOLMAN, and Dr. LANGFORD. Refreshments were again provided, and the children received their presents, and a miscellaneous entertainment was given. Nearly 4000 persons were entertained on the

two days. The arrangements were made and carried out in an admirable way by the committee, and considering the onerous duties devolving upon them, those gentlemen did themselves great credit, and contributed largely to the success of the festival.

A vote of thanks was passed on Wednesday night to the principals in the office, and also the committee of management. On each occasion the proceedings terminated with dancing.

HYDRANTS IN THE CITY OF LONDON.

During the past year the Gas and Water Committee of the Corporation have done much to advance the provision of hydrants at high pressure in the City for extinction of fires and street cleansing, and as the very possibility of any successful action has been denied in many quarters, and doubted everywhere, a short review of what has taken place is not without interest. In their report of July 30, 1874, the committee set forth the great importance of hydrants supplied with water at high pressure for immediate use in case of fire, and they showed so clearly that it was possible to establish these at a cost which, though considerable in amount, was small in comparison with the public good to be done, that the Court of Common Council at once adopted their recommendation, and they were instructed to take steps for the laying in of service-pipes at constant high pressure, and the erecting of hydrants in streets about to be repaved, at a first cost of £1000. On April 15, 1875, they presented a further report, recommending 36 streets or places in which the pipes might be laid and 64 hydrants erected. This was approved, and the pipes were laid in accordingly; and the Commissioners of Sewers, recognizing the value of such a water supply for the cleansing of some of the street pavements, agreed to contribute towards the cost of the hydrants to be used by them for that purpose. Again, in April, 1876, the committee presented a further report, seeking to obtain the sanction of the court for a further expenditure of £2800, in utilizing forthwith all the pipes which had been laid in, by obtaining designs for the most improved form of hydrant, and erecting the same without further delay. This report was also adopted, and the committee at once advertised for designs, and having received a number, gave the whole a very careful consideration, assisted by the engineer of the Commissioners of Sewers. Finally they made a selection of four, and, having suggested several further improvements—especially that there should be means to fix the hose to each hydrant, so as to obtain a double effect—a trial was held in presence of the committee on the 29th of November last, which was entirely satisfactory as regards the pressure in the service-pipes and the height to which two jets of water could be thrown simultaneously from the same hydrant. This was found to range from 65 to 75 feet, as the jets were slightly affected by the wind; but the relative merits of the several hydrants have not yet been determined, and are still under consideration, and probably excellence of workmanship and non-liability to get out of order may decide the question, as there is little difference in other respects. It should be mentioned that Mr. S. Morley, M.P., kindly permitted the committee to use for their experiments a vacant plot of ground belonging to him next the Memorial Hall. In a short time we may expect that the hydrant found most suitable in all points will be selected and forthwith fixed in the several places already prepared for the purpose. The trial above named proved that the jets of water (from an inch nozzle) could be thrown to a height sufficient for effective use in the event of a fire; in fact, to much the same height as at Manchester, where Mr. Tozer, the superintendent of the Fire Brigade, states that since the use of hydrants, by means of which the police or any one near can use the hose at once, there has been but one case of total destruction in three years, and that out of 306 fires in one year, in only eight cases was it found necessary to use the engines to assist. In a word, it is the use of water in the first ten minutes which prevents a fire. Let it have 20 to 25 minutes to establish itself, and not all the brigade power in London may be able to do more than to preserve adjoining property, to say nothing of the saving of life. This, however, is not all. The New River Company have for nearly two years had works in progress which are approaching completion, and which will have the effect of adding about 50 feet of pressure to the service over the greater part of the City. In other words it will enable a jet of over 100 feet in height to be thrown from the hydrants, instead of some 75 feet, as at present. But it may be asked—What becomes of the pressure when water is being drawn off the main for the house supply? In the first place it may be observed that this at present occurs at a time in the morning when fires rarely break out, but a careful note having been taken once every quarter of an hour in the 24 hours, it appears that while the pressure at night, or from five p.m. to six a.m., is four to five pounds per square inch greater than it was on the occasion of the experiment of the 29th of November (which took place between twelve a.m. and one p.m.), it is from six a.m. till nine o'clock a.m., when the house supply is being drawn off, never more than two to three pounds per square inch less. In close thoroughfares, like some of those branching from Cheapside, where fire engines can be placed only with difficulty, and where goods to an enormous value are closely stored, it is hardly possible to over-estimate the great public good done by the corporation in this matter, which, like so many other of their public works, is for the most part paid for out of their own private resources and not from rates. There remains, however, another important purpose which hydrants will answer—viz., the street cleansing. Wherever the truth may lie in various arguments urged for and against different kinds of street pavement, there can be no doubt that a perfectly non-absorbent pavement like compressed asphalt admits of being most thoroughly and effectually cleansed by a jet of water sent through a chisel-shaped nozzle, with power enough to cleanse the surface of that film of dust, which becomes occasionally greasy, and is distressing to horses unless sprinkled with sand, which seems rarely at hand when wanted, and thus may enable the authorities to use a pavement of that sort with satisfaction in all respects, and with a great saving of labour and money for cleansing purposes; in addition, it may afford the means of more frequent street-watering in summer, which in Paris is done three times a day, to the great comfort of the public, and at the same time no doubt preserving the asphalt from the effects of heat, where exposed to the sun's rays.—*City Press*.

BRADFORD CORPORATION WATER SUPPLY.—At the meeting of the Town Council of Bradford this day, the Water-Works Committee of the Corporation will recommend that the salary of Mr. A. R. Binnie, M. Inst. C.E., F.G.S., be raised from £400 to £1000. The intended recommendation is exciting much opposition in the borough.

ALCESTER WATER SUPPLY.—The success of the Abyssinian well is now an established fact. The boring has proceeded to a depth of 60 feet, but no water was found after a depth of six feet till a thin stratum of gypsum was reached at the above depth, when the water rose within one foot of the surface, being also one foot above the level of the roadway and four feet above the level of the wells. Upon the pump being applied on Wednesday the spring was giving 3½ gallons per minute, which increased to 41 on Thursday, equal to a flow of 270 gallons per hour. It is, however, thought desirable to go a few feet deeper, as it is expected more gypsum will be found immediately underneath the strata already pierced, which will give a much greater supply.—*Birmingham Gazette*.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The general aspect of affairs in the iron trade of the town has not greatly altered since my last communication was penned; but it appears almost certain that matters have taken a turn for the better in many branches, and are more promising than they were in the autumn. The new year has hardly advanced far enough for any very decided improvement to have been effected, yet there are, in several quarters, preparations for an increased output, both of pig and manufactured iron. The blast-furnace owners are getting a few additional furnaces ready for relighting, the present firmness of the pig-iron market leading them to believe that there will be an increased demand for pig in the course of a month or six weeks. In North Lincolnshire, too, a similar state of things prevails, two, at least, of the furnaces there having been relighted, in addition to the fourteen or fifteen which were in blast when the year came in.

Pig iron quotations are steady all round, at the figures quoted in these notes last week, the foundry brands being especially well upheld, owing to the renewed activity of several of these establishments. There is not only a more cheerful inquiry for pipes and colliery castings, but a much more considerable call for all sorts of machine castings and stove-grate work. A firm producing the last-named goods has just secured an order for 4000 sets, and other houses are nearly as well off.

At the brass-works there is no especially noteworthy change, all the chief makers of water and gas fittings having a fair supply of orders on hand and in course of execution.

The coal market still runs in a very quiet groove, there being a good deal of difficulty in obtaining the current prices of the day. The Sheffield Coal Company, Limited, have just issued a new list, which runs as under:—Picked brands, 13s. 6d.; best Birley Silkestone, 10s.; ditto picked cubes for the London market, 10s. 6d.; screened Silkestone nuts, 6s. 6d.; screened seconds, 6s. 6d.; coke breeze, 10s.; hard melting coke (washed) and slack (unscreened), 3s. per ton of 21 cwt., at the pit mouth near Sheffield.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Business, which is only just being resumed after the New Year's holidays, continues very quiet both in the coal and iron trades of this district, and so far as the general position of the market is concerned, there is but little change to notice, either as regards prices or demand.

Although stocks are not going down in the better classes of round coal, there is no push for supplies, the mildness of the weather still keeping back the demand for house fire purposes. For gas-making coals one or two inquiries continue to turn up in the market, but there is no special feature to notice with regard to this branch of trade, the bulk of the coal now sent away being to cover contracts. Common coal hangs in the market, and the common classes of burgy and slack continue a complete drug. Pit prices generally remain the same as those ruling last month, but there is a tendency towards weakness in the inferior descriptions of fuel, and to effect sales of common burgy and slack very low rates are in some cases accepted. The average pit prices in the Wigan district remain about as under:—Best Arley, 11s. to 12s. per ton; Pemberton four-feet, 9s. to 9s. 6d.; common round coal, 7s. 6d. to 8s. 6d.; common steam coal, 7s. to 7s. 6d.; burgy, 5s. to 5s. 9d.; and ordinary slack, 3s. to 4s. per ton.

The shipping trade is not opening very favourably this month. During December a fair quantity of coal was shipped abroad; but at present there is not much prospect of any considerable foreign shipments for January, whilst the coasting trade is in a very stagnant condition.

In the iron trade buyers are generally holding back until after the quarterly meetings, and there is very little going on in the market. With the exception of a few holders of Cleveland iron, who appear anxious to put their stocks upon the market, prices are maintained, makers, as a rule, being firm at late quotations; the local smelters having sufficient orders on hand to keep the few furnaces at present in blast going for the next couple of months. Lancashire pig iron, delivered into the Manchester district, is still quoted at from 57s. to 58s. per ton for No. 3 foundry, and 55s. to 56s. per ton for No. 4 forge. The finished iron trade continues steady, local forge proprietors, as a rule, being tolerably well supplied with orders, and for Lancashire bars, delivered into the Manchester district, £6 17s. 6d. to £7 per ton is asked.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

Last week, as the week before, the coal trade of the Tyne and Wear partook very much of a holiday character, and very little business was done. Most of the larger contracts for gas coals have been arranged for next year. Last week, notwithstanding the stoppage of steamers was greater than ever by tempestuous weather, the shipments of gas coals by them from the Tyne Dock were a good average. Most of the steamers which had been detained in the Tyne from Monday got to sea on Friday, and by the time this column is printed, it is every way possible there will be another large delivery of sea-borne coal in London river. It is astonishing how the steamers have overcome difficulties in connexion with the navigation between the Tyne and London during the past three weeks. And it says much for the perseverance and determination of the men who navigate them, that they have carried such a vast deal of property through some of the worst weather we have experienced for years with so small a loss. Second-class gas coals remain pretty much where they have been for the past three months, and that is not a very strong position. Household coals are about 6d. per ton lower, with a very poor demand. Steam coals are not much inquired after, and the pits, as a rule, are working short time.

There is an abundance of tonnage in the coal ports, and very few coasting orders. Small sailing vessels are in little demand. Steamers are paid from 4s. 6d. to 5s. per ton to take coals to London, Havre 6s. per ton, Hamburg £7 10s. per keel. The demand for gas coal for the Mediterranean is well sustained, and higher rates are paid for steamers to load thence.

The iron trade of the North of England is about, off and on, what it has been for a fortnight. If anything, it is creeping up a little. In anticipation of a war in the East in spring, a large speculative business is being done by shipowners in new iron steamers. The shipbuilding yards of the Tyne, the Wear, the Tees, and Hartlepool have suddenly emerged from a condition of extreme depression to considerable activity. Most of the steamers built are of large tonnage.

At present manufacturers are busy stock-taking, and making up their books for the past year. Under these circumstances, therefore, very little new trade will be entered upon until the end of January. But there is no doubt the position of affairs in the East continues as a very disturbing influence on trade. It has introduced a large element of uncertainty into it, and if the armistice continues until March, with no definite idea as to the result at its termination, business will go on after a hand-to-mouth fashion well into the spring.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The directors of the Blairgowrie Gas Company have intimated a reduction in the price of gas, from 7s. 6d. to 6s. 8d. per 1000 cubic feet.

At the usual monthly meeting of the Town Council of Aberdeen, held last Thursday, the Gas Committee reported that they had received various tenders for supplying four dry lime purifiers and additions to the scrubbers at the Corporation Gas-Works, as sanctioned at the December meeting of the council, and that they had accepted the following, which were the lowest, namely—For the purifiers, Messrs. James Garvie, jun., and Co., £869; for the scrubbers, Messrs. Blaikie Brothers, £199 10s. Bailie Donald, the convener of the Gas Committee, in supporting the approval of the minutes, gave notice of a motion that it be remitted to the Gas Committee to look at the salary paid to the present manager, Mr. Smith, with a view to making some advance. The matter was eventually remitted to the committee for consideration and report.

A very remarkable, and at the same time interesting, illustration of the recent rapid growth of business in Paisley was furnished at a late meeting of the Corporation Gas Committee, at which plans for increasing the production and storage capacity of the works were discussed. The consumption of gas 30 years ago, when the bargain between the gas company and the corporation was arranged, was 48 million cubic feet per annum. In 1866—20 years afterwards—it was 62 million cubic feet per annum; while last year—after the lapse of another decade—it was no less than 134 million cubic feet. No more conclusive proof of the growing prosperity of the town could be adduced.

Several matters connected with the corporation gas supply came up for consideration at the monthly meeting of the Town Council of Glasgow, held last Thursday. With reference to the carrying out of gas contracts, it was resolved—"That nothing contained in the Standing Orders enacted by the magistrates and council on Feb. 23, 1857, shall prevent the committee on gas supply from purchasing articles which they consider necessary for the proper carrying on of the gas undertaking, or from entering into contracts for coal, or other commodities required for that purpose, without having previously obtained the sanction of the Town Council." Mr. John Taylor, jun., who proposed the resolution, remarked that the Standing Orders had served the Town Council tolerably well, but since they became gas managers the ninth one, which restricted the expenditure to £50 daily, was infringed every day, for he might state that the operations of the Gas Committee involved a revenue of £364,000 per annum, so that to limit the power of spending to £50 a day was quite ridiculous. In connexion with the Gas Committee's minutes, Mr. Finlay remarked that it was some time since the council remitted to the committee of the Improvement Trust, and the committee of the Gas Trust to do something with the old gas-works at Townhead, which had now remained idle for three years. The committees had not been able to come to any determination as to what was to be done with the property. He thought the council should issue some instructions, which the Gas Trust might feel it in their power to obey. A long discussion ensued, in the course of which it was strongly urged that the Improvement Trust should secure the property, the value of which was set down at £25,000. It is thought probable that the Gas Committee will be able to secure that amount for it. The Gas Committee's minutes showed that the question of discontinuing the Partick Gas-Works had been under consideration, and that the sub-committee on works had agreed to delay making any recommendation in regard thereto in the meantime. The salary of Mr. Davidson, manager of the Dawsholm Station, has been increased to £900 per annum, as from the 11th of July last; and on the recommendation of Mr. Foulis, the general manager, it was agreed last month to get 50 of Giroud's rheometers to be tested in the street-lamps in lieu of the regulators which are at present in use.

On Friday week, the ninth annual festival of the *employés* of the Gas Commission took place, on which occasion Mr. McCrae, the manager, delivered an interesting address as chairman of the meeting. He said that there were in all 230 people connected with the works, and that the firemen had only to work 56 hours per week. Every 24 hours they used 140 tons of coal, producing 1,600,000 cubic feet, or 27 tons of gas, the balance being tar, naphtha, ammonia, coke, ashes, &c. The gas was sent through upwards of 120 miles of pipes, and what was at the moment being made by the workmen would be consumed in the place of meeting in about fifteen minutes. They had 29,000 meters at work, measuring the 27 tons of gas, a process which went on every moment of the night. In a few minutes more than an hour nearly 4000 public lamps were lighted, and they were extinguished in about the same length of time. Above 300,000 visits were paid every year to the consumers by the officials of the Gas Commissioners, which was about 1000 visits per day. Mr. McCrae also referred to the complaints made to the officials and to the commissioners. At a meeting of the Gas Commissioners last Wednesday, a letter was read complaining of the quality of the gas. It was stated that the gas was not only bad, but the consumption had increased enormously. Mr. McCrae, the manager, stated that in an immense number of cases the fittings in the houses were inadequate, and no system of regulation would be sufficient to give good gas or prevent an extreme consumption. The only way to prevent complaint was to make a radical change in the character of the fittings. The matter was left over for further consideration. With reference to this matter, the leading local newspaper (the editor of which is "well up" in gas affairs) suggests that the Gas Commissioners should reduce the illuminating power of the gas at a given date, so as to see whether or not 14-candle gas affords more light than that of 28-candle illuminating power. The writer shows, by reference to his own accounts, for nine months in 1875 and in 1876, that, by dint of proper management of the burners and the pressure, his consumption of gas has diminished, even though the number of burners has been increased.

At a meeting of the Dundee Water Commissioners, held last Thursday, Provost Robertson laid upon the table the revised account of Mr. Easton Gibb, the contractor for the Clatto Reservoir. It appeared that the contract price was £23,000; but, in addition, a bridge had to be erected, at a cost of £174. The total extras which had to be paid amounted to £970. For the Lintrathen and Clatto Reservoirs Mr. Gibb had done work to the amount of £59,000, and the extras on the whole of that scarcely came to 5 per cent. The commissioners expressed themselves highly satisfied with the excellent character of the work, and that the contract prices had been so little exceeded.

On Friday last the ceremony of cutting the first sod in connexion with the long-contemplated water-works for Galashiels took place. The total cost of the works, parliamentary expenses, &c., is set down at about £40,000, and there is to be a supply of 30 gallons per head for a population of 25,000. It is expected that the works will be finished in the course of another year.

The Inverness Police Commissioners have just resolved on applying to the Public Works Loan Commissioners for the loan of a sum of £6000, the balance of £41,000, which had been voted for completing the new water-works.

In the early part of last week the price of pig iron in the Glasgow market declined somewhat. By the end of the week, however, prices

recovered to the extent of 4d. per ton, and 1d. per ton over the closing price on the 22th ultimo. The closing price was 57s. 10d. cash.

Orders for coal are very scarce, both for shipping and for local trade, but a hope is entertained that the demand will soon increase. For the present quotations are a shade weaker.

REDUCTION IN THE PRICE OF GAS.—The price of gas at Frome has been reduced, from the 1st inst., to 3s. 9d. per 1000 feet, with discounts to large consumers.

RICHMOND (SURREY) NEW WATER SUPPLY.—The *Surrey Comet* of Saturday states that some of the residents are already receiving the water provided by the vestry, and satisfaction has been expressed at the excellent supply. Others will be supplied as soon as the necessary connexions can be made.

EXPLOSION OF GAS AT KINGSLAND.—At about a quarter to seven on Thursday evening last, an escape of gas caused an explosion, which set fire to the residence of Mr. H. Osborn, bonnet-shape maker, 69, Kingsland Road. The skylights of the workroom in which the explosion occurred were blown out, but the fire was extinguished, owing to the prompt arrival of the engines, before any very serious harm had been done.

ABERDARE LOCAL BOARD PIPE-LAYING.—Some time since a contract was taken by Messrs. S. Chandler and Sons, of Newington Causeway, London, for about 15,000 yards of pipe-laying, which was to be completed in three months. This was done, and not only so, but done efficiently, and since the time of maintenance has expired, the cost for repairs to roads and joints, during the six months has only amounted to £1 14s. 5d.

QUALITY OF THE NEWCASTLE-ON-TYNE GAS.—Mr. John Pattinson reports the following as the results of his examination for the past week of the quality of the gas supplied to this borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Date—1877.	Illuminating Power in Sperm Candles.	Grains of Sulphur in 100 Cubic Feet of Gas.	Sulphuretted Hydrogen.
Jan. 2	14.1	6.56	Nil.
5	14.2	6.91	Nil.

According to Act of Parliament the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas.

EXPLOSION OF GAS AT ARUNDEL.—An alarming explosion of gas occurred here a few days ago. A girl in the service of Mr. W. Atfield, of Causeway Villas, Arundel, was in the act of entering the front sitting-room with a lighted candle, at a quarter to seven, when a fearful explosion occurred. Two railway porters, who happened to be passing, rushed into the house, and found several articles on fire, and the girl screaming loudly. They immediately put out the fire, and removed her to a cottage close by, where she was attended by Dr. Hubbert and Mr. C. L. Evershed. It was found that she was suffering from severe burns and general shock to the system, and she is at present in a very precarious condition. The kitchen, drawing-room, sitting-room, and dairy were completely wrecked, the furniture being blown about, and burned, in all directions. The report was heard at a distance of quite two miles. The total damage done is estimated at £300.

GAS EXPLOSION AT ST. HELEN'S.—On Thursday evening, an explosion of gas occurred in the house of Mr. Joseph Beasley, St. Peter Street, St. Helen's. During the evening the inmates of the house smelt a strong escape of gas, and about seven o'clock a son of Mr. Beasley, about 15 years of age, went into the parlour to ascertain the cause, taking with him a lighted candle. He had no sooner entered the room than a violent explosion took place, the lad being thrown down with great force, and severely burned about the face and hands, his clothes being also literally singed off him. The window was blown out, as was also that of a bed-room above, the gas at the same time making its way into the lobby with such force as to blow the street door out, throwing it to the other side of the street, and smashing it into splinters.

PROPOSED PURCHASE OF THE DROITWICH GAS-WORKS.—At the meeting of the Droitwich Town Council on the 1st inst., a report was read from the Watch and Lighting Committee, stating that they had received a deputation from the gas company, and again discussed with them the terms offered by the company for the sale to the corporation of the gas-works, and that they had, subject to the approbation of the council, agreed to purchase the same at the sum of £3675, such amount to include all stock, materials, and property of every kind belonging to the company, except the gas, coal, unused lime, and new gas-fittings, which it was agreed should be taken to at invoice cost price; the purchase, if no financial difficulty intervened, to be completed at Midsummer next. After considerable discussion the report was unanimously adopted, and steps were ordered to be taken to carry out the sale and purchase.

WATER SUPPLY OF MEXBOROUGH.—The local board having, in accordance with their former resolution, advertised for tenders for carrying out the water supply of the town by a private company, it was stated, at their meeting, on the 4th inst., that ten engineers had sent in applications. Mr. Brundell, C.E., attended the board, and explained the particulars of a scheme which he prepared in 1874, based upon a supply of water near Manvers main, known as "Shrogg's scheme," at an estimated cost of £10,858. He proposed to give a supply for double the present population, and all the material to be of the very best and most durable kind. There would be a pumping-station and well, also an engine of 24-horse power, capable of supplying 200,000 gallons in 12 hours. He had also estimated for an engine-house and boiler-house; also an additional engine and boiler house for contingencies. There were also two service reservoirs (covered), one to hold a two and a half and the other a two days supply. Mr. Tomlinson, C.E., also appeared before the board, and offered to form a company to carry out the water scheme for £6000; to find the necessary capital; and to enter into a legal agreement with the board for the purchase, at any time (by the board) of all the various works, at a premium of 10 per cent. on the outlay.

TREATMENT OF SEWAGE AT SALFORD.—At a meeting of the Salford Town Council on Wednesday last, a report was submitted by a committee to the effect, that they had visited the sewage-works at Leeds, Bradford, Birmingham, Coventry, and Edmonton, for the purpose of obtaining the fullest information on the subject of the treatment of town sewage. The report having given an account of the various systems adopted at the different towns visited, concludes as follows:—"The committee have given the above processes their most careful consideration. They are of opinion, and beg to recommend to the council, that the contemplated works for the borough of Salford should be constructed on the principle of precipitation, and that the borough engineer should be instructed to prepare the necessary plans and drawings as soon as possible accordingly. Inasmuch as any chemical process for the precipitation of sewage can be applied to works constructed on this principle, the committee do not at present make any recommendation to the council as to the selection of any particular mode of treatment. They consider it advisable to wait until the intended works are approaching completion, in order that they may have

the latest scientific information to guide them in the selection of a process for the approval of the council." On the motion of the chairman of the committee, it was resolved that the recommendation contained in the report be adopted, and that the borough engineer be instructed, under the direction of the Building Committee, to prepare plans for the treatment of the sewage of the borough on the principle of precipitation.

HULL WATER-WORKS.—At the meeting of the Water-Works Committee of the borough of Hull, on the 1st inst., the engineer (Mr. Maxwell) reported that the total water pumped at Stoneferry during the previous fortnight was 71,106,427 gallons; average daily supply, 5,079,030 gallons. Coal consumed, 96 tons 6 cwt.; ditto per million gallons, 27 cwt.; cost of ditto, 14s. 8d. The Springhead wells were just beginning to receive the influx of the autumn rains. The rainfall this season had been so abundant that there was no fear of scarcity in the springs during the ensuing summer. The contractor had completed the second new bore, having pierced through the chalk into impermeable blue clay, at a depth of 404 feet. He was now making the connexion between the bore and adit. The engine contractor had drawn out and replaced the second set of lift-pump valves, and the engine was again at work. Mr. Maxwell recommended that the new engine-house should be boarded round to a height of 7 feet 6 inches above the floor, and the upper portion of the walls painted instead of plastered. He also presented the following summary of the quantity of water supplied to the town, and the cost of coal and labour for the last five years:—Water supplied: Average of years 1872-3-4, 1660 million gallons; in 1875, 1659 million gallons; in 1876, 1815 million gallons. Coals consumed at Stoneferry: Average of 1872-3-4, 3005 tons, costing £3274, or 39s. 2d. per million gallons; ditto, in 1875, 2167 tons, costing £1760, or 21s. 3d. per million gallons; ditto in 1876, 2356 tons, costing £1426, or 15s. 9d. per million gallons. Coals consumed at Springhead: Average of 1872-3-4, 2479 tons, costing £2819, or 34s. per million gallons; ditto in 1875, 2749 tons, costing £2197, or 26s. 6d. per million gallons; ditto in 1876, 2855 tons, costing £1732, or 19s. 1d. per million gallons. Wages at Stoneferry and Springhead, and of turncocks and pipe-layers, as per weekly pay-sheets: Average of 1872-3-4, £4272 0s. 5d., or £2 11s. 5½d. per million gallons; ditto in 1875, £3483 13s. 6d., or £2 2s. per million gallons; ditto in 1876, £3208 10d., or £1 15s. 3d. per million gallons. The total cost of coal and labour per million gallons supplied: Average of 1872-3-4, £6 4s. 7½d.; ditto in 1875, £4 9s. 9d.; ditto in 1876, £3 10s. 1d. The engineer's report was adopted, and it was ordered that tenders should be advertised for the work required to be done in the new engine-house.

PETROLEUM TRADE IN 1876.—The fluctuations during the past year have been unusually rapid and severe, prices ranging from 9½d. to 2s. 5½d. per gallon, and the excitement occasionally witnessed in our market has been hitherto unknown. Our principal supply has, as usual, been drawn from the United States, but during the year about 17,000 barrels have been imported from Canada, which met with a ready sale as a second-class oil, in the place of coal oil, which has been practically unavailable during the last few months. Some of this oil was of very fine quality, and could with difficulty be distinguished from Pennsylvanian. Should prices keep near their present level, we are led to believe that a continued supply may be looked for. The total shipments from America, including about 40,000 barrels of Canadian oil, to all parts of the world, were 236,751,446 gallons, against 221,710,049 in 1875, and 222,869,010 in 1874. This is the largest quantity ever shipped from the States in one year, and the increase is accounted for by large shipments to Japan and other Eastern markets. During the year the stock of crude oil in America has been very much reduced, and stands now at about 3 million barrels. On the other hand, although the number of wells is larger, the total daily production has not greatly increased. It stands now at about 26,000 barrels per day, against 25,000 barrels in 1875. Petroleum spirit continues to make its way with the public, and is in some districts a formidable competitor to petroleum oil. The total deliveries for the year are 61,875 barrels, against 57,569 barrels in 1875. Prices have fluctuated considerably, from 7½d. in May, to 1s. 5d., which is the present price. As far as London is concerned, the demand for common spirit appears to be steadily decreasing, its place being almost entirely taken by English rectified, which is now produced at a trifling cost above the price of common spirit. As to coal oil, the past season has been highly gratifying to the British refiners, but unfortunately for them not many of their works were remaining, and, consequently, they were unable to profit to the extent they could have wished by the late high prices. Our supply of this article has been drawn almost exclusively from Scotland, but although their works were fully occupied their total production was unable to keep pace with our demand, after satisfying their own local trade. This is to be regretted, as some of the oil was of very fine quality, and found a ready sale here at good prices.—Messrs. Mordaunt Bros. *Annual Circular*.

LIVERPOOL WATER SUPPLY.—On the 18th ult. a special meeting of the Corporation Water Committee was held, to hear a statement from Mr. Mather, of the firm of Messrs. Mather and Platt, engineers, Manchester, with reference to the probability of obtaining a water supply from local sources. Mr. Mather said it was stated upon authority of the most reliable kind, that the triassic rocks below and around Liverpool had a depth of at least 1400 feet, and beneath these the permian might be found, overlying the coal measures, perhaps of a thickness of 200 feet. But they might assume, anyhow, that for 1000 feet or 1200 feet there was a clear section of water-bearing rock, consisting of sandstones of various degrees of porosity, separated from each other by thin partings of impervious marl or clay. This vast deposit extended, as Professor Dawkins and other geologists had shown, over an enormous area, with several great depressions tending to separate into basins, but yet having continuity throughout, bounded inland by the older rocks and the coal measures, and having freedom of outlet by gravitation seawards for the water it contained in the districts of Fleetwood, Southport, and Ormskirk. In this area it was obvious there was a vast supply of water at present untouched, which was kept up by the rainfall. It might be assumed that about 800 square miles of surface would contribute to this reservoir by percolation, if it were not to some extent covered by marls and clay. But at least one-third was exposed to the rainfall by being covered with sand, shingle, and drift at the outcrop. Moreover, the rivers flowing over the triassic rocks would contribute largely to this store, where not filled and overflowing with water. Now, if one-third of the rainfall be taken as the possible replenishment of these rocks, should they be drawn upon, they had a quantity of no less than 114,688 million gallons annually, apart from the incalculable store now locked up in this porous strata. In the presence of these figures there was little fear of exhaustion. At present these rocks were saturated, and the surplus water flowed over the surface. It was to this enormous store of water he would direct the attention of the committee. In order to liberate it, he recommended a boring of 1000 feet deep, of large diameter. After passing through some of the impermeable bands of marl or clay, or close sandstone, many of which existed in this formation, he would by mechanical means cut off all connexion between the rocks they had already pierced and those lying below, and the water of the sub-lying sandstone should rise to its normal level in the pipes lining the bore. The pump-barrel should be placed at such a depth as would keep it replenished with the quantity equivalent to

its extracting power, and thus a continual flow of pure water might be secured, untouched by drainage or sea-water, and entirely independent of that which they now used. His belief was that there was a vast source of water in these rocks, which would fill up as quickly as it was drawn upon, and that a quantity, equal to what Liverpool had at present, could be obtained by penetrating those lower rocks, and by putting down a series of bore-holes and pumping arrangements, such as he had described. Questioned by Mr. Forrest as to the time it would take to bore 1000 feet, and complete all the machinery, Mr. Mather said that, if a good price were paid, his firm could complete the work in twelve months, putting down a pump which could lift 8 or 10 million gallons per day. Asked further with regard to the cost, Mr. Mather said that the whole cost for buildings, engines, boilers, erections, travelling-cranes, and everything would be about £13,500. The working expenses would be about the same as that of the present wells.

"CHEMICAL ANALYSIS CONSIDERED IN ITS APPLICATION TO CIVIL AND MECHANICAL ENGINEERING."—At the meeting, on Thursday last, of the members of the Civil and Mechanical Engineers Society, a paper, with the above title, was read by Mr. Bernard Dyer, F.C.S. The writer began by offering some remarks on the close connexion of chemistry with other sciences, drawing attention to the marked and subtle relations between the chemical composition and physical properties of various kinds of matter. The influence of minute proportions of certain foreign substances, such as phosphorus and sulphur, upon the quality of iron and steel, was alluded to under this head, as also were the variations in the electric conductivity of copper wire designed for telegraphic purposes, when certain impurities chanced to be present even in minute traces. The composition and properties of some of the principal alloys of copper, having been briefly referred to, the value of chemical science in studying the nature of furnace action, with a view to the economy both of heat and fuel, was considered, the advantages of systematic chemical analysis of the coal or coke used in most metallurgical operations being also pointed out. The subject of furnaces led to some observations on the nature of fire-clay and other refractory materials, the author showing that while, for all practical purposes, chemical analysis could decide upon the suitability or otherwise of a given clay for use in a high temperature, there was still room for sound chemical research in discovering the best artificial substitutes for natural fire-clay. The subject of water analysis was treated at some length, both as regarded the supply of drinking water and the suitability of various waters for boiler use, some practical remarks being introduced on the occurrence and prevention of boiler incrustations. The distinctions between "hard" and "soft" waters, and the softening of the former under treatment by Clark's process, were described, the author quoting a recent statement by a well-known engineer, to the effect that no less a sum than £50,000 is annually lost to the people of England by the wasteful consumption of soap entailed by the use of hard waters. The London water supply, if treated by Clark's process, would probably deposit upwards of 50 tons of chalk daily. The subject of oils and other lubricants, with reference to their adulteration with drying oils, and the consequent damage to machinery, having been alluded to, the paper was brought to a close with a passing reference to sewage purification, agricultural chemistry as affected by engineering, and gas-matters into which the author regretted that the limits of space and time at his command forbade him to enter further.

Register of New Patents.

264.—JOHNSON, S. H., Stratford, Essex, "*Improvements in the preparation of ferrocyanides from spent oxide of iron.*" Provisional protection only obtained. Dated Jan. 22, 1876.

In the treatment of spent oxide of iron with alkaline earths, which dissolves out the ferrocyanogen as a soluble salt of the base employed, it is usual (the inventor states) to acidify the resulting solution with hydrochloric acid, and then precipitate the Prussian blue by any of the well-known methods, but the product produced in this way is largely contaminated with free sulphur produced by the decomposition of the sulphide of the alkaline earth, formed by the action of the alkaline earth on the free sulphur existing in the spent oxide. In order to avoid this, he proceeds as follows:—The solution resulting from the treatment with the alkaline earth (lime, for example) is submitted to the action of a current of carbonic acid gas, which may be produced and passed through the solution by any of the methods usually employed, but he prefers to burn coke with air in a closed vessel, pumping the air into such vessel, so as that a pipe from the vessel may conduct the products of combustion into the alkaline liquid, or the air-pump may be connected with a flue from any adjoining furnace, and the flue gases after having been passed through the water will answer the purpose, provided that the fuel employed is of a comparatively smokeless character. This treatment decomposes the sulphide of calcium, forming carbonate of lime, which precipitates along with the sulphur. When the point of neutralization has been carefully attained, the liquid is allowed to remain at rest for some time, and then the clear solution of ferrocyanide of calcium free from the sulphide is drawn off into the precipitating vat for the precipitation of the blue in the usual manner.

273.—JOHNSON, J. H., Lincoln's Inn Fields, London, "*Improvements in apparatus for cleansing water from impurities.*" A communication. Patent dated Jan. 24, 1876.

This invention relates to improvements on the apparatus for cleansing water from impurities, described in patent No. 1552, April 29, 1873.

The improvements consist—1. In the addition and application of a tank or vessel constructed by preference of cast or wrought iron, and of a rectangular or circular form, which is placed above the upper tank or vessel, described in the former patent, in the centre or at the side of such tank, or in any other convenient position. 2. In dispensing with the tank placed in the upper tank, as described in the former patent, and in the application of a partition carrying the bearing for the axle or shaft of the bucket-wheel and the overflow-pipe in connexion therewith. 3. In the application of more simple arrangements for taking up the chemical ingredients or solutions, a rotating curved pipe, by preference having two arms or spouts, is employed, which pipe takes up the chemical solution out of a small vessel below. 4. In the employment of holes in the bottom of the lower tank and of outlet-pipes, which are provided each with a stop-cock or plug.

The apparatus operates in the following manner:—The water which is to be purified enters the additional tank through the supply-pipe at or near its bottom, where it becomes intimately mixed with the waste steam entering through the central pipe. The water is thus heated to a very high degree, and, consequently, deposits the carbonate of lime contained in it. The condensed waste steam separates or deposits all greasy substances, the particles of which, by the addition of chemical liquid in the lower tank, form a soap, which falls to the bottom, mixed with the heavy sulphate of barium. The heated water, with the uncondensed steam, passes through the additional overflow-pipe into the larger compartment of the upper tank, whence the water is conducted through the other

channel or overflow-pipe, and falls into the buckets of the water-wheel, acting so as to turn the wheel. From the bottom of this compartment the water, after having worked the wheel, flows by another pipe into the lower tank near one end, and it then passes along this tank in a zig-zag direction, alternately downwards and upwards, on its way to the opposite end, where it is discharged at the upper part. The steam arriving in the upper tank passes through a pipe, which reaches above the level of the water to the end compartment of the tank, and escapes through another pipe into the atmosphere.

281.—BRINJES, J. F., Whitechapel, London, "*Improvements in apparatus for raising, forcing, and exhausting water or other liquids, also air and gases.*" Patent dated Jan. 25, 1876.

This invention consists in the combined use of a cylinder, acting as a piston or plunger, working eccentrically within an outer fixed cylindrical casing of any desired length and diameter, and between two end covers, and having a gyrotory in lieu of a rolling motion therein, as heretofore, with a radial web or partition rigidly secured longitudinally to the outside of the gyrotory cylinder or piston, or cast thereon, and working fluid-tight within a radially disposed chamber, which is formed on and extends the entire length of the outer cylindrical casing, the inlet and outlet orifices being separated by the radial web or partition.

The gyrotory motion is imparted to the inner cylinder or piston by one or more cranks or eccentrics working in the interior of the gyrotory piston, and formed or carried on a revolving shaft concentrically disposed within the outer fixed cylinder, and working in bearings in the end covers, and as the radial web or partition is rigidly secured to the inner cylinder or piston, and is also controlled by the chamber on the outer cylindrical casing, within which it works to and fro, it is obvious that although the inner cylinder or piston will be caused to follow a circular course round the inside of the outer cylindrical casing, it cannot rotate on its own axis or roll over the interior of the outer casing, the nature of the motion of the cylinder or piston and its radial web being in fact precisely analogous to that of an ordinary eccentric strap and rod.

The amount of motion of the gyrotory cylinder or piston will, of course, depend on the length or amount of eccentricity of the actuating cranks or eccentrics, and the difference between the diameters of the inner cylinder or piston and the outer fixed casing.

392.—WEYHE, W., Bremen, "*Improvements in apparatus for raising or forcing fluids.*" Patent dated Feb. 1, 1876.

This invention relates to an apparatus for raising or forcing fluids, wherein a piston receiving both longitudinal and rotary motion in a closed cylinder is so arranged that while it draws fluid into and expels it out of the cylinder, it at the same time effects the alternate opening and closing of the inlet and outlet ports without the use of valves. For this purpose the piston has formed round its periphery an oblique groove, into which fits a roller projecting from a recess in the side of the cylinder. The piston-rod is provided outside the cylinder with a crank or pulley, by which rotary motion is imparted thereto, and as the piston is made to revolve the effect of the roller fitting in the oblique groove will be to cause the piston to move backwards and forwards in the cylinder, so as alternately to draw fluid into and expel it from the cylinder on each side of the piston. The cylinder is provided at some distance from each end with two opposite ports, one for inlet and one for outlet of fluid, and the piston has formed upon it on each side a projection or shield fitting against the side of the cylinder, and extending so much beyond the semicircle that in a certain position it just covers both the inlet port and the outlet port, the two shields being in opposite positions on each side of the piston, and so arranged that they each close their respective ports in one and the same position of the piston—namely, when this is at either end stroke.

Assuming, now, that the piston is at the end of one of its strokes, it will by its continued rotation be made to commence its return stroke, while at the same time its one shield, in revolving with it, will begin to uncover the inlet port on the one side, and the other shield will begin to uncover the outlet port on the other side, and the ports will continue open until the piston has performed half a revolution, and at the same time arrived at the end of its stroke, by which time the shields will have again closed the ports, and will now commence to open the other inlet and outlet ports as the piston begins its next stroke.

When the apparatus is constructed of large dimensions it is preferred to assist the action of the roller and oblique groove in imparting the requisite longitudinal motion to the piston by connecting the piston to the one end of the cylinder by means of a link situated to one side of the axis of the cylinder, so that when the piston is turned from the position in which the link is parallel to the axis into that in which the link must assume an oblique position, the effect will be that the link will draw the piston towards its end of the cylinder, while as by the continued rotation of the piston the link moves from the oblique into the parallel position again, it will push the piston towards the other end of the cylinder.

497.—MASON, C., Southampton Buildings, London, "*Improvements in and relating to valve apparatus for steam-pumps and other purposes.*" Patent dated Feb. 8, 1876.

In these improvements an ordinary D valve, having a bracket or prolongation on its back, works against the three-ported valve face of the cylinder. This valve face has the ports near together, as usual, but has a much longer blank surface beyond the outer side of each steam port than is generally the case. The bracket cast on the back of the valve is securely held by a valve spindle, having a piston at each end working steam-tightly by means of piston rings or other packing in cylindrical or other casings. These casings are freely open to the steam-chest on the inner side nearest the valve, but have no openings into them beyond the piston, except the steam passage. They are firmly fixed to the valve face of the cylinder, the casting joining them usually forming the steam-chest. In the large blank surfaces of the steam-chest, on each side of the ports, two smaller ports are constructed, quite clear of the travel of the main valve. Of these ports, the one nearest the main valve ports is connected with the exhaust, the other with the steam passages opening respectively in the casings behind the pistons. Two small auxiliary valves work against the valve face opposite these two pairs of ports, and are connected together and grasped by the same valve-bracket or spindle. This bracket usually encircles the main valve, passing round each side of it without touching it, and is attached at each end to spindles working in stuffing-boxes in the ordinary manner. Or instead of passing round the main valve, the spindle can pass through a hole or tunnel in the valve made in it for the purpose.

Supposing the valve to be working vertically, the following is the mode of action:—The auxiliary valve-spindle being slowly lowered exposes the steam port of the upper auxiliary valve to the steam, which rushes through the steam passage to the upper side of the upper valve-piston, and depresses it; at the same time, by a precisely similar but opposite process, the steam below the lower valve-piston is admitted to the exhaust. The two pistons in descending move the valve, and thus let steam into the upper port of the engine cylinder, causing the piston to descend. This reverses the motion of the auxiliary spindle, which in its turn reverses the main valve, and thus causes the return stroke, and so on indefinitely.

499.—KÖTTGEN, F. W., Barmen, Prussia, "An improved pumping-engine." Patent dated Feb. 8, 1876.

This invention relates to an arrangement of pumping-engines by which certain important advantages are attained over the constructions at present in use.

The engine is arranged with two cylinders properly supported on beams and columns. Below the cylinders is placed a crank-shaft with a fly-wheel, the connexion between the piston-rods and the cranks, as well as the arrangement of the guides, being similar to the engines called inverted cylinder engines. The two cranks, however, are not placed at an angle of 90° to each other as usual, but in opposite directions—i.e., at an angle of 180°, so as thereby to balance the two sets of pump-rods and other parts in reciprocating motion. The piston-rods pass through the tops of the cylinders, and the upper end of each of them is attached to the end of an oscillating beam in the usual style of beam-engines. The two beams, however, converge towards each other, so that their extreme ends, to which the pump-rods are attached, are brought close together over the shaft of the mine, or, in general, over the two sets of pumps.

508.—NEWTON, A. V., Chancery Lane, London, "Improvements in centrifugal pumps." A communication. Patent dated Feb. 8, 1876.

This invention consists in various constructions and combinations of parts, whereby a more copious discharge is obtained for a given diameter of pump-case cylinder, power is economized in the operation of the pump, and the construction of the latter cheapened; also its capacity or ability to pass foreign bodies or substances is enlarged, likewise increased facilities

are afforded for putting together and removing the working parts without disturbing either the suction or discharge connexions, and other advantages are obtained, including an increased facility for varying the working position of the pump.

675.—KIDD, J., Dartmouth Street, Westminster, "Improvements in apparatus for the manufacture of gas for lighting and heating purposes." Provisional protection only obtained. Dated Feb. 18, 1876.

This invention is an improvement on patent No. 531, Feb. 13, 1875, and consists in combining with the gas-producer there described, a carburetting apparatus, together with ascending and descending pipes for cooling the gas, and also a small portable steam boiler for generating the necessary steam for the jet.

In carrying out the invention, a furnace is made, similar to the one described in the former patent, but in lieu of the coil, a small portable boiler is used for generating the steam required. This boiler should be heated by a gas or oil burner, so as to give off a regular flow of steam to the jet. The gas, after it leaves the furnace, passes up an ascending and down a descending pipe; the gas being cooler in the descending-pipe acts as a syphon, and increases the pressure. The gas then passes through a carburetting apparatus of any desired form or internal arrangement, after which it is ready to be used for lighting purposes. The gas, before it is carburetted, is non-luminous, and may be used for cooking or heating purposes. The carburetting material should be shale or petroleum spirit, such as is now used in air-gas machines.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

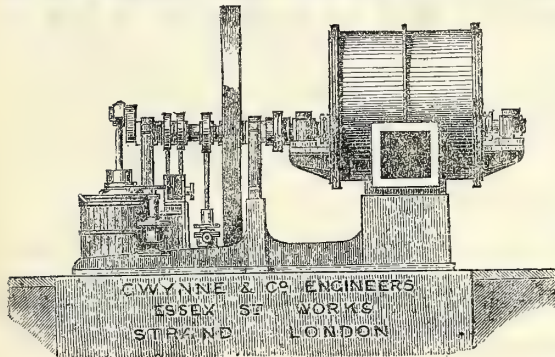


FIG. 224.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the most perfect system of action yet discovered. Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement. Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters at alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

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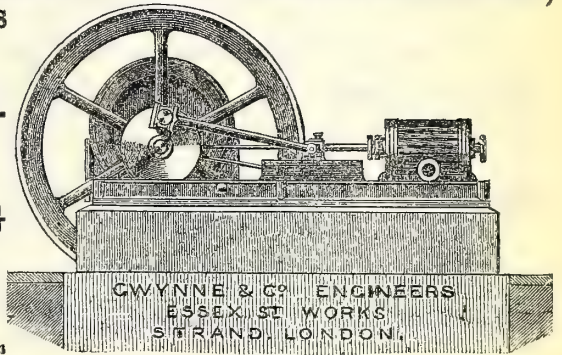
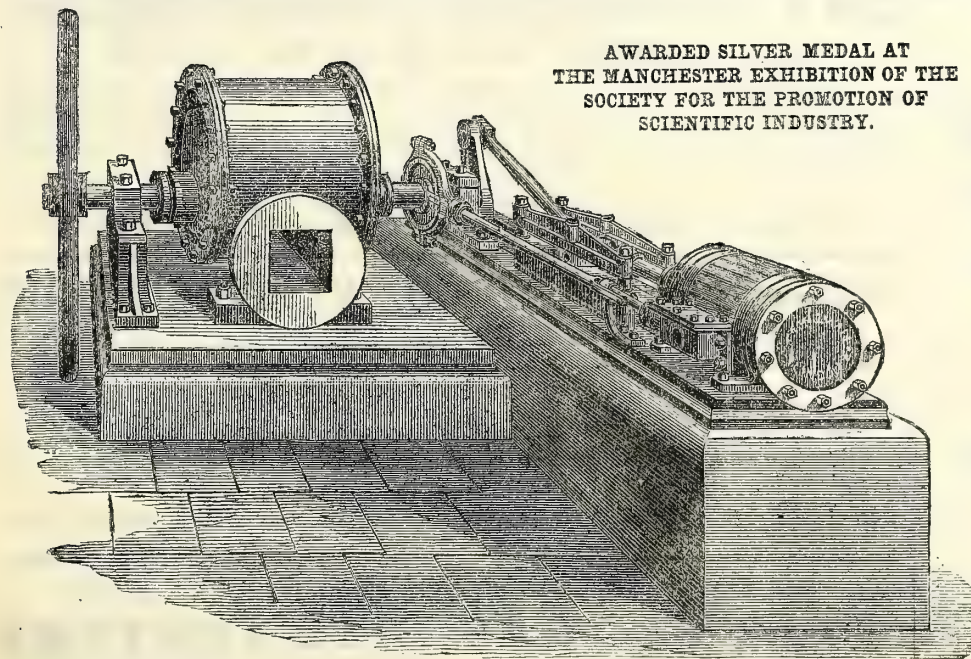


FIG. 225.



AWARDED SILVER MEDAL AT
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Improved Patent
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Applications, in own handwriting, stating age and qualifications, accompanied by recent testimonials and fitness for managing men, to be sent to me on or before the 11th of January next.

None but those whose character will bear the strictest investigation need apply.

By order of the Directors,
S. B. DARWIN, Secretary.

Gas-Works, Dec. 28, 1876.

TO GAS-WORK MANAGERS.

REQUIRED, an Engineer to take the
entire MANAGEMENT of a Gas-Work in a healthy city in South America.

None but thoroughly qualified men need apply, and they must have had the management of works where the production has been from 100 to 200 million cubic feet per year.

A knowledge of Spanish will be desirable.
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The Manager will have a house, coals, gas, and garden free. He will also have an opportunity of adding to his income by gas-fitting.

Applicants to forward recent testimonials, and state amount of salary expected, and when they could enter upon their duties, either to Messrs. J. EDMUNDSON AND CO., Capel Street, DUBLIN; or to Mr. JOHN BAMFORD, Secretary, PORTRUSH, on or before Feb. 1, 1877.

BOILERS.

FOR SALE, Cheap, Two 5-h.p. Cornish
BOILERS, in good condition. May be seen at the Reading Gas-Works.

Particulars can be obtained of Mr. E. BAKER, Engineer.

FOR SALE—A second-hand Gasholder,
in good condition, 33 ft. diameter and 9 ft. deep. Has been in use about nine years. Also some 5-in. and 4-in. Donkin Valves. To be sold at a moderate price.
Apply to Mr. W. T. HEWS, Gas-Works, HENLEY-ON-THAMES.

THE Blackburn Gaslight and Coke Com-
pany have FOR SALE one 25,000 feet per hour EXHAUSTER and ENGINE combined, with one 10-h.p. Boiler. The Exhauster is by Musgrave and Co., of Bolton, and is only to be sold as it has been replaced by a larger one.

Application to be made for price, &c., to the undersigned.
S. R. OGDEN, Engineer.

GOVERNORS FOR SALE.

FOR SALE, at the Eccles Street Works
of the Liverpool United Gaslight Company, two GOVERNORS, each having a 10-in. cone and 16-in. bye-pass.

Also four GOVERNORS, each having a 6-in. cone and 8-in. bye-pass. These Governors are in excellent order, and are fitted complete and ready for work, and have been replaced by apparatus of larger dimensions.

Apply to Mr. KING, Engineer, Gas Office, Duke Street, LIVERPOOL.

THE Swansea Gaslight Company have

for immediate SALE, the following Plant:—
A 6-h.p. Patent Trunk Engine. (Beale.)

Exhauster to pass 15,000 feet per hour. (Beale.)

An 8-h.p. Grasshopper Engine. (Easton and Amos.)

Exhauster, 20,000 ft. per hour. (Beale.)

Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.

Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.

Wrought-iron Scrubber, 5 ft. diameter, 20 ft. high.

A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.

May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.

Further particulars may be obtained on application to Mr. THEOBALD ANDREWS, SWANSEA.

TO EXCAVATORS, BUILDERS, AND GASHOLDER
MAKERS.

THE Directors of the Castleford and

Whitwood Gaslight and Coke Company, Limited, invite TENDERS for the construction of a GASHOLDER TANK, 102 feet 6 inches diameter and 22 feet 6 inches deep; also for supplying and erecting one Single-Lift GASHOLDER, 106 feet diameter and 22 feet deep.

Plans and specifications may be seen at the Office of the Company, Gas-Works, Wheldale Road, CASTLEFORD, from Friday, the 5th, to Friday, the 26th inst.; and any further information may be obtained on application to Mr. T. B. WILSON, Gas Engineer, Eastfield House, CASTLEFORD.

Sealed tenders, endorsed "Tender for Gasholder," or "Tank," addressed RICHARD HEPTINSTALL, Esq., Chairman of the Castleford and Whitwood Gaslight and Coke Company, Limited, Castleford, YORKSHIRE, to be sent in not later than Friday, the 26th inst.

The Directors do not bind themselves to accept the lowest or any tender, nor will any allowance be made for such tenders.

Gas-Works, Castleford, Jan. 1, 1877.

RETORTS, FIRE-BRICKS, AND IRON RETORT
FITTINGS.

THE Gas Committee of the Wigan Cor-

poration are prepared to receive TENDERS for the supply of 140 lengths of Fire-Clay through RETORTS, and the necessary Fire-Bricks and Fire-Clay for the same. TENDERS are also invited for the supply of the necessary IRONWORK for the above.

Plans, specifications, and other particulars may be obtained on application to Mr. J. G. HAWKINS, the Manager of the Gas-Works, Wigan.

Sealed tenders, endorsed "Tender for Retorts, &c.," to be sent in to Mr. HAWKINS, on or before the 17th of January, 1877.

The lowest tender not necessarily accepted.
Dec. 9, 1876.

FOR SALE—A 10 ft. Gasholder (second-
hand), with metal tank, columns, pulleys, and weights, now erected and in working order. Suitable for a small factory or private residence.
Apply at LINTZ FORD MILL, Lintz Green, near New-CASTLE-UPON-TYNE.

CONDENSERS FOR SALE.

THE Tillicoultry and Devonside Gas

Company have for immediate SALE, as they stand—One set of Atmospheric Vertical Condensers, 18 pipes, 11 ft. 3 in. high by 7 in. diameter, with tar-boxes, &c., complete.

Also a Battery Condenser, 13 ft. by 8 ft. by 2 ft., with boxes, &c., as above.

Apply to Mr. FRANK SCOTT, Gas Manager, TILlicoultry.

TO BE SOLD.

THE Keighley Local Board of Health

have FOR SALE, by private contract, the GASWORKS PLANT and APPARATUS at present in use at the Low Bridge Works, in Keighley, comprising 165 Mouth-pieces, Hydraulics, two 12-in. Vertical Condensers, Engine and Exhauster, Tar and Liquor Pumps, with shafting, &c., wrought-iron Scrubber, Station-Meter (Braddock's), and other apparatus, with the valves and connexions complete (12-in. diameter throughout).

The whole are in good condition, and can be seen at work, on application to the undersigned, at the Offices, Low Bridge Works, Keighley, from whom any further particulars can be obtained.

By order,
JOHN LAYCOCK.

Keighley, Dec. 21, 1876.

TO RETORT MAKERS.

THE Gas Committee of the Bury Cor-

poration are prepared to receive TENDERS for the supply of 88 D Fire-Clay Through RETORTS, 18 in. by 14 in. by 10 ft. long; and 23 D Fire-Clay Through RETORTS, 16 in. by 14 in. by 9 ft. 9 in. long, delivered free at the Railway Station, Bury. The whole to be delivered on or before the 30th of June next.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Retorts," to be sent in on or before the 12th day of January, 1877.

The Committee do not bind themselves to accept the lowest or any tender.

Bury, Lancashire, Dec. 23, 1876.

NOTTINGHAM CORPORATION GAS-WORKS.

TO GASHOLDER MAKERS AND IRONFOUNDERS.

THE Gas Committee of the Nottingham

Corporation are prepared to receive TENDERS for constructing, erecting, and fixing a 90 ft. GASHOLDER at the Eastcroft Station of the Nottingham Works.

Plan and specification may be seen at the Engineer's Office, George Street, on and after Thursday, the 4th day of January, 1877, where also forms of tender may be obtained.

Sealed and endorsed tenders to be delivered to the Town Clerk on or before Wednesday, the 17th day of January, 1877.

The Committee do not bind themselves to accept the lowest or any tender.

By order,

M. OGLE TARBOTTON, Engineer.
Gas Office, George Street, Nottingham,
Dec. 28, 1876.

Now ready, Second Edition, price 7s., by post 7s. 3d., the
GAS MANAGER'S HANDBOOK.
By THOMAS NEWBIGGING, A.I.C.E.

The scope of this work is apparent from its title. The First Edition, published a few years ago, was eagerly sought for, and has been now for some time out of print. The favourable reception accorded to it sufficiently proved that it supplied a generally acknowledged want in the profession. The work has undergone careful revision; much new matter has been added; and the New Edition is published in fcap. 8vo., morocco, gilt.

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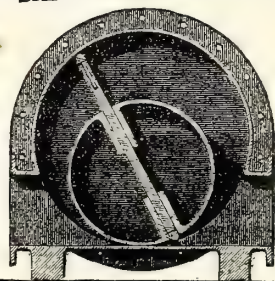


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MR. J. BEALE, of East Greenwich, having retired from business, has made an arrangement with B. DONKIN & CO. for the sole manufacture of his Patent Solid-Slide Gas Exhausters. B. D. & Co. also make Steam-Engines to drive Gas Exhausters direct or otherwise, and Gas-Valves.

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LONDON, S.E.**

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NOTICE TO SUBSCRIBERS.

The JOURNAL OF GAS LIGHTING is supplied direct from the Office to residents in any part of the United Kingdom, at the rate of 21s. per annum, payable in advance. If credit be taken, the charge is 25s. Subscribers who desire to avail themselves of the reduction in the subscription to the JOURNAL by paying in advance for the year 1877, are reminded that this can only be done during January. Vol. XXVIII. (second half of 1876) will shortly be ready, bound in cloth, gilt letters, price 18s. Cloth cases for binding may now be obtained on order from any bookseller, or from the Publisher.

TO CORRESPONDENTS.

- W. C. B.—1. *Oval retorts, clay, 21 inches by 14 inches, or 21 inches by 15 inches, and 9 feet long, properly heated, will produce, on an average, 5200 cubic feet per diem, with Newcastle coal.* 2. *Six-hour charges, 2½ cwt. each.* 3. *Enlarge the scoop, or charge with shovel.*
- C. H. F.—*Your inquiry respecting the proportionate rateability of stone quarries and iron ore works to other property in the assessment of a lighting rate, is hardly within our province to furnish a reply to.*
- D. H.—*If our correspondent's question be, whether gas will improve in illuminating power after being made for 24 hours, our answer is, that it will not. Whether it will deteriorate or not depends upon circumstances.*

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 16, 1877.

Circular to Gas Companies.

SOME months ago there was a good deal of correspondence in a Glasgow paper on the subject of the payment of commissions by coal dealers to managers and other officials connected with gas undertakings. We took but little notice of it, although several letters on the matter were addressed to us, for a perusal of the correspondence seemed to prove to us that it had its origin in a purely personal grievance. The general question of the morality of taking commissions has, however, been recently raised in the columns of *The Times*, and when Bedford Row and Capel Court are boldly attacked, the small fry of gas officials could hardly hope to escape.

Accordingly, we find a letter published in *The Times*, which we have thought right to transfer to our columns, in order

that it may have a wider circulation among gas officials than it could otherwise possibly obtain. It is well for men to know the worst that can be said of them.

On the general question we shall say very little. The commission pestilence is an outcome of the present age, in which every man seeks to obtain the most money possible for the least amount of work, and, until now, only the artisan has been blamed. This latter has no chance of obtaining a commission, so he does his work in his own way; but ascending in the social scale, we find the disease permeating every class of society. Why, then, should the poor gas manager be expected to be exempt? We may at once admit that the taking of commissions is very general among them, though by no means universal; and what is the reason? It is simply because (in our special case) people who have goods to sell, offer bribes to those who have the power to recommend their purchase. The "Commission Abolitionist," whose letter we print, freely admits, that probably, if he had never bribed, his business would never have grown to its present profitable dimensions. He was not content to rely on the excellence of his wares alone. He has got on in the world by a sort of "purchase system," and now he is disposed to kick down the ladder, by the use of which he arrived at fortune.

It must not for a moment be considered that we defend the practice of paying and receiving commissions. We regard it as utterly vicious; but let the blame be fairly divided. In the first place, it is well known that Gas Companies and Corporations (we do not include all) pay their officials inadequate salaries, on the distinct understanding that they will receive gratuities and commissions. If this were not the case, perhaps some clever Directors or pushing Aldermen and Town Councillors would contrive to absorb the *douceur*. It is not only managers who are canvassed for business, and it is not they alone who must be accused of taking bribes.

The defence of the practice of accepting commissions lies, as is stated by the writer whose letter we print, in the assertion that the amount paid is only so much taken out of the seller's profits. As a question in political economy the statement requires no answer. It is that much be-wronged individual, the gas consumer, who pays everything. True, when a company do not pay maximum dividends, the commission may be supposed to be a deduction from profit applicable to dividend, and thus the shareholders may be considered as robbed. But who knows whether a seller, certain of a market, would part with his goods at a lower price, even if he did not pay a commission? If we dared to adduce instances, we think we might show that, in many cases, the non-payment would only result in the commission-money going into the pocket of the seller. The maxims of political economy do not apply in all cases.

There is one passage in the letter to *The Times* which deserves some particular remarks. The writer alleges that it is the custom of managers leaving a situation to overstock the concern they are quitting. If this be done—and the writer says he knows for a fact that it is—the Directors of the Company are little less to blame than the outgoing Manager; and we draw especial attention to the point, for their edification. Effective superintendence would at once put a stop to practices of this kind, which, after all, we must believe cannot be common.

We need not say anything in defence of consulting engineers. They are quite capable of taking care of themselves. The mode in which they are paid may not be the best that could be devised, but it has been settled by custom. They get their commission, like architects, on the cost of the works they design and see carried out; but we do not believe that any respectable consulting engineer ever takes a commission from a contractor.

We have nothing to say against the correspondent of *The Times*, except that he evidently lacks moral courage. He admits as much. He falls in with a system of which he disapproves, because he finds it to his advantage to do so. He fears, or knows, that his business would leave him if he did not bribe; so he bribes and grumbles. We do not believe in this sort of virtue. Let our first-class firms resolutely set their faces against the practice, and it would quickly come to an end. If the writer would boldly avow himself, and try it, we should heartily wish him success. Competition in excellence would be substituted for competition in bribing, and the moral atmosphere of many gas undertakings would be vastly improved. As we said when commenting, some time ago, on the Glasgow revelations, the bribers are as much to blame as the bribed.

A word to directors and local authorities. It is, we fear, notorious that, as said above, a number of managers are paid small and inadequate salaries because it is understood that they will receive commissions on everything that goes into the works.

This state of things should be remedied at once. A manager should receive a fair initial salary for the labour he must devote to the necessary work of superintendence. Beyond this, there might be inaugurated a system of "payment for results." Should the engineer reduce the "leakage," bring down the fuel account, and increase the production of gas, or do aught, in fact, to increase the efficiency of the undertaking, he should receive a proportionate reward. In such an event, directors and authorities might bind their officials not to receive commissions, either in money or gifts. We shall, no doubt, hear a good deal more of this question, now that it is once again ventilated, and need say no more at present.

We have, more than once, referred to the complaints made against the Corporation gas supply at Leeds, and it is with no pleasure that we recur to them. But it appears, from the report of a recent meeting of the Chamber of Commerce, that they are becoming louder and stronger. Leading consumers, it will be seen in another column, lament the departed days of the two companies. They had their shortcomings, but, we believe, it must be admitted that the quality of their gas was well maintained, if, in the case of one, the pressure was sometimes insufficient. We may say at once that, without the evidence of a competent examiner, which is not before us, we must decline to accept the statement in the report of the Council of the Chamber of Commerce as a rigidly truthful expression of fact. We are so used to exaggerations, that we no more believe an accusation brought against a Corporation than we do one made against a Gas Company. That there are, however, some grounds for the complaints made at Leeds we must believe. The Corporation, at the outset, did not, perhaps, make a very good bargain, and they have been far from displaying the enterprise which was necessary to place the whole undertaking in a satisfactory condition. They have, to use the expression we employed last week, rather "starved" the concern. Judging by the Bill they are promoting in the next session, they are about to repair the error, and due consideration should be shown by the Chamber of Commerce. If the Leeds gas undertaking be not put into first-class form in the course of the next two years, the Town Council may be justly blamed. We do not say that they may not be found fault with to-day, but, in extenuation of their conduct, we may state that the Corporation have only exhibited a weakness common to local authorities.

The Gas Accounts of the Corporation of Bolton reveal a satisfactory condition of affairs. The profits made in the past year amount to £11,336, as against £6272 in the previous year. Out of the sum mentioned, £3000 has been appropriated in "aid of rates," the rest being devoted to the payment of necessary charges. With a sustained prosperity, which is guaranteed for the current year, the Town Council will, we feel certain, be able to make some reduction in the price of gas in the course of another half year.

A Medical Officer of Health at Lowestoft recently reported that the gas supplied to the town was of very inferior quality, and concluded his remarks by suggesting that the Improvement Commissioners should provide the means for testing it. How, in the absence of such apparatus, he arrived at the conclusion that the gas was bad, he did not explain. Probably, he guessed. While the complaint was being made, it was remarked that the gas burning in the board-room was "very brilliant indeed." It seems, however, to be admitted, that for some weeks there may have been grounds of complaint, for the works have been undergoing alterations, and the weather, we presume, has delayed their completion. Whatever they may be, we have no doubt that all cause of complaint will soon be removed by the able Engineer of the works.

Local newspapers are always amusing reading when gas is the topic under discussion. We have referred to the Warrington journals, which have yielded fun, and never more than in the most recent reports published in them, which show that the disputants have resorted to pugilistic arguments. With regard to this case, we may mention that a proposal has been made that Mr. T. Hawksley should be called in, to give a decisive opinion as to the reasonableness of the price agreed upon. No higher authority can possibly be consulted; and the opinion, which we hope will be obtained, should be accepted with respect by both parties.

The correspondence in the Ramsgate press, though grave and decorous, is scarcely less amusing than the account of the proceedings at Warrington, because of the hallucinations of the writers, and the ignorance displayed by them of the manner in which Parliament usually deals with cases such as will be presented, during the next session, in the Ramsgate Gas and Water Bills. Whatever may be the result of the contest, it is clear that many of the Ramsgate public are indulging hopes, and

entertaining fears, which will never be realized. The sum the Local Board will have to pay, if they succeed in obtaining power to acquire the undertakings, is scarcely doubtful, and it will soon be discovered that this amount will effectually prevent any reduction of price until the business, by a natural development, is greatly extended. It has rarely happened that a purchased gas undertaking has become immediately profitable to the purchasing authority; but it has happened, in not a few cases, that the works have for years been carried on with the narrowest margin of profit, and in some an actual loss has been sustained for a period. We do not remember a single instance in which a reduction of price followed on the acquisition of the undertaking. Hence, we anticipate that that section of the Ramsgate public, who expect a large reduction in the rates, and equal benefits in the shape of a reduction in the price of gas, are certain to be disappointed. The two things are, in fact, incompatible. A middle-aged inhabitant, if of sound constitution, may, perhaps, live to pay for cheaper gas, with unreduced, but much more probably increased, rates; but cheap gas and low rates he will never survive to witness. Coal will never cost much less than it does to-day, and if it should be much cheaper it would bode no good to Ramsgate, which is mainly dependent for such prosperity as it enjoys on the expenditure of what we may call surplus profits.

Water and Sanitary Notes.

THE all-absorbing local question in the Metropolis, to-day, is the prevention of inundations, respecting which a good deal of controversy rages, not so much as to the means to be adopted, but as to who shall pay for the work. A majority of the Metropolitan Board of Works are disposed to compel the riparian authorities to construct the embankments necessary for their protection. Now, it is true that a parish is a unit, but it is sometimes made up of parts, the inhabitants of which have few interests in common. Thus the well-to-do dwellers in the upper parts of Lambeth, who never suffer from floods, fail to see why they should be rated for the benefit of those who herd close to the river banks, and get occasionally washed out of house and home. In their opinion they are no more interested in the matter—that is, only interested to the same extent as—the ratepayers of Highgate and Hampstead, who are perfectly safe from overflows of the Thames. They, therefore, urge that the cost of the works should be defrayed by a general metropolitan rate, and there is a good deal to be said, both for and against the proposition. We are disposed, not without misgivings, to agree with those who contend for the metropolitan character of the work. The source of our doubts need not be mentioned. This, however, we may say—that if London had, at the present moment, a proper Municipal constitution, the question would never have arisen. In Manchester, Liverpool, or Glasgow—all made up of several parishes, welded, for certain purposes, into a homogeneous Municipality—no difficulty would have been experienced. Mr. Beal will take notice of the present dispute. Lord Camperdown will see, more clearly than ever, that the members of the Metropolitan Board of Works are mere delegates of Vestries, representing local jealousies rather than the general metropolitan interest. It is too much to expect any immediate change, but these disastrous floods will not have been without their advantage, if they call special attention to the necessity for an efficient Municipal Government for London.

Colchester has been in difficulties about the disposal of its sewage for some years. It was at one time, we rather think, contemplated to carry a main sewer for some miles along the bank of the river Colne, and then discharge the sewage into the estuary. A sewage farm was also thought of; but both these schemes appear to have been given up. Now, however, a Subcommittee of the Town Council have been visiting places where precipitation processes are carried on, and appear to have been struck with the merits of Hillé's system, which is practised at Edmonton, Tottenham, Wimbledon, and Taunton. The inventor of this system offers no promise of profits to local authorities. His efforts are directed to the treatment of the sewage at the lowest possible cost, provided a decent effluent water be obtained. No pretence is made of producing marketable manure; but the sludge is disposed of by pumping it on to a small area of land, where, in fact, a system of intermittent downward filtration is carried out. If any difficulty be found in working this system, it will be caused by an accumulation of sludge; but this may be provided against for many years, by taking sufficient land. The process was described in our columns a year or two ago, and we need only say here, that the precipitant is a mixture of chloride of magnesium and lime, with a little crude carbolic acid as a disinfectant.

A TREATISE ON THE SCIENCE
AND PRACTICE OF THE MANUFACTURE AND
DISTRIBUTION OF COAL GAS.

CXXV.

MAIN-PIPES (continued).

At the close of our last chapter we referred to the method of jointing with Russian tallow. The metal of the socket in this case need not be stronger than that in the body of the pipe. Several coils of spun-yarn, covered with putty or very thick paint, are first driven into the bottom of the socket. Tarred gasket, made of such a thickness as to fit tightly into the annular space between the spigot and the socket, is then caulked round the lip of the latter in such a manner as to leave about 1½ inch of space between the yarns. On the upper side of the pipe the ends of the gasket are drawn out to form a mouth, and a mixture of two parts of melted Russian tallow and one part of common vegetable oil being poured, while warm, through the mouth, runs into, and fills up the space all round. Fig. 19 shows the complete joint; the light portions of the plugging being the yarns, and the dark portion between them the tallow.

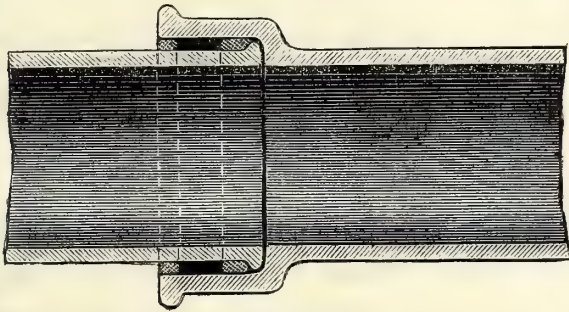


FIG. 19.

In the earlier days of gas lighting, after the objections to the use of the rigid flange joint had become apparent, the lead joint, as described in our last week's article, was invariably employed in the laying of mains. Even at the present day, some managers prefer this before any other. Whilst admitting, and that not unreservedly, its excellence when carefully made, and its value and utility under certain extreme conditions, such as the subsidence of the ground in which the mains are laid, we believe that, in a general way, it cannot be compared with the bored and turned joint, either on the score of cheapness, tightness, or durability. It is much to the credit of the late Mr. Alfred King, the able engineer of the Liverpool Gas-Works, that he was the first to apply this latter description of joint, having adopted it as far back as the year 1826. These are universally in use in the streets of Liverpool and Manchester, where the traffic is enormous, and where defective and insufficient joints would be particularly objectionable.

It is sometimes urged, in opposition to the turned and bored joints, probably by those who have had least experience in their use, that, owing to the contraction of the metal in winter, the pipes are drawn, and that heavy leakage is the consequence. If there is any foundation of truth in this allegation, it arises from defects that need not necessarily present themselves.

The failure of some of these in places where they were adopted for the first time, was due to the circumstance of the surfaces having been made too tapering in form. It is well known that the more conical a plug is made, the easier it is of displacement from its seat, and the wider the interval between its surface and that of its seating produced by an equal extent of withdrawal. So in the matter of which we are treating, the nearer the two surfaces can be kept to the true cylindrical shape, the better, not only for ease in connecting, but in permanent efficiency and tightness. We know, as a matter of fact, that leakage rarely occurs with properly constructed—that is, all but cylindrical—joints, such as we have described.

It must be remembered that there is a lateral as well as a longitudinal contraction of the metal; and as the socket of the pipe has a greater bulk of metal than the spigot, it follows, as a natural consequence, that it contracts to a greater extent than the other, so retaining the soundness of the joint, notwithstanding the drawing of the pipe end from its original seat.

As a general rule, then, it may be asserted that pipes with bored and turned socket and spigot joints are superior to all others for gas-mains. Their first cost is not more, or but a trifle more, than open joints. The speed, certainty, and cheapness with which they can be made, far exceed most others in these respects. The soundness and durability of the joint is undoubted, and the ease with which it can be taken asunder, without damaging the pipes, in cases of renewal and enlargement of mains, is not its least recommendation. The bored and turned joint is easily manipulated so as readily to follow any ordinary curves, but when these are sharp and angular, an occasional lead or iron cement joint has to be employed.

The application of the turned and bored principle to the joints of the various branches and bends required in main-laying is more difficult, and, consequently, not so common as with the straight lengths, although it has been attempted in several instances with success.

In laying turned and bored pipes, the spigot and socket ends are carefully cleaned with cotton waste; and if rusty in any degree, by a piece of wire card. It is scarcely needful to say that the use of a file for that purpose is altogether inadmissible. The clean surfaces are then covered, by means of a brush, with a coating of thick paint, composed of one part of white and one part of red lead, mixed with boiled linseed oil. The pipe is then lowered into the

trench, the end inserted and driven home with a mallet if the pipes are of small diameter, or with a swing tugging-block if large.

In driving the pipes, they will sometimes be found to spring back at every stroke. This may be due to one of two causes—either the joint is too conical in form, as previously mentioned, or there is a slight ridge or roughness left on the inside edge of the bored part of the socket, or turned portion of the spigot. This latter can easily be removed with a chisel; but the former is a radical defect that is incurable—a permanently close and durable joint under the circumstances being impossible.

One great merit of the turned and bored joint is the ease and facility, and the consequent saving in cost, with which pipes can be joined by its aid. This economy would, of course, go for nothing, if the after results of the system were unsatisfactory; but when it is found that the economy is supplemented by efficiency, then we realize the full value of the work.

We have no hesitation in speaking strongly on this point, having had a long and varied experience with the different joints, under the most opposite conditions of soil, situation, and temperature, in recommending the general adoption by managers and engineers of the bored and turned joint in the laying of ordinary gas-mains, resorting to the use of lead, or of iron cement, in the jointing of the various branch-pipes and bends.

In a paper read before the British Association of Gas Managers in 1868, by the late Mr. Rafferty, of Manchester, whose experience on all matters connected with main and service laying was very great, the following estimate of the saving effected per joint, in laying a 30-inch diameter turned and bored, as compared with a lead-jointed main, is given. The particulars of the items dispensed with, and which are required in making a lead joint of the size named, are as follows:—

54 lbs. of lead, at 2½d.	£0 10 9½
White yarn, 4½ lbs., at 8d.	0 3 0
Making caulking chamber	0 1 9
Melting lead and making joint	0 0 10
Quarter cwt. of coal	0 0 2
Extra soil to be carted away	0 1 1½
Flagging or pavement taken up and relaid, 3 yards, at 1s. per yard	0 3 0
	£1 0 8

Since the year mentioned, the cost of both labour and material has increased, consequently the gross saving of the turned and bored over the lead jointing will be greater at the present time than is represented by the above sum. An allowance ought to be made in the calculation for the cost of the red and white lead paint used for coating the turned and bored joint of the size given. A sum of 4d. will be ample for this purpose.

We append a useful table giving the approved thickness of metal in the sockets, and also in the body, of turned and bored pipes of the different sizes, from 2 inches up to 20 inches, the accompanying engraving (fig. 20) explaining the particular parts to which reference is made. The depth of the socket is also stated in each instance.

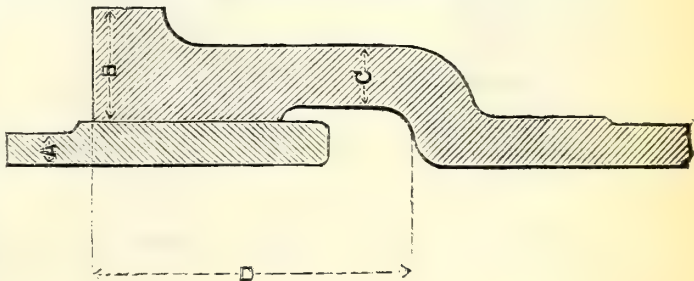


FIG. 20.

TABLE

Of the Thickness of the Metal and the Depth of the Sockets (inside Measure) of Turned and Bored Cast-Iron Gas-Pipes.

Dia. of Pipe.	A	B	C	D	Dia. of Pipe.	A	B	C	D
Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
2	5-16ths	¾	½	3	10	5-10ths full	1½	¾	4½
2½	3-8ths bare	13/16	9/16	3½	11	9-16ths	1½	13/16	4½
3	3-8ths	1	1	3¾	12	9-16ths	1½	13/16	4½
3½	3-8ths	1¼	1¼	3¾	13	9-16ths full	1½	13/16	4½
4	3-8ths full	1¼	1¼	4	14	9-16ths full	1½	13/16	4½
5	3-8ths full	1½	1½	4	15	9-16ths full	2	1	5
6	5-10ths	1½	1½	4½	16	5-8ths	2	1	5
7	5-10ths	1¾	1¾	4½	17	5-8ths	2½	1½	5½
8	5-10ths	1¾	1¾	4½	18	11-16ths	2½	1½	5½
9	5-10ths	1¾	1¾	4½	20	11-16ths	2½	1½	5½

It is sometimes preferred by engineers to combine the turned and bored with the lead or cement joint, by having the socket of the pipe cast with a recess in front of the bored part of about 1½ or 2 inches in depth (fig. 21), so that in the event of leakage from the turned and

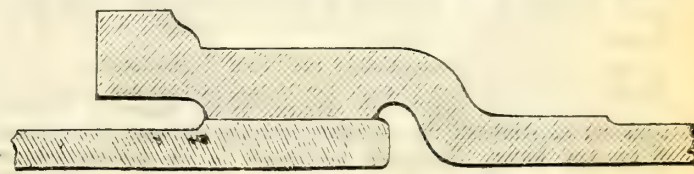


FIG. 21.

bored portion of the joint, it may be supplemented by a plugging of other materials—either lead, iron cement, or Portland cement. If the pipes are of good quality, being obtained from a manufacturer of repute, and proper care bestowed upon the boring and turning, there is no necessity for this; though it must be admitted that, in many instances, these indispensable conditions as to quality are not observed.

(To be continued.)

FRENCH PRACTICE IN THE CONSTRUCTION OF GASHOLDERS.

By M. ARSON, Engineer-in-Chief of the Paris Gas Company.

[Translated expressly for this JOURNAL by Dr. W. POLE, F.R.S., Mem. Inst. C.E.]

(Continued from page 52.)

BELL OF A TELESCOPIC GASHOLDER.

Various considerations determine the use of telescopic gasholders; such, for example, as want of room, or the defective nature of the ground, which does not permit of the construction of deep tanks.

The Throat or Lute Ring (Gorge).—It is well known that the two vessels which constitute the bell of a telescopic gasholder are connected by a lute or water-joint ring, which forms a continuity between them. This water-joint ought to have sufficient height to establish an equilibrium between the internal and external pressure; it ought further to have an excess of height to allow for the irregularities in level of the lute during the movement of the bell; and finally it ought to contain a further quantity of water to provide for any leakage, and for the loss by evaporation on hot days.

The fulfilment of these conditions cannot be subject to fixed rules; they will vary necessarily with the conditions of the gasholder; but the two first ought to be observed with rigorous exactitude.

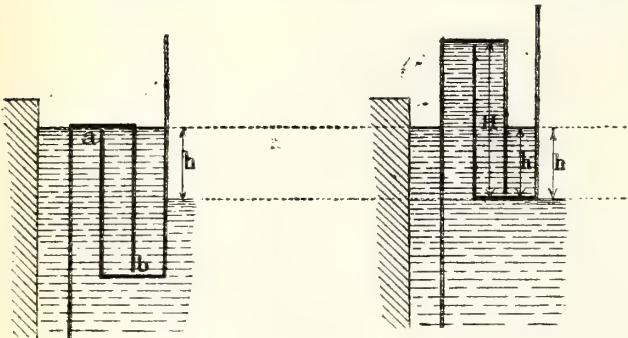


FIG. 1.

FIG. 2.

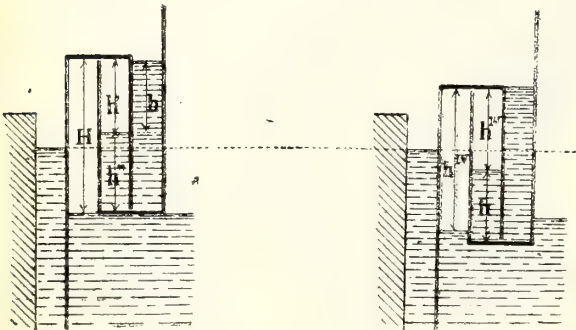


FIG. 3.

FIG. 4.

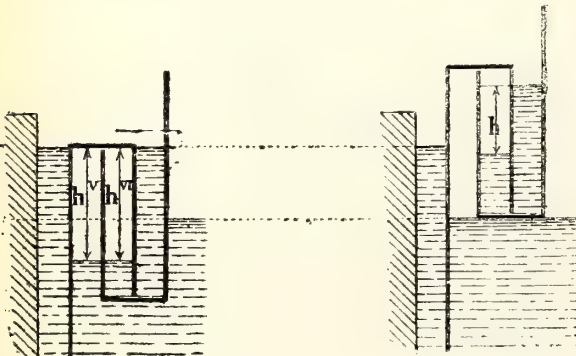


FIG. 5.

FIG. 6.

Figs. 1, 2, 3, 4, 5, and 6 represent different positions of the water-joint, and will show the different conditions which it ought to satisfy.

Fig. 1 represents the lute entirely filled with water in all its parts, as may happen either by the absorption or the leakage of the air it contains.

Fig. 2 supposes the lute with its whole height just raised above the level of the water inside the holder, but the gas not having yet entered it to displace the water.

Fig. 3 shows the distribution of the liquid in the lute, as soon as the gas has entered it, acting on it with the internal gas pressure.

The conditions of equilibrium give rise to the following observations, which establish the necessary relations between the volumes of gas and water. Supposing the section of the lute everywhere uniform, the volumes will be proportional to the heights. Hence the

volume of water contained in the lute may be represented (fig. 2) by

$$H + h. \tag{1}$$

The volume of the gas, $H + h$, shown in fig. 3, will be—

$$H + h = \frac{3}{2} H \tag{2}$$

which shows, as a first deduction, that if the height, H , is not equal to $2h$, the water will run over the top of the lute as soon as the gas penetrates into it.

With the lute in the position shown in fig. 3, the bell may rise and fall without any change until it begins to be immersed, so imprisoning the volume of gas it contains. This immersion will give rise to new effects as follows:—

Fig. 4 represents the lute so far immersed that the water in the part open to the atmosphere has reached the level of the top of the lute. In this case the height, h^{iv} , which the gas occupies above the water in the middle compartment, is deduced $= H - h$; and the height, h^{iv} , above the surface of the water in the outer compartment, will be—

$$h^{iv} = \frac{H}{2} + h$$

Fig. 5 supposes that the bell has continued to fall—that the excess of water has fallen over into the tank—and that the lute is on the point of entire immersion. In this case, the volume of the gas is subject, in both compartments, to the same pressure; the two heights, h^{iv} and h^{vi} , are equal to each other, and

$$h^{iv} = h^{vi} = \frac{3}{4} H$$

This relation of the two levels will be maintained as long as the bell descends. Supposing, then, the ascent to recommence, the lute will only carry up a volume of water $= \frac{5}{4} H$, which ought to be enough to assure, in the ordinary service, the margin necessary for the other conditions, which the process of working, and the imperfections of the construction may demand—especially to secure the efficiency of the joint in the oscillations of the bell between its guides.

Effect of the Bell being out of Level.—It is, of course, assumed that the lute-ring remains constantly horizontal; but this result is not always attained in practice. It may either be out of level by defective construction, or it may get so by a movement of the entire bell.

It is further necessary to leave some play between the rollers and the guide-bars, and this cause alone will cause some obliquity of position. For example, taking the dimensions of the telescopic gasholder at St. Denis, which has the following dimensions:—

	Mètres.	Feet.
Height	14.18	= 46.5
Mean diameter of the lute-ring	19.65	= 64.5
Play between the rollers and the guides	0.015	= $\frac{1}{16}$ of an inch.

it is found, by a simple calculation, that the difference of level between the two opposite sides of the ring may amount to 0.0414 mètres = $\frac{1}{8}$ inch.

For this reason it is necessary that the lute should be this amount

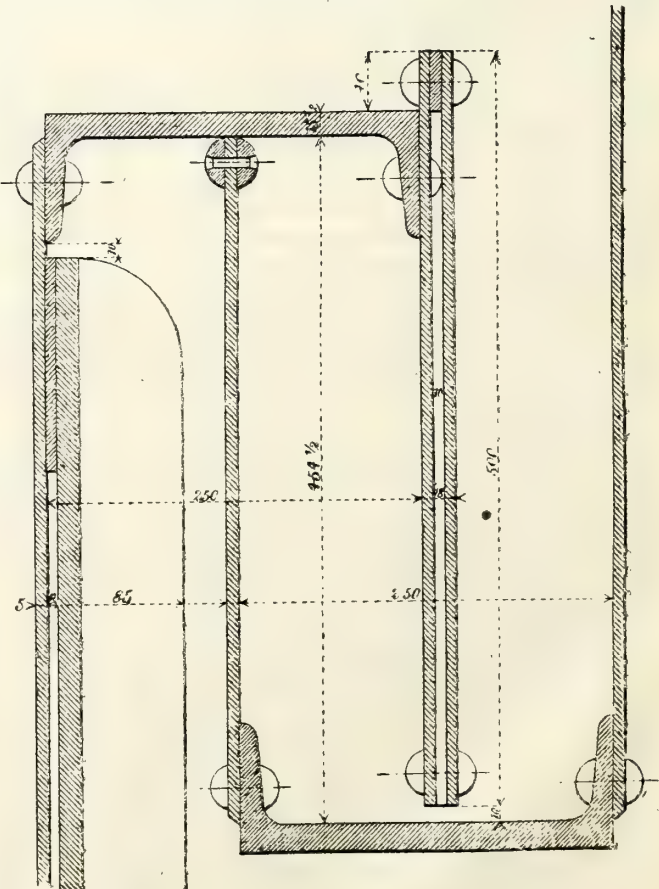


FIG. 7.

deeper than is given by the foregoing calculations. To this must be added an allowance for the risks of imperfect workmanship, evaporation, &c.; and for all these reasons combined the lute has been given a total depth of 0.50 metre (19½ inches), as is shown in fig. 7.

Height of the Lower Portion of the Bell.—The hydraulic lute must necessarily plunge into the water, when the lower portion of the gasholder rests on the bottom of the tank, otherwise the upper portion could not act properly.

This condition of complete immersion may even be exaggerated with advantage, and it is very advisable to oblige the lute to descend a little below the ordinary water-level. In the first place the action is better protected against evaporation, or accidental leakage of the tank, and, further, it is less exposed to freezing, which is a grave inconvenience. A submersion of a few décimètres [a décimètre is about four inches] will suffice to protect the lute, and the space thus left free is very useful, in order to allow of the upper guides being attached to the side of the bell, where they are much better placed than on the crown.

Utility of the Volume of Water in the Tank.—The freezing of the water in a tank is evidently retarded by its relative quantity. If the volume is large, frosts of short duration will not have time to lower its temperature so much as if the quantity were smaller. Hence, in cold countries, it is of importance not to diminish the capacity of the tank, as is frequently done.

Warming the Lute.—It is not sufficient to put the lute out of the way of the cold when it is down; it is necessary to adopt some means of preventing its freezing when it is elevated above the tank.

Two modes are employed for this purpose. One is to enclose the entire gasholder in a large closed building, the air of which is kept warm; the other is to warm the water in the lute when it is liable to freeze.

The last method, in order to be effective, requires special arrangements, and those adopted at St. Denis have been perfectly successful. One of the sides of the lute is double, leaving a space, into which steam can be introduced (see fig. 7). The condensed water mixes with the water in the lute, and the whole of the heat is utilized.

The number of points by which the steam is introduced should be such that it will spread itself equally; and it is found that a temperature of 10° cent. (18° Fahr.) above that of the surrounding air can be easily obtained over a space of 60 mètres (nearly 200 feet), i.e., 30 mètres on each side the point of introduction.

The extremity of the heating compartment must be kept in full communication with the atmosphere, to allow the air to escape, and to prevent any inconvenient effects by condensation.

CONSTRUCTION OF THE GASHOLDER BELL.

The construction of gasholder bells is a special kind of iron-plate work, on the peculiarities of which it is desirable to make some remarks.

The cost of such work may be much diminished by introducing into the manufacture certain simplifications which the Parisian Company apply with success, and which experience has fully confirmed. The most important consists in the entire preparation of the work at the manufactory, nothing being left to be done on the site but the rivetting together.

All the sheets should be cut at the iron-works, according to a template furnished with the order, so that there will be no necessity to retouch any one of them, or to have any trouble as to the place they will occupy. One single template will suffice for the whole of the side-sheets, and one for each row of the sheets in the crown.

These templates are formed in duplicate at the gasholder manufactory, before the order is given. They are oil-painted white, numbered in red, and are thus distinguished from the actual plates themselves. The crowns of large gasholders may all be designed and cut out to a spherical surface of fixed radius, and for this reason the same templates will serve for all diameters. The last ring only, which is connected to the angle-iron, will require to be adjusted to suit the diameter. A radius of 200 mètres (650 feet) will suit all gasholders from 20 to 60 mètres (65 to 200 feet) in diameter. Below 20 mètres, it is necessary to diminish the radius, in order to increase the sphericity; above 60 mètres, the sphericity may be diminished, in order to reduce the useless volume of the crown, and the expense to which it gives rise.

The duplicate series of templates are preserved at the workshop, and are marked, divided off, and punched with the greatest care, in order to serve for marking the plates to be worked up. The best way of doing this is by a punch which has the diameter of the hole, and which carries at its centre a short blunt point, sufficient to produce an appreciable mark with a slight stroke of a hammer.

The punch of the punching-machine carries a similar point, which the workman causes to coincide with the mark made on the plate.

Punching the Plates.—Punching-machines which ensure perfect accuracy, whether in the alignment of the holes or in their spacing, will answer well enough for the side plates, and for the two straight lines of each crown plate; but the punching of the holes for the circular joints of the crown plates ought to be done by hand.

Flattening.—When the plates arrive at the gasholder factory, they are flattened by hammering on thick cast-iron anvil-tables.

After this they are marked and punched, and then the side plates are curved; making the curvature a little greater than is necessary, as the transport and manipulation tend to flatten them again.

Rivetting.—In spite of the care with which these directions may be followed, it may happen that the holes do not exactly correspond,

and that the steel drift tool, passed in before the rivet, will not make them coincide. This defect should be corrected by the malleability of the rivet. The rivets ought to be made from iron which is very malleable, and may be hammered cold into irregular shapes. Swedish iron is the best for this purpose, and when it is considered how small a proportion the rivets form of the cost of a gasholder, there should be no hesitation in using the best possible.

Angle-Irons.—These are of rolled iron, and should be punched and bent by machinery. The curvature may be given by hand, by blows with the hammer, but this plan is costly and defective. The Parisian Company have had a special machine made for the purpose, something like that used for bending wheel tyres; but differing in that the rollers have grooves corresponding to every class of angle-iron used. The large angle-iron of 104° is bent by this machine.

Erection.—All the parts of the bell of a gasholder ought to be put together at the manufactory, piece by piece. Work in sections—i.e., the junction of several sheets together—leads to objectionable defects in shape. Perfect form can only be obtained by every sheet being prepared at the workshop.

Further, the rivetting ought not to be begun till three rows of sheets at least are put together. Little bolts, having nuts with ears, ought to be used on this temporary fitting.

The play which exists in a mass composed of such a large number of pieces renders it possible to bring accurately to their places the sheets in which the holes have been previously made to carry the frames of the guide-rollers. Of course, the bottom angle-iron and the first row of sheets must be correctly placed in their proper positions.

The diameter ought to be accurately obtained by putting the whole of the circumference together at once, and should not be deduced by offering them together in separate portions. If, on beginning the erection, any correction is necessary to one of the pieces of the base, it should be done without hesitation, rather than alter the proportions which have served for the design of the whole structure.

The interposition of paper or of paint in the joints is not necessary; a well-executed work can and ought to dispense with this contrivance, which, after all, only assures the tightness of the joint in the first instance, and which may subsequently lead to disastrous consequences. The oxidation of the metal in the joints (which are not so close as to exclude the water) will complete the tightness, which may not have been produced by the rivetting.

During the erection of the crown the sheets that are put together before rivetting are supported by stays fixed to the planking. They may be multiplied, if necessary, taking care not to overload the timber in any one place. This accidental load, however, although temporary, may possibly attain a large amount, and it demands the use of framing and planking sufficiently strong to withstand it.

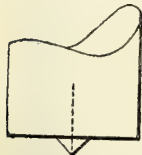
(To be continued.)

REDUCTION IN THE PRICE OF GAS.—The directors of the Scarborough Company have announced a reduction in the price of gas to 4s. 2d. per 1000 cubic feet, the reduced price to commence from the 1st inst.

TESTIMONIAL TO MR. JAMES WATSON.—On Wednesday last, Jan. 10, at noon, Mr. Henry Robus, the foreman, and all the workmen who could conveniently be present, went through the pleasing ceremony of presenting a splendid testimonial to James Watson, Esq., late engineer and manager of the Crystal Palace District Gas-Works, at his residence, adjacent to the works, Lower Sydenham. The testimonial consisted of a handsome silver bread-basket and kettle, with stand and spirit-lamp affixed, bearing suitable inscriptions, with an address expressing their heartfelt sympathy for him in his affliction, and their deep regret that he had to resign his appointment through ill-health.

LLANDAFF WATER SUPPLY.—At the monthly meeting of the Cardiff Rural Sanitary Authority on the 10th inst., Mr. South, the engineer for the Cardiff Water-Works Company, laid before the board a plan by which it was proposed to supply the city of Llandaff with water. The water would be pumped from the river Ely into a reservoir some feet higher than the houses in the city, and then it would be conveyed there by means of about a mile of earthen pipes. They were willing to carry out the work, provided that the authority would guarantee them a rental of £400 per year for seven years. At the expiration of that time the water-works company would take the water supply in their own hands, and depend on the income they would receive from the water-rents collected in the city. The plan was generally approved of, and Mr. South was requested to formally prepare the agreement, and submit it to the next meeting.

BARBADOES GAS COMPANY.—The *Barbadoes Globe*, of the 21st ult., in its account of the Agricultural Society's Annual Exhibition during the previous week, remarks that "Mr. Moorhouse, the enterprising manager of the gas-works, occupied a department of the hall with some models of gas-fittings and meters, and exhibited a stove of his own invention. There was also a display of manures from refuse lime, and used in gas manufacture, which is worth the attention of the planter. This department formed an attractive feature in the Exhibition. There were some prodigious beans, grown in the yard of the gas company's works, in Bay Street—a good specimen of the nutritive properties of the manures from gas manufacture refuse, which the manager desires to introduce to the notice of the planters." The *West Indian*, also speaking of the Exhibition, says: "The chief novelty and a centre of attraction was the corner appropriated to the exhibition of gas, and occupied by the Barbadoes Gas Company, represented by their engineer, Mr. R. K. Moorhouse. It consisted of various articles of interest to all classes, both young and old. First was the 'Model Parlour Gas-Stove,' illustrating the combustion of gas at a moderate heat. Then came the mechanism of dry and wet consumers meters in glass cases, which, when at work, drew a crowd of admiring spectators. The art in works of brass—by Messrs. W. Blews and Sons, of England and Moscow—was favourably displayed. Punch smoking a cigar, and a prancing horse, driving out sparks of fire from its nostrils, were a special attraction and treat for the young folks. An experimental meter with clockwork—a piece of perfect workmanship, was calculated to afford information concerning the mode of measuring the consumption of gas. The excellent quality of coke, and tar and other products, were objects to the planters and others for their practical uses. As there were no prizes offered for this class of products, the judges unanimously made 'honourable mention' of them."



Correspondence.

PRICE OF GAS AT PRESTON.

SIR,—Allow me to call your attention to an error in your JOURNAL of the 9th inst.

In alluding to the price of gas at Preston, in your "Circular to Gas Companies" you say, "The company have now resolved to reduce the price to 3s. 9d. per 1000 feet, allowing the same discounts, which makes the cost 3s. 6½d. for small, and 3s. 4d. for large consumers." These prices ought to be 3s. 2½d. and 3s., as you will see, if you take off the discounts of 15 per cent. and 20 per cent. The last prices before the reduction were 3s. 6½d. and 3s. 4d.

HENRY GREEN,
Gas-Works, Preston, Jan. 12, 1877. Engineer and Secretary.

BUENOS AYRES GAS SUPPLY.

SIR,—Respecting the paragraph, under above heading, in your number of the 9th inst., I beg to say that the "Mutual," alias "Buenos Ayres Gas Company, Limited," having given, and continued giving, credit, knowing the Municipality to be insolvent, they are not, I think, entitled to recover till the old company have been paid in full. The *Buenos Ayres Standard* of the 31st of October says:—

"The final collapse of the Municipality is the talk on 'Change. For many years this corporation has been embarrassed, and struggling with difficulties, which no meeting of creditors, no arrangement with creditors, no loans from bank, Government, or Legislature, could overcome, and the drop scene fell on Tuesday, when the bailiffs from the court entered with an execution in their pockets for 20,000 dols. m/c, with the court order to embargo the very cash in the municipal office. The assembled municipales, with breathless astonishment, heard the order of the court read, and refused, unless force were used, to give up what they termed public money; recurrence was then made to the court for public force, and to-day the bailiffs, with policemen and soldiers, seize the municipal cash-box of this city. In presence of such a judicial indignity, the municipal members have determined to lock up the premises and send the keys to the Government, but all this will not save them; the embargo must be carried out. Let us all admit that this monstrous municipal humiliation is a blessing in disguise, and from the tablets of Buenos Ayres let the name 'Municipality' be forever effaced; could we even blot from memory the very recollection of this board, so best. But, unhappily, the citizens will, for one, or two, or three generations to come, have the most unpleasant reminiscences of this most desperately effete board, in the shape of debts piled upon debts, bonds, mortgage coupons, claims, executions, protests, and all the records of a bankrupt board. Nine years ago we advocated the closing up of this board, and the Municipality took an action against us, but the *Standard* gained. Had we succeeded, however, in shutting up the board, then millions would have been saved to the citizens of Buenos Ayres."

LOUIS WILDE,

Agent for the Buenos Ayres Gas Company.

4, Cable Street, Liverpool, Jan. 13, 1877.

GOATS ON ASS-MAKING.

A correspondent, who signs himself "Billy-Goats," sends us the following notes:—

ON NAPHTHALINE.—This is the *pons asinorum* of the gas manager. The cause of its production is not very clear, notwithstanding the fact of its being a crystalline substance; but when it does make its appearance it is *thar*.

The name is probably derived from Naphthali, one of the sons of Jacob; indeed, it is said by some to be the "geist" (gas), or spirit, of that lost tribe. We are inclined to give full credence to this alleged derivation, from the fact of naphthaline being a kind of *wandering dew* that settles in odd corners, growing rich and amassing substance at the expense of its neighbours.

Naphthaline is often deposited on any roughnesses in the main—entirely blocking up the passage at times. When this is the case, naphthaline may be said to rule the main; this may be considered a new version of the old mythological saw, "Neptune rules the main."

Naphthaline is also frequently to be found at or near a joint or an elbow. The greatest Nap of the family that bears that name once found himself at *Elba*, and it was unfortunate for him that he did not remain there.

Naphtha (first cousin to the other) dissolves naphthaline; but a gas rich in hydrocarbons prevents its deposition. The proper logical inference, then, for the gas manager is, "Look to the quality of your gas, and don't be caught napping."

ON KEEPING GAS IN CONTACT WITH TAR.—The ancient adage informs us that "we cannot touch pitch without being defiled." This ought to have occurred to the gas manager who first proposed the keeping of the gas in contact with the tar as long as possible. He deserves tarring and feathering for the oversight. However, he is (s)tarred already in the pages of a contemporary, the feathers being all monopolized by the artist who *plumes* himself on having exploded this other folly of the (g)ass fraternity.

ON THE PURIFICATION OF GAS FROM CARBONIC ACID.—There is a mine of wisdom in these old sayings, that gas managers would do well to fathom. "Take a hair of the dog that bit you," embodies the whole philosophy of the process of the removal of sulphide of carbon. It is the lime which has been fouled with sulphuretted hydrogen that takes out this latter impurity; but unless you first extract the carbonic acid, all your efforts to remove the sulphide of carbon will be of no avail—indeed, you will have more at the end than the beginning; it will crop up on its exit from the last purifier, like the clown at the pantomime, with "Here we are a gainer;" and pantaloons, the gas manager, will have to bear the brunt of all his mischievous tricks. Asinine as ever! You have looked upon the CO₂ as of no moment, although, of all the impurities, it is the one you have most need to get rid of.

BARTON LOCAL BOARD DISTRICT GAS SUPPLY.—At the meeting of the board on the 9th inst., at the offices, Patricott—Mr. Henry Leigh, J.P., presiding, the question of the gas supply was considered—and it was resolved that the clerk should write to the town clerk of Salford, and say that as the Corporation of Salford were not prepared to supply them with gas without going to a considerable outlay, the corporation should allow the board to make their own gas.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1877.

Memorials, complaining of non-compliance with the Standing Orders in the cases of the following petitions for Bills, were deposited in the Private Bill Office before the 9th of January:—

Bolton Improvement Bill from John Bromley and others.
Bristol District Water Bill from Bristol Water-Works Company.
Bromsgrove, Droitwich, and Redditch Water Bill from R. L. Freer and others.
East Worcestershire Water Bill from H. Hodson and others.
Limerick Gas Bill from Henry White and William Hanson.
North East Worcestershire Water Bill from A. Lucas and others.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, JAN. 11.

(Before Vice-Chancellor Bacon.)

THE CORPORATION OF BLACKBURN v. THE GUARDIANS OF BLACKBURN.
POLLUTION OF WATER AT BLACKBURN.

Mr. KAY, Q.C. (with whom was Mr. STIFF EVERITT) in this case moved for injunction to restrain the defendants, who are the rural sanitary authority of Blackburn, from causing or permitting, directly or indirectly, sewage or filthy water to flow into the natural stream or water-course, called Higher Croft Brook, or the Fish Moor reservoir of the plaintiffs, or any dyke or ditch communicating with them. The reservoir was the property of the plaintiffs, who, by certain local Acts, have the right and power to supply the town of Blackburn with water.

Mr. RIGBY, for the defendants, said that the nuisance was now abated, and his clients were in a position to give an undertaking to continue the abatement. Under those circumstances he did not think there was any necessity for an injunction.

Mr. KAY saying that an undertaking did not run with the land, and that the persons who gave a personal application would in time die,

His Lordship granted the injunction in the terms asked for, with the costs of suit.

WARWICKSHIRE QUARTER SESSIONS.—WEDNESDAY, JAN. 3.

(Before Mr. W. DICKENS, Chairman; and Messrs. CALDECOTT, P. DICKENS, and SALE.)

THE CORPORATION OF BIRMINGHAM, Appellants, v. THE PARISH OF SHUSTOKE, Respondents.

RATING OF THE BIRMINGHAM CORPORATION WATER-WORKS.

Mr. A. YOUNG, Mr. COLMORE, and Mr. GRIFFITHS appeared for the appellants; Mr. DUGDALE, Mr. SODEN, and Mr. FITZGERALD for the respondents.

Mr. DUGDALE, in opening the case for the respondents, said this was an appeal by the Corporation of Birmingham, as proprietors of the water-works for supplying that town, against the assessment of their reservoirs, filter-beds, engine-houses, and other premises situated near Whitacre Junction, in the parish of Shustoke. These covered an area reckoned at about 30 acres, the gross estimated rental being taken at £5350, and the net rateable value at £4280. These works were constructed on the most approved principles, with the very finest machinery, under the powers of the Birmingham Water Act of 1870. They were constructed by the Birmingham Water-Works Company, from whom they had been acquired by the corporation. There were two magnificent engines, perhaps two of the finest in England, each capable of pumping four millions of gallons of water per day. There was a reservoir of 10 acres, which was embanked all round, and lined with concrete, and there were six or seven large and admirably-constructed filter-beds. The works were about the best specimens of water-works that could be found in England. There were also, in the parish with respect to which the rate was laid, 39 chains 77 links of inlet-mains, 4 feet in diameter, by which the water was conducted from the river Blythe to the reservoir and filter-beds, and about 71 chains of outlet-mains, 3 feet in diameter, by which the water was pumped up to Birmingham. The land was rated not only as land, but for the water upon it, by which its value was enhanced. The works were not finished until late in 1875 or early in 1876, and it was not until then the parish officials took steps with regard to making an assessment upon the works. The corporation did not object to the first rate; but upon that fact he would not place much stress, as they and the company were busily engaged at the time promoting a bill in Parliament for transferring the works to the corporation. A new valuation of the property in the Union of Meriden, where this property was situated, was ordered in 1875. In March of that year, Mr. Cooper, valuer, of Birmingham, who had been employed to value the works at Aston, was employed to make a valuation of these works. He made an estimate accordingly, and 5 per cent. of that sum was given by him as the gross rental, and 4 per cent. as the rateable value. The value of the property he made out to be £150,689 12s. 4d., and after making certain deductions, he calculated upon that basis the value of the property as rateable. After this Mr. Cooper placed himself in communication with Messrs. Fowler and Son, auctioneers and valuers, of Birmingham, who acted for the appellants, and who in the course of some letters (which were read) said he considered the estimates too high. After this, of course, he (Mr. Dugdale) must throw Mr. Cooper over. The question was how could the Court arrive at the value of the works. What would a tenant give for them, with their capacity for supplying water to Birmingham? Surveyors were usually employed to make estimates of the value of such property. Property of the kind was always subject to be altered by circumstances, and, consequently, no royal road for arriving at the value of any hereditament of the kind could be laid down. The superior courts of law and Parliament had refused to lay down any such road, and, consequently, the sessions had to find the value. In this case, however, there was a circumstance which would far outweigh the evidence of any valuer. It so happened that the value had been determined by the appellants themselves. They, in 1875, went to Parliament for a bill to buy the whole of the undertaking of the Birmingham Water-Works Company, and he believed the result was that the corporation gave water annuities for the maximum dividend, payable on the capital called up by the company. If the Court, then, could find out, at any rate approximately, what was the amount of the capital of the company which was due to these water-works, they had a very easy mode of determining what the appellants themselves considered to be their annual value. Up to 1870 they had raised £420,000 of capital, carrying 8 per cent. interest. He believed in 1866 the company were allowed to raise £336,000 capital, at 7 per cent. interest. The £420,000 was all spent in 1870. When they got the amount of capital expended by the company on these works, and took it at 7 per cent., the rate of annuity paid by the corporation, they would find what the appellants considered to be the real value of the place. The Shustoke works were an integral part of the valuable works of the company. If, therefore, they took 7 per cent. on the amount of the capital spent on

these works, they would be doing a very handsome thing, as they really ought to rate the appellants at a great deal more. In order to do this they would have to find out how much of the capital had been sunk in these works, and they could only do that from the books. These annuities were in the nature of a perpetual rent, and the corporation paid so much as perpetual rent for the works. What was the difference, in a case of this kind, between a perpetual rent and what a tenant would give? If anything, it was in favour of the corporation, because the works were increasing in value year by year. Every year the demand for water in Birmingham was increasing, and every year the corporation had to increase their capacity for supplying water. Therefore he submitted that this part of the undertaking was one of the most valuable parts of the works of the corporation, and that the perpetual rent which they agreed to pay in 1875 was not likely to be diminished by a tenant, but increased. Taking the appellants own figures—Mr. Fowler's figures—the sum of £76,515 19s. 5d. was the amount spent on the works; and that, at 7 per cent., gave £5235, which would more than support the rate. This £5235 was what he should call the net rent, because the appellants gave it, themselves paying all expenses of working and maintenance, and all the money necessary for keeping the hereditament in a state to command the rent. The principle he had spoken of, he submitted, would outweigh the theoretical calculations of any and every surveyor in England. It might be that the rent paid was too little, but of course the Assessment Committee were bound to look at the actual value of the premises. What, however, could be better evidence than the fact that the appellants themselves had given it so very short a time ago? It was eminently fair to take it as the value, because the corporation had splendid works. They had been enabled during the last half year, so prosperous were they, to pay all the water-works annuities, and they had a small surplus. They therefore got the immense amount of water the town required for nothing. If that was not a sagacious and prudent purchase, he did not know what was. He expected nothing else when he knew that the two gentlemen most prominent in the negotiations were Mr. Chamberlain, M.P., and Alderman Avery. They had previously purchased the gas-works, and they were conducted so sensibly that in the first year a profit of £30,000 was made, and the price of gas reduced. If he might pay a tribute to Mr. Chamberlain, he should say he was a Liberal in politics and a Conservative in finance. Alderman Avery was no less sagacious in financial matters, and he would show, from a speech made by that gentleman, that he had congratulated the town on the acquisition of these works. He might also call attention to the fact, as a further proof of the value of the property, that on the land upon which the reservoir and filter-beds were constructed there were all the materials—clay, sand, and gravel—required. Moreover, under the Act of 1875, the corporation could supply water for the Local Boards of Aston and Handsworth, and yet they do no works for these purposes on which the local boards did not pay interest at 6 per cent., so the corporation valued their property at that rate themselves. The profit of the whole undertaking for the last half year amounted, according to the report of the Water-Works Committee, to £47,712 for payment of the annuities, and £7950 for interest on mortgages for the year. So the appellants were making £55,000 a year, while their total rateable value was only £23,000. In fact, he believed the appellants were underrated, and he trusted the Court would think it was quite clear, not only that they were not over-rated, but that the respondents had more than amply supported their rate.

Mr. Arthur Seymour, examined by Mr. SODEN, said in January, 1875, the Assessment Committee of the union which included the parish of Shustoke decided that a new valuation of the property of the union should be made. In March of that year Mr. Cooper, who had valued the water-works at Aston, was appointed valuer to assist the overseers in making the valuation of the works. On the 3rd of August the overseers brought in a draft of the valuation list, in which the works were valued at a gross rental of £6786, and the net rateable value at £5420. Subsequently the overseers found that two cottages had been included, and the figures were altered to £6740 gross value, and £5392 net rateable value. On the 12th of July the rate was made on the latter amount, and he heard nothing more of the matter until he received a letter from Mr. Fowler on the 24th of February. The Assessment Committee gave Mr. Cooper no authority to place himself in communication with Mr. Fowler. Mr. Fowler and Mr. Cooper attended a meeting of the committee on the 29th of February, and after that a number of letters were written from one to the other. The committee decided, at an adjourned meeting, not to disturb the estimate. He wrote to Mr. Fowler, asking for further information, which was declined. Mr. Cooper's reason for making a reduction in the rateable value was stated, in a letter to him, to be that some of the mains outside were included in his original estimate. He had had a correspondence with Mr. Hayes, the town-clerk, asking for information as to the value of the property, but had failed to get what he required.

Mr. W. Starkey, examined by Mr. DUGDALE, said he was secretary of the Birmingham Water Company for 22 years, and still retained the office under the corporation. He produced the books containing the amount of the cost of the works included under the Act of 1870. [Witness was examined at some length upon the accounts, and, as it appeared certain that the case could not be concluded that day, an adjournment was agreed upon until the Friday. It was further resolved that Mr. Castle, of Chancery Lane, London, valuer on behalf of the respondents, and Mr. Hedley, of Sunderland, on behalf of the appellants, should examine the books at the water-works offices, on the following morning, so as to be able to give evidence concerning them.]

FRIDAY, JAN. 5.

At the sitting of the Court,

The CHAIRMAN inquired whether there was any principle upon which they were agreed.

Mr. DUGDALE: We cannot agree upon any principle, because there is not one.

Mr. YOUNG: I do not agree to that. There is an admirable principle. It is that of *The West Middlesex Water Company v. The Parish of Hampton*. The whole principle is there, and I intend to bring my case within it.

Mr. DUGDALE: My case is within it. The question is what a tenant from year to year would give.

The CHAIRMAN: I did not know whether you might have taken the original outlay as the basis of the valuation.

Mr. YOUNG: Mr. Castle and Mr. Hedley have gone through the books, and they have agreed on the outlay.

Mr. DUGDALE: A great deal of time has been saved, but we cannot agree as to the per centage which is to be put on.

The CHAIRMAN: Do you agree upon the basis on which the per centage is to be calculated?

Mr. YOUNG: No.

The CHAIRMAN: If you had agreed to anything we would get to the point at once.

Mr. YOUNG: My friend himself put forward three suggestive principles, and as I do not know upon which he means to rely, I cannot agree with him at present.

Mr. Henry J. Castle, examined by Mr. DUGDALE, said he was senior partner in the firm of Castle and Son, of Chancery Lane, London, and had had 36 years experience in valuing land, railways, water-works, &c., for rating purposes. On the previous day he and Mr. Hedley visited the offices of the water-works at Birmingham, and went through the books. The result was that they had agreed upon the following joint report:—

Birmingham Water-Works Appeal.

In accordance with the agreement made on Wednesday, we met at the Birmingham Water-Works Offices, Broad Street, yesterday morning, and examined the books of accounts containing the entries of the amounts paid for the water-works at Shustoke and Whitacre. We also examined the deeds conveying the lands purchased for the said works, and we annex the several particulars.

1. Total expenditure in respect of the whole works. 2. The area and expenditure for the lands purchased. 3. The area of the land occupied by the works in the parish of Shustoke, and the capital expended in the parish of Shustoke upon such works. 4. And the accounts paid for law charges and compensation.

We had every facility afforded us by the appellants officers, Messrs. Gray and Starkey, and the fullest explanation was given upon all points.

(Signed)

THOS. F. HEDLEY, for the Appellants.
J. H. CASTLE, for the Respondents.

The first schedule upon which they were agreed was one showing that the total expenditure in the parishes, professional charges, compensation, &c., down to the 31st of December, 1875, was £157,175 4s. 4d. Included in this was the sum of £11,830 7s. 1d. for mains, which consisted of 1000 yards of 48-inch mains, and 1500 yards of 36-inch. The area of land occupied by the works was 30 acres 26 poles, and the capital expended on that land in the parish of Shustoke amounted to £71,482 17s. 5d. The site of the works consisted of two properties—one, 14 acres 3 roods 22 poles, bought of Mr. Dugdale, which he valued at £11,477; and the other, 15 acres 1 rood 4 poles purchased of Mr. Salmon, which he valued at £2030, making a total £13,507. For way-leave, or the privilege of laying pipes through the land of Mr. Coxall, was paid £150. These sums added together made a total of £85,140. He did not find anywhere in the books the amount expended for architects or engineer superintendent. He presumed that the officers of the company undertook these duties in addition to their own, and he had, as usual, allowed 5 per cent. upon the total cost of the works, £71,482 17s. 5d., for this commission, which amounted to £3574. He then added another item of 10 per cent., because the works were constructed at a favourable time, under favourable circumstances, when material and labour were cheap, and a saving to that amount was effected.

The CHAIRMAN did not think the amount could be included, as the money had never been spent.

Witness said he had always been accustomed to do this in cases where the building contracts had been of a favourable nature.

Mr. DUGDALE: Did you find that the works were constructed under such exceptional advantages, that they had all the materials on the spot for the construction of reservoirs and filter-beds, and did not have to bring or carry from anywhere else this material? Do you mean that a reduction should be made on that account?

Witness: No; I think that was one reason the company gave so much for the land.

Mr. DUGDALE: The witness says an addition should be made to the actual outlay, because the contracts were so exceptionally cheap.

Examination continued: The 10 per cent. upon £71,482 would be £7148, which, added to the figure already given, would make a total of £96,062. He should say that a landlord who expended that amount of money upon building would expect from the tenant a yearly net rental of £4843.

The CHAIRMAN: That is about the rateable value as according to the respondents.

Mr. DUGDALE: It is more than the rateable value.

Witness said the sum he had mentioned was 5 per cent. net on the fair outlay. The gross estimated rental would be £5811, which would be the rent paid by the tenant if the landlord had to do the repairs.

Cross-examined by Mr. YOUNG, witness said the principle upon which he always acted in making estimates of the rental of railways and water-works was to take a per centage upon the total fair outlay. The per centage he had always allowed on the expenditure as the rateable value was 5 per cent., except on one occasion in London, when for one year the per centage was put down at 4 per cent. The original practice of allowing 5 per cent. had since been returned to. He valued the St. Pancras Station; indeed, he valued all the railway stations in London, and he did not remember that he deducted a large amount from the total outlay on the ground that part of the station was not used. He should certainly have made such a reduction if part of the station only were used. He went to Shustoke on the Wednesday before Christmas-day, and was there only two hours, for he could not find the place. He found there were two large filter-beds, which cost £5775, put down in the schedule, and as these had never been used, he should reduce the total by that amount. For the land not used he would not make any allowance, as by not using the land, they did not deprive themselves of all the advantages of site for the rest of the work. The sum of £1579 19s. 6d., which was for pipes which were bought and not laid down, should also be taken off the total, for such pipes should not be rated. He should not make any allowance because the works laid down were only used to a quarter of their capacity. He did not know that the agreement between Mr. Dugdale and the company for 50 acres of land at a cost of £18,500 included the cost of his opposition in Parliament, payment of his water rights, and compensation for other privileges.

Mr. YOUNG: You said you estimated the architect's fee at £3574; but if you knew that the sum paid was only £606, that sum would be considered correct?

Witness: If the architects had no assistance to do the work.

Mr. YOUNG: The architects were the eminent Birmingham firm of Martin and Chamberlain.

Witness said if they only received £616, they did their work very cheaply in Birmingham. The land of Mr. Solomon, for which £133 an acre was paid, adjoined the land of Mr. Dugdale, and he knew no reason why Mr. Dugdale's land should be worth £200, and that of Mr. Solomon only £133. He could not say whether the larger sum was paid as the costs of his opposition in Parliament.

Mr. DUGDALE proposed to put in evidence, as showing that the Blythe was in the manor of Blythe and parish of Shustoke, an ancient document found among the papers of Sir W. Dugdale, the historian. It recorded a suit between Sir W. Dugdale and the Vicar of Coleshill, described as a "proud and stomachful person," with reference to the right of the former to cut the bulrushes on an island in the river. Sir W. Dugdale won the suit, and carried off his bulrushes in triumph. He submitted that the document in question was evidence of repute.

Mr. YOUNG thought the document showed nothing, except that his friend's illustrious ancestor claimed the river. It might be admitted for what it was worth. He, however, had a document, in the shape of a deed, under which the water-works company purchased the land in question, in which the river was shown to be in the parish of Coleshill.

This was the case for the respondents.

Mr. YOUNG, in opening the case for the appellants, said he could not help thinking that the authorities of Meriden Union and the parish officers who had been in Court during the hearing of the case must long ago have

regretted having compelled the Corporation of Birmingham to bring the matter before the Court by way of appeal, and equally have regretted that they had ignored the agreement between Mr. Cooper and Mr. Fowler. Had they acted upon that agreement they might have had their rate of so much in the pound upon £3060, which was the amount agreed upon by them. He thought they would regret not having adopted that course, because he should be able to make out to the satisfaction of the Court that the rateable value of the property in question was considerably lower. Before dealing with the figures, he wished to refer, in a supplemental way, to the history of the water-works company, which the advocate for the respondents had somewhat extensively introduced into his case. He should only refer to it incidentally, and so far as it seemed to show very grave reason why the appellants should not be rated at the excessive amount at which the parish authorities desired to assess them. It appeared that the Water-Works Company, who transferred their powers to the Corporation of Birmingham in January, 1876, went to Parliament in 1866 for the purpose of obtaining additional powers. They obtained an Act that year, by virtue of which they were enabled to sink wells at Perry Barr, King's Vale, Sutton, Edgbaston, and one or two other places, from which sources they contemplated supplying the town of Birmingham with water, Parliament having stipulated that after the execution of the new works the company should discontinue their operations under a former Act obtained in 1826. The only reason why they went again to Parliament, in 1870, when they obtained the Act for constructing works at Whitacre and Shustoke was that during the sinking of the well at King's Vale, Mr. Gray, the company's engineer, discovered that some of the anticipations which had been made with reference to the wells, were not altogether well founded. Great trouble was met with in reference to the running sand and gravel, and as it was thought similar difficulties might arise in the case of the other wells, the company went to Parliament and obtained further powers for the construction of additional works at Shustoke. As was shown by the plan submitted to the Court, it was contemplated by the company, and was still in contemplation by the corporation, to construct the works for which powers were obtained in 1870, but in point of fact they had been only partially constructed, the large reservoir for water from the river Bourne being wholly untouched at the present time. He mentioned this to show, as had appeared from the evidence of Mr. Castle, which had been supported by Mr. Gray, that those large works were constructed with a view, not to existing requirements, but to what might be required in future. The works, under the Act of 1870, were very much larger than the demands of Birmingham at the present time required. They had constructed, first of all, a reservoir capable of containing 30 million gallons of water, the filter-beds numbered 1, 2, 3, 4, 5, which were only partially in operation at the present time, and also two large filter-beds which had never yet been used at all, and the construction of which ought not to be calculated in the outlay on the works, or considered in the question of rating. The company also put down plant, machinery, engines, and boilers, sufficient to supply a very much greater quantity of water than was contemplated to be supplied, in the present state of development of the scheme, under the Act of 1870. The result of all this was that the appellants had got filter-beds now in actual use, capable of filtering 7 million gallons of water per day. They had also constructed two filter-beds, which had never been used, capable of filtering 5 million gallons. They had also laid down plant and machinery which was capable of supplying to Birmingham 6 million gallons of water per day, and they had laid down mains capable of conveying into Birmingham 12 million gallons a day, only in anticipation of the development of the scheme of water supply, which was in view when the Act of 1870 was obtained. Although they had all this extensive plant, the company and the corporation had not, from first to last, supplied Birmingham at any time with more than an average quantity of 2 million gallons. When Mr. Castle was in the box, and estimated the outlay on the works at £71,000, he (Mr. Young) asked whether in his opinion some deduction ought not to be made from the rateable value for the unemployed capacity of the works, and Mr. Castle replied that in his judgment it ought to be so. Of course it would be a matter for the consideration of the Court how far this was an element in the question before them. Mr. Gray would tell them that works capable of supplying 2 million gallons a day could have been constructed for an expenditure of £25,000. He could not help thinking that if the corporation had been desirous of contesting this matter on their strictest rights, and without any consideration for the agreement come to by Mr. Fowler with Mr. Cooper, they might have asked to be rated, not upon the basis of £75,000, but upon £25,000. He would say at once, however, that he was not going to ask the Court to take its stand upon that figure, but upon the actual outlay by the water-works company, now represented by the corporation. He thought he should be able to show that the figures he was about to lay before them were the correct figures; and if that were so, the only question of contest would be what they were to take as the per centage on that expenditure; whether it should be 5 per cent., as the respondents contended, or 4 per cent., as urged by the appellants. He now came to the rate of October, 1875. That rate was made upon inaccurate data. Mr. Cooper, who made out the valuation list for the rating authorities, went to the offices of the water-works company, and asked what was the outlay upon the works. The person who gave him the figures appeared to be under the impression that Mr. Cooper wanted the outlay not in Shustoke parish only, but at Shustoke and Whitacre, including the land for the large reservoir not yet constructed, and the figures accordingly given to him were £150,869 12s. 4d. It was now admitted that this was inaccurate, but it was upon this that Mr. Cooper acted in making the assessment for the October rate. Mr. Cooper appeared to have discovered afterwards that it was an error, and reduced the figures to £135,869. That, however, was equally erroneous. The figure which Mr. Cooper ought to have had was the actual outlay on the works in Shustoke, which was £71,000 odd. The assessment for the October rate was made at 4 cent. upon £135,869; and upon receiving notice of it the corporation instructed Mr. Fowler, their surveyor for the water-works, to put himself in communication with the person who was supposed to be authorized to make the valuation list. Mr. Fowler entered into negotiations; but it turned out that Mr. Cooper was not authorized. Mr. Cooper, however, thought that he was, and agreed with Mr. Fowler to the correction of the valuation. He asked Mr. Fowler for some figures to lay before the Assessment Committee for the purpose of justifying himself. Mr. Fowler then handed him some figures, amounting to £75,000 odd, which again were erroneous, upon the basis of which it was agreed to reduce the assessment from £6000 odd gross rental and £5000 rateable value to £4000 odd gross rental and £3060 rateable value. Owing to these negotiations the time for appealing against the October rate went by, and the corporation paid without prejudice the amount with which they were charged. Next came the rate of July, 1876, against which the present appeal was made. The appellants property was described in the assessment as "Reservoir, filter-beds, engine-house, and works, near Whitacre Junction, 30 acres, £5350 gross estimated rental, £4280 rateable value," and then £21 was added for the cottages and sporting right. This assessment was not made upon any figures of Mr. Cooper's, nor upon the £71,000 supplied as being the accurate figure, but at a valuation of £107,811 12s., upon which 5, not 4, per cent. was taken in arriving at the assessment. The figures of the respon-

dents had not been supported by the evidence of any of their witnesses, although it had been attempted to be defended by the ingenuity of Mr. Dugdale. Even upon the figures of Mr. Castle, the assessment ought to be very much lower than it was. It was evident from Mr. Castle's evidence that the true principle on which the rate should be based was to ascertain the expenditure upon the land and works, and take a per centage on that expenditure as the rateable value. The witnesses for the appellants would tell the Court that this principle was right; but they would say that the per centage taken should be 4 per cent., and not 5, as urged by Mr. Castle. The theory of Mr. Dugdale of taking a proportionate part of the profits of the corporation on the whole of their works as a basis of valuation was utterly fallacious and repugnant to law. The case of *The West Middlesex Water-Works Company v. The Overseers of Hampton*, in the Queen's Bench Reports, was one on all fours with the present, and in that case it was clearly laid down that the Court were not to rate the works—which were situated in a parish where the water was not being sold—upon the profits obtained elsewhere. They were to take them as land covered with buildings, which had an enhanced value from its application and use for water-works. In *Shustoke* the land was purely agricultural, and not worth more than £2 an acre to let, and as soon as the water-works were made it had an additional value; but they were not entitled to arrive at that value by inquiring into the profits obtained elsewhere. His friend asked them to say the land had an enhanced value because the water was found in the parish of Shustoke, and not in the parish of Coleshill; but a portion of the valuable old record he put in said that, although the parishes were divided by the river Blythe, the lordships were not. That showed what a weak bullrush his friend had relied on. There was no doubt that the water was obtained from the parish of Coleshill, and if anybody was entitled to advantage from that, the inhabitants of Coleshill were. In the *Amwell* case, which had been referred to, the water was derived from wells which were in the parish of Amwell; whereas in this the water was derived from the river Blythe, which was not in the parish of Shustoke, but in Coleshill. In the *Amwell* case the water bubbling up in the wells might be considered as fixed capital in the soil; but even if the Blythe were in Shustoke, it had been established by the case of the *Tallaglog Mining Company v. St. Asaph's Union* (3 Q. B., 478) that the right to take water from a running stream was a mere easement, and not the subject of a rate at all. Upon the principle of finding the value of the land and its fixed capital, and taking a per centage upon them, he would show the Court what the amount of the assessment ought to be. The first figure he took was the total outlay on the works, as in the accounts prepared between Mr. Castle and Mr. Hedley—namely, £71,482 17s. 5d. In cross-examination Mr. Castle had admitted that there ought to be deducted from this £5775 in respect of the two filter-beds not used, and £1575 for mains which were not laid when the rate was made. Deducting these amounts, there was left £64,132 17s. 5d. as the admitted expenditure on the works at Shustoke. To this had to be added the cost of the land. The land purchased for the works from Mr. Dugdale was 50 acres, of which 14 acres 3 rods 22 perches were in the parish of Shustoke. The total amount paid by the company for the 50 acres was £18,500; but Mr. Castle put down as the value of the 14 acres odd in the parish of Shustoke £11,477. How on earth such a calculation was arrived at surpassed comprehension. The value ought to be put down at the sum of £200 per acre, and even that, in comparison with other land in the neighbourhood, was an excessive price. As the appellants desired to be liberal they would put it down at £200 per acre, which would give, in round numbers, £2800 as the value of the land in the parish of Shustoke. Add to this £150 for way-leave, £2030 the price of the land purchased from Mr. Salmon, and it gave £69,312 17s. 5d. as actual cost to the water-works company of the land and works. Upon that sum a per centage of even 5 per cent. would only give a rateable value of £3465, as against Mr. Castle's £4843. Taking, however, 4 per cent. as the right principle, and the one which was adopted by the overseers in their previous assessment, it would give a rateable value of £2772, at which amount he asked the Court to fix it at.

Mr. John W. Gray, examined by Mr. Young, said he was the water-works engineer of the Corporation of Birmingham. He was appointed in 1866 engineer to the Birmingham Water-Works Company, and in that year the company had a bill before Parliament for an extension of their powers. This bill gave them power to sink wells at Aston, Perry, Erdington, Edgbaston, and other places. The company proceeded at once to sink a well at Aston, and another at Kingsvale. They did not obtain from these wells the water they expected, and he recommended the company to go again for additional powers. They obtained the Act of 1870, and the works at Shustoke were commenced at the beginning of 1871. In his judgment a sufficient expenditure to convey 2 million gallons from that place would be under £25,000. It was part of a complete scheme of water supply that the works at Shustoke were made so extensive, but it was afterwards found that the supply from the wells was more favourable than it was supposed would be the case. The water supplied from the Blythe had not, on the average, exceeded 1½ million gallons per day. The water was drawn from the river within a few hundred yards of the junction of the Blythe and the Cole, within the parish of Coleshill. No water was drawn from the Blythe in the parish of Shustoke. The reservoirs and filter-beds were constructed to supply 7 million gallons per day, but the requirement was not more than the quantity he had mentioned. The two engines were each capable of sending into Birmingham 3 million gallons per day. The works had been constructed with a view to the future development of the system of water supply, and not for present requirements only. The corporation had adequate means at present of supplying the town of Birmingham with water without using the Shustoke works at all.

Cross-examined by Mr. DUGDALE, witness said the company went for additional powers in 1870, because they were forced to abandon the Tame supply. The water flowing from the river into the reservoir was, when necessary, shut off at the reservoir, and not at the mouth of the pipe. Before the works were turned over to the corporation, about two-thirds only of the inhabitants were supplied with water. The remainder of the population were supplied from wells, many of which the corporation had now closed under the Public Health Act, and the persons formerly using them were now supplied with water-works water. He had no idea of the increased consumption caused by this alteration. Messrs. Martin and Chamberlain were applied to only for the buildings, and he (witness) designed the engines, and reservoirs, and works, all of which were constructed under his supervision. The cost of the buildings designed by Messrs. Martin and Chamberlain was £12,000, and the sum they were paid, £600, was 5 per cent. on that amount. He supposed the company saved the commission on the other portions of the work which he designed and superintended.

In re-examination, witness said the Blythe was tapped nowhere but in the parish of Coleshill.

SATURDAY, JAN. 6.

Mr. William Fowler, examined by Mr. Young, said he was the principal partner in the firm of William Fowler and Sons, surveyors and land agents, Waterloo Street, Birmingham. He stated that he had had 40 years experience as a surveyor in rating questions, and had been extensively engaged in the rating of canals, gas-works, water-works, &c. He was surveyor to

the Birmingham Water-Works Company from 1854, until the transfer of the powers of the company to the Corporation of Birmingham, since which time he had been surveyor to the corporation in respect of the water-works department. He recollected the rate made on the water-works property in Oct. 1875. Mr. Cooper, a surveyor of some eminence at Sutton Coldfield, was employed by the parish authorities to make the valuation list, on which the October rate was based. The amount took the corporation by surprise. Knowing that there was some grievous mistake, he saw Mr. Cooper, and told him of it. Mr. Cooper said if there was a mistake it should be rectified. Witness gathered from what Mr. Cooper said that he had been down to the water-works, and asked to be supplied with the cost of the erection of the works, and he had been supplied with the sum of £157,175 4s. 4d. That was the cost of the works in the whole of the seven parishes, and had been supplied to him, in error, as the cost of the works in the Shustoke parish only, which was what he wanted to know. It was upon that he made his valuation charge. Witness supplied Mr. Cooper with the information he required—namely, the cost of the works in the Shustoke parish—£71,482 17s. 5d. Upon the matter being explained, Mr. Cooper accepted that as the correct amount. The sum first given to Mr. Cooper by witness was £76,000 odd, but that turned out to be an incorrect sum, in consequence of some cottages having been erroneously included, and the £71,000 odd was finally accepted as the correct sum. In the first sum he included the cost of the mains laid after the passing of the rate, which was £1579 19s. 6d.; and £5575, the cost of the two unused filter-beds, which, with the cottages, made the difference between the £76,000 odd first given, and the £71,000 odd finally accepted. He found that Mr. Cooper had proceeded to make the assessment by putting the gross at 5 per cent., and the rateable value at 4 per cent. upon the estimated cost of the works. To that principle witness did not object, and he believed at the time that Mr. Cooper was perfectly authorized to enter into this arrangement on behalf of the Assessment Committee of the Meriden Union. When he afterwards discovered that the Assessment Committee ignored what Mr. Cooper had done, witness was taken entirely by surprise.

The CHAIRMAN said he doubted whether the filter-beds ought to be deducted.

Mr. YOUNG said the only filter-beds they asked to be deducted were two which had never yet been used, and which could not be used until the large reservoir was constructed. They were made while the contractors were on the premises with their material and plant, which it was thought would save a considerable sum. He was not going to deny but that if these beds had been used the corporation would have been liable to be rated in a sum, but as they had never yet been used, he denied that they should be rated beyond the mere agricultural value of the land.

Witness said he had seen the valuation list upon which the rate of the 12th of July, now in issue, was based, and he had heard from Mr. Seymour, the clerk to the Assessment Committee, that it was based upon £107,000 odd. Upon examination of the valuation list, he found that the Assessment Committee had adopted, in that rate, the principle of assessment upon which he and Mr. Cooper had agreed—namely, 5 per cent. upon the cost as the gross value, and 4 per cent. upon the cost as the rateable value of the property. That principle he regarded as the right one. In point of fact, the only error in the assessment was that the committee had taken £107,000 odd as the cost of the works in Shustoke parish; this, the initial figure, was wrong, but the principle of 5 per cent. and 4 per cent. for the gross and the rateable values was right. He agreed that the figures elicited in the course of this trial—£69,312 17s. 5d.—represented the proper amount upon which the works should be rated. Taking it in round numbers 5 per cent. upon that sum would represent the gross annual value at £3465, and deducting for repairs 1 per cent., it would leave £2772 as the rateable value, or 4 per cent. It had always been his experience to put 5 per cent. for the gross value and 4 per cent. for the rateable value. The capital figure—namely, the cost of the property, was a matter that always required care in determining it, as it varied. In this case, the works having just been erected, and including all modern improvements, he considered it fair to take the actual cost incurred as the capital figure upon which to base the gross and rateable values. Supposing it was the case of some works which had old-fashioned and exploded appliances, the value would be less. He was intimately acquainted with the land upon which these works stood, and settled the draft agreement for the purchase of the same. The price paid to Mr. Dugdale for the land he surrendered—£200 per acre—included other matters than that of land merely. The purchase-money included £1500 for damages to mill, and £2000 for damage to residence. There was also a sum of £5000 for the sake of peace. He could not account for Mr. Castle putting £800 as the price per acre of the land. Mr. Dugdale was at the time opposing the application to Parliament for the Bill, and they were advised by Mr. Hawksley to pay Mr. Dugdale that sum, in order that his opposition might cease, otherwise it was thought they would not be successful. The memorandum of agreement showed that the purchase-money was not confined to the land. It was as follows: "Memorandum of agreement for the settlement of Mr. Dugdale's opposition to the Birmingham Water-Works Bill, 1870. 1. In consideration of the following stipulations, Mr. Dugdale agrees to withdraw his opposition to the Bill now before the committee of the House of Lords. 2. The company to pay Mr. Dugdale, within twelve months from the passing of the Act, or sooner if they require the earlier possession of the land, the sum of £18,500 for 50 acres of land, and all damage done to his estate and mill, by the execution and maintenance of the company's works, as proposed to be authorized by the present Bill, and if a less or greater quantity than 50 acres of land be taken, a deduction from, or an increase to such sum of £18,500, is to be made at the rate of £200 per acre. Mr. Dugdale is to compensate his tenants. The company to determine and give notice to Mr. Dugdale within six months from the passing of the Act, the quantity and situation of the land they require, which must not exceed 53 acres in all." It was customary in new works to write off 10 per cent. for depreciation. It was exceptional to take the actual cost as the basis of value, but he did so in this case because the works had just been completed on the most approved principles, and were perfect in their character. During his 40 years experience he had never known, in cases like the present, a higher rateable value than 4 per cent. He had recently valued the Worcester Water-Works, which were under a special Act, at 4 per cent.

The CHAIRMAN inquired whether the estimate of the rate at 4 per cent. or 5 per cent. upon the outlay would not depend upon the success of the works.

Witness replied that it would not.

The CHAIRMAN said it appeared to him to be an erroneous principle to fix upon 4 or 5 per cent. as the basis of calculation without looking at the prosperity of the works, because a tenant might be disposed to give a higher rental for a prosperous concern than he would for one which was not prosperous.

Witness replied that for the whole concern a tenant might give more, but he certainly would not do so for the portion of the concern lying in the parish of Shustoke alone.

The CHAIRMAN remarked that nothing could be earned elsewhere without the Shustoke works.

Mr. YOUNG said that in the case of *The Chelsea Water-Works v. Putney* it was held by the Court of Queen's Bench that for rating purposes the parish

could only take cognizance of that part of the concern lying within the area of the parish.

Mr. DUGDALE said he should have something to say upon this part of the case, but he quite agreed with the answer of the witness.

Witness said that, under the first assessment made by Mr. Cooper, the rating of the part of the works in the parish of Shustoke was more than the whole of the parish besides.

Cross-examined by Mr. DUGDALE, witness said that he could not state what was the total rateable value of the company's works in all the parishes. He was willing to accept the following figures as being probably correct:—Aston, gross £13,860, rateable value £11,750; Minworth, gross £1809, rateable value £1447; Sutton Coldfield, gross £84, rateable value £67; Hands-worth, gross £230, rateable value £200; Perry Barr, gross £520, rateable value £450; Edgbaston, gross £1370, rateable value £1143. There were several other parishes the aggregate value of which might be slightly under £20,000. It was correct to say that the value of the works was what a tenant would give them.

Mr. DUGDALE: Suppose a tenant, instead of your 4 per cent., gave 5, 6, or even 7 per cent., what would you say then?

Witness: I should think he ought to be sent to Bedlam.

The CHAIRMAN: You would never send him there for that.

Mr. DUGDALE: But if a man is foolish enough to give 5, 6, or 7 per cent., then it should be valued accordingly. The net amount is what a tenant would give.

Witness: I am quite sure you would not find a tenant to give it. I am quite as sure of it as I am of being in this box.

Mr. DUGDALE said that if a tenant paid more for a house than its value, the rent could be taken as its rateable value.

Witness said it was generally assumed that the rent paid by a tenant was the minimum, but this was a case *sui generis*, and that of a house was not at all analogous to water-works. His experience of water-works was confined to the Midlands.

Mr. DUGDALE: You never came into contact with the late Sir William Bodkin and 5 per cent.?

Witness: I should expect to find great points of difference between water-works in the Midlands and such properties in London. I value Mr. Dugdale's land at £2500. Mr. Dugdale's solicitor and agent contended that there should be a large sum paid for the abstraction of the water, but the company disputed the claim, and denied that he had any right to the water. I know the sum of £5000 was paid for the abandonment of the petition, but it was very reluctantly done. They were advised by Mr. Hawksley that they would lose their bill if they did not do so. They looked upon it in the nature of black-mail to a certain extent.

Mr. DUGDALE: Did you add any value to the land in consequence of the water?

Witness: Certainly; else I should have put it at about 50s. per acre. I did not, however, value the water, but I increased the value by reason of its having a reservoir, which, whether full or empty, I should value at the same figure. For the water they take from the reservoir the corporation do not pay a single farthing. The difference between my estimate of the value of the land and Mr. Castle's is £8520. Interest at the rate of 5 per cent. upon my value would be about £585 per annum. I have not the least idea how much the corporation get per million gallons for what they sell. I was present in the House of Commons when Mr. Till, the borough surveyor, was examined. It is very likely that I heard question 398 put to him, where he was asked by counsel if he had a statement giving the quantities of water used and paid for by the corporation since 1863, but I do not recollect it. I cannot recollect that the statement handed in by Mr. Till showed that the corporation paid to the company at the rate of £25 per one million gallons. I do not know that the profit of the last year was sufficient to pay the whole of the annuities, but I know the concern was very prosperous.

Re-examined by Mr. YOUNG: I do not know of any reason why the Shustoke water-works should be rated as suggested by the other side; it is quite contrary to law, practice, and common sense. The water is tapped from the river Blythe, in the parish of Coleshill. The map produced shows that Salmon's land has double the extent of frontage to the river Blythe that Mr. Dugdale's land has.

Mr. T. F. Hedley, examined by Mr. YOUNG, said he was a surveyor and valuer, and was in business at Sunderland with his son, and in Birmingham with Mason, Hedley, and Mason. He had had 20 years experience in valuing large works for assessment and other purposes, and was the valuer appointed by the County Rate Committees for Durham, Northumberland, Brecknock, and other places, and for several unions in Yorkshire, Derbyshire, Northamptonshire, Bedfordshire, &c. In all these instances he acted as valuer for the Assessment Committees, and was much more frequently employed for them than for the companies. In valuing works of this kind, where the whole apparatus was not within the area, his mode of proceeding was to estimate the value of the works as a whole, deducting from the aggregate value such portions as did not produce direct profit, and distributing the remainder, according to the gross or net receipts, as the case might be, between those parishes in which the direct profits were earned. In parishes where the works earned nothing, he estimated them upon the structural value of the buildings and fixed machinery, taking the gross at 5 per cent., and from that he deducted one-fifth or one-sixth, according to the scale of reduction in force in that particular district. In this case he understood the deduction was one-fifth, and that gave 4 per cent. as the rateable value. He had taken 5 per cent. as the rateable value of manufactories, but not of the gas-works, water-works, or railway-stations. Mr. Castle had valued Mr. Dugdale's land at £800 per acre, and Mr. Salmon's at £135 per acre. He could not distinguish between the value of Mr. Dugdale's land and Mr. Salmon's land as Mr. Castle had done. He estimated the whole of the 30 acres at a rental of £8 per acre, and thought it would be worth that for the purpose of the water-works concern. He could make no distinction between the value of the land within the area of the works purchased from Mr. Dugdale and that purchased from Mr. Salmon. They had both equal frontages to the Blythe, and if there was any difference in that respect, the balance was slightly in favour of Mr. Salmon's land. If this land had not been purchased, but rented, it would have been worth £8 per acre, and if the water-works company had not gone there it would have been a long time before the land would have been let at £8. Taking that at 25 years purchase, it was equivalent to £200 per acre. He and Mr. Castle examined the books on Thursday, and found the cost of the works to be £71,482 17s. 5d. In that were included the cost of the two unused filter-beds, and the mains laid since the rate was made. Deducting those two items, the real cost would be £64,131 17s. 5d. He agreed with Mr. Castle that those two items ought to be deducted. His opinion was that a further sum of 10 per cent. ought to be deducted from that for rating purposes. It was quite usual to make such a deduction, even in the case of new works, in consideration of unforeseen and accidental expenditure which might have taken place in constructing the works. It was the custom of his friends in the profession always to make such a deduction. He was well acquainted with the iron trade, and the difference between prices in 1871 and 1875 was in favour of the latter period. There was no profit made now out of the production of

iron. In the former period the iron trade was in a most inflated condition, and that would be a reason why something should be written off the outlay upon these works. In his opinion, if the Birmingham Corporation had to construct these works now, they could do it at a cheaper rate. His estimate was that £3132 should be the gross, and £2555 the rateable value. Those he considered to be fair and liberal figures. The corporation of Birmingham ought not to be assessed for the water taken from the rivers Cole and Blythe. He had never added the value of water to the land. Had always understood that the right to take water from a running stream was a mere easement, and therefore it could not be rateable. In this case the water was taken from another parish, which was another reason why it could not be rated in Shustoke parish, and if there was any beneficial occupation it arose there. In his calculation he had valued the land occupied by the filter-beds, although he had excluded the cost of those beds.

Mr. DUGDALE said he thought the witness was quite right in excluding the cost of these two unused filter-beds, for no tenant taking to these works would pay anything for filter-beds which could not be used for the next three or four years.

Witness said it would not be in accordance with the principles laid down in the West Middlesex case to do so.

Cross-examined by Mr. DUGDALE, witness said the value of the land might fluctuate. The object of a valuation theoretically was to ascertain what a tenant from year to year would give for the works, but in point of fact no one would take water-works. He did not think that the fact of a tenant paying 5, 6, or 7 per cent. upon the cost would at all supersede a fair valuation. He knew a case in which a tenant had been paying 8½ per cent. upon the mere structural cost, and in that case he reduced the valuation because he thought the tenant was paying an exorbitant sum. As corporations and large companies could borrow money at less than 4 per cent., a tenant could not be expected to pay more, as it would be cheaper to borrow the money and build for himself. He had valued the reservoir as capable of holding water, and not as holding water. He did not think the time when these contracts were made was more favourable than the present moment, as such works could be erected equally cheap now. He did not know that it was usual to put 5 per cent. down as engineer's commission. That was the usual commission for an architect.

Mr. John Chesshire, examined by Mr. Young, said he was a surveyor, and partner in the firm of Chesshire and Gibson, Waterloo Street, Birmingham. He had had 40 years experience in valuations of this character. He was perfectly familiar with the water-works at Shustoke. His valuation was as follows:—Two engines of 225-horse nominal power, with boilers and self-acting stokers, engine-house, wells, chimney-stack, pumping machinery, &c., at £4 per horse power, £1800; reservoir, occupying nearly 10 acres of land, and constructed to contain 30 million gallons, £350; five small filter-beds and two large ones, occupying, including the embankments and supports, about seven acres of land, at £50 per acre, £350; 1467 yards of 36-inch pipe, and pipe-way under land, at 3s., £220; 900 yards of 48-inch ditto, at 4s., £180. Add for surplus land, brickwork, valves, railway siding, and underground work, say net £100; total, £3000. From this he made the following deductions:—20 per cent. on engines, pumps, &c., £360; 10 per cent. on reservoir, £35; 20 per cent. on filter-beds, £70; and 10 per cent. on mains, £40; altogether £505, say £500. The gross rental he took as £3000; rateable value, £2500. In making this estimate he did not take for his guide the cost of the work, but he took all the circumstances (including the cost) into consideration, and fixed the annual value accordingly. The filter-beds were a source of expense rather than profit to the corporation, as the water had to be lifted out of the river into the beds, and did not run into them by gravitation, as it might have done under more favourable circumstances. Therefore the cost of them in that case ought not to be taken.

Cross-examined by Mr. DUGDALE, witness said he valued the reservoir as land capable of containing water, but he did not value the water itself. He was a director of the water-works company up to the time that it was dissolved. The company advertised for contracts for these works, and employed the best men in the country. He had no doubt but that if these works had to be constructed now they could be done at much the same cost. The engine-house and the chimney were erected in a very expensive manner, in order to satisfy Sir Charles Adderley; but for the purposes of the company they were no better than if they had been put up at the ordinary cost. The company charged the corporation 6d. per 1000 gallons for the water supplied to them. That was the worst-paying part of their concern, but it was a duty imposed upon them under the Sanitary Act.

Mr. DUGDALE: I suppose you will admit that it was absolutely necessary for the company to go to Parliament to take the water from the Blythe?

Witness: We have always looked ahead, because, with a large population like Birmingham, which is nearly 400,000, if the people from any cause were without water, it would be something very serious. Before we gave up the works the corporation were pressing the company to abandon the supply from the Tame. With regard to the wells in the borough, I admit that the corporation did not show their desire to close them when the works were in possession of the company, so much as they have done since the works have been in their own hands.

[It was announced that Alderman Avery, the chairman of the Water-Works Committee, was in Court, if the respondents desired to ask any questions of him, but it was not proposed by the appellants to call him.]

Mr. Young: In your judgment, as having an intimate knowledge of all the circumstances, supposing all the profits of the various parishes were allocated among them, and the expenses averaged, with the exception of Birmingham, is there any single parish which would yield a per centage of 4 per cent.?

Mr. DUGDALE objected to the question as, having had no notice on the subject, he was unable to test any facts that might be stated.

Mr. Young briefly summed up the case for the appellants. He said the simple question was as to the principle upon which the water-works at Shustoke, where no earnings were obtained, should be rated. That principle, he maintained, had been clearly laid down in the case of *The West Middlesex Water-Works Company v. Hampton*—viz., that they must be rated as ordinary buildings contributing only indirectly to earnings in another parish.

Mr. DUGDALE, in reply, submitted that the contention of the appellants, that the per centage upon which the valuation was based was a fixed per centage in relation to the question of cost, was erroneous, for the cost was only an element in the process of calculation by which the fair annual value of the works was determined. The per centage was not fixed, but varied according to circumstances, and according to what a tenant might be disposed to give for the property. He took it to be clear law that there was to be no hard and fast line, but that the value should be determined from year to year, and from time to time, according to the circumstances of the case. And, further, there were no fixed principles by which the Court could be guided in this matter. In that view he was fortified by the remarks by Justice Wightman, who delivered the judgment of the Court in the West Middlesex case, upon which Mr. Young relied. The cost of the works was the starting-point in the calculations made by the surveyors, but it was not necessarily the basis of the assessment. He submitted that the

fact that persons had been found willing to take the works at an increased value was evidence of the liability of the works to be rated at that increased value. In arguing this question, he was not bound by anything which the Assessment Committee had done, because they had made out their assessment without having had access to the books, and the case now came before the Court *de novo*. He contended that the profits made in other parishes were to be taken into consideration in assessing the value of the works in Shustoke parish, and in support of that he submitted the ruling in *The Queen v. Mile End Old Town Vestry* (10 Q.B. Reports, 208), where it was held that "the parts indirectly conducing to produce profit are to be rated as mere land, &c., with some additional value from their capacity of being applied to such purposes as those of a water company." That view was upheld in the case of *The King v. The New River Company* (1 M. and S., 503), where the question before the Court was whether Amwell should rate Chadwell Mead at £5 or £300. The case stated that no profits arose in Amwell; that the land alone, without the spring, was of the value of £5; but if the advantage which the company derived from the use of the spring might by law be included in the rate upon the land, the land and the spring would together be of the annual value of £300. The judgment of the Court was for the £300. He referred also to the case of *Tallagoe Mining Company v. St. Asaph's Union* (3 Q.B. Reports, 478), where allowance was made for the water. With reference to the value of the land, he submitted that the portion purchased from Mr. Salmon was merely agricultural land, which had no connexion with the Blythe, while Mr. Dugdale's land was that over which the water flowed, and the purchase also included pipes in the parish of Coleshill right up to the mouth of the river. There was, therefore, nothing extravagant in the price they had put upon it, for surely the company did not expect to get their water for nothing. If interest at the rate of 5 per cent. per annum were computed upon the total value they had placed upon the land and water, it would amount to £585 per annum, and that distributed over the quantity of water raised and pumped into Birmingham would be at the rate of £1 4s. per million gallons. But the company sold their water at the rate of 6d. per 1000 gallons, or £25 per million gallons, which showed that it was worth their while to pay £800, or even £1000 an acre for the land. At all events, whatever they paid, it was clearly a profitable concern, for they had been able to meet all their dividends and debts, and make a profit beside. He again submitted that this land ought to be valued as land covered with water, and not as land capable of holding water, and if they did not value it in that way, it was not valued as the law said it should be. No matter whether the water flowed upon the land, or had to be pumped upon the land, it was as much impounded there as in the Amwell case, respecting which Lord Ellenborough said: "The water has a certain ascertained local value at the fountain head. If it has, it is rateable for that value, irrespective of profits which may or may not be derived elsewhere from distribution through the pipes." In asking that, in this case, the land should be rated at £800 per acre, the respondents were only asking that the assessment should be based upon four times the amount which the appellants said was its fair value. But in the Amwell case the sum of £300, fixed by the Court, was more than sixty times in excess of the value of the land.

The CHAIRMAN: But you do not take any water in Shustoke parish. Mr. DUGDALE said the old record of a trial at Warwick Assizes, between Sir William Dugdale, the historian and antiquary, and the then vicar of Coleshill, which had been referred to, respecting the right of cutting bulrushes in the river Blythe, contained an old map which showed the Blythe to be in the parish of Shustoke.

Mr. Young objected that in contradiction to this the evidence now given proved that the river was in the parish of Coleshill.

Mr. DUGDALE proceeded. He thought the ruling of the Court in the Tallagoe Mining Company's case, to the effect that "the value of the land was increased by the value of the water upon it," was favourable to his view of the present case, and that his learned friend's witnesses were mistaken in valuing this land as though it was only capable of holding water. With regard to the commission for architects, &c., the learned counsel supported the view of Mr. Castle, that something should be added, because Mr. Gray, the engineer of the company, had no doubt been the means of saving them a very large sum of money, and he hoped that when the company were dissolved his services were handsomely acknowledged. Then, again, as to the materials found upon the land. Were they not elements of value? If they had not been there the cost of erecting these works would have been very much increased. Taking Mr. Castle's estimates of 10 per cent. for the latter and 5 per cent. for the former, it would bring the total cost up to £86,000, which substantially proved the rate. Under the circumstances, he asked the Court to say that this was a case in which the evidence of the surveyors, as to cost, was of no value, because there was evidence of an increase of value, and also evidence of a tenant having taken to the property at a greatly increased price. He looked upon the appeal as an attempt on the part of the people of Birmingham to obtain an undue proportion of the profits of the water-works for distribution in the town.

The Court having conferred for a few minutes,

The CHAIRMAN said: We have given this case our most careful consideration, bringing to bear upon it the best intelligence we possess. Looking at the course laid down by the Act of Parliament, and confirmed by the West Middlesex case, we have arrived at a certain conclusion. It is quite right that valuers should be appointed, in cases of this sort, on the part of the Assessment Committee, to ascertain what is the value of property of this description. But then we take the result of that valuation as it comes before us to-day in the joint valuation of two gentlemen—one appointed by each party. Those gentlemen consulted together and made the entire outlay £71,482 17s. 5d., subject to deductions on two accounts—viz., £5775 for unused filter-beds, £1575 for pipes not at present used—making together £7350 to be deducted from the gross outlay of £71,482. After making these deductions, there remains the net sum of £64,132 17s. 5d. That takes in all the plant. Then there is a question as to the value of the land. In considering this while the case was in progress, it occurred to me that the real value of the land which we ought to take is the price for which that quantity was sold when it was appropriated to these works. Mr. Dugdale obtained from the company a very high price for his land, amounting to £370 per acre. Of the 50 acres it appears they have appropriated 15. I will say 15, because it is not worth while looking at the 18 perches. We think that, taking that 15 times over, would be the proper addition to the £64,132 arrived at by the surveyors on account of Mr. Dugdale's land, and that that would naturally and fairly include all the easements and advantages which were derived to the company from the land conveyed to them by Mr. Dugdale. We think the fair and proper way of dealing with Mr. Dugdale's land is not to include the 35 acres which the water department do not use in part valuation of the money paid for it. It is totally independent. The 35 acres do not come into our consideration. There is the cost of Mr. Salmon's land, £2030, and £150 for way leave. Adding these to the increased value I have named of Mr. Dugdale's 15 acres makes a total of £7730. This sum increases the £64,132 to £71,862 as the outlay on the works at Shustoke. That gives a gross estimated value, at 5 per cent., of £3593. We propose that that figure shall stand as the gross in the valuation list, subject to the deduction for rateable value;

and if you take that at 1 per cent., which is what they adopted before, it would reduce the rateable value at £2875.

Mr. YOUNG: You direct the assessment to be amended accordingly.

The CHAIRMAN: The valuation list will be so amended.

Mr. YOUNG: I do not know what is the usual course of the Court as to costs.

The CHAIRMAN: The Court rarely grant costs, and never in a case which has been fairly and properly brought before them. In cases where they think there is no ground for increasing the assessment, the Court do sometimes order costs; but we do not say that no such probable grounds existed here. I hope that that will be satisfactory to the parish.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The Registrar-General publishes the following return of the average daily quantity of water supplied by the London Water Companies during the month of December, 1876. According to these, 110,423,339 gallons, or 501,704 cubic metres of water (equal to about as many tons by measure, tons by weight), were supplied daily; or 208 gallons (94·5 decalitres) rather less than a ton by weight, to each house, and 29·3 gallons (13·3 decalitres) to each person, against 30·1 gallons during December, 1875. According to returns of the London Water Companies made to the Select Committee on East London Water Bills (Session 1867), it is estimated that, during the year 1866, about 82 per cent. of the total average daily supply of water for all purposes was for domestic use. Applying this proportion to the total quantity supplied daily in the month of December, 1876, it may be estimated that about 90,547,138 gallons were probably used for domestic purposes, or about 24·0 gallons per day for each inhabitant, against 24·7 in the corresponding month of last year.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	Dec., 1875.	Dec., 1876.	Dec., 1875.	Dec., 1876.
Total supply	521,566	531,445	111,420,340	110,423,339
From Thames	245,577	250,648	56,423,469	56,032,761
„ Lea and other Sources	275,989	280,797	54,996,871	54,390,578
THAMES.				
Chelsea	28,600	28,737	6,744,600	6,881,600
West Middlesex	47,400	48,680	9,131,684	9,533,505
Southwark and Vauxhall	80,300	80,705	18,000,009	17,820,000
Grand Junction	36,036	37,055	10,186,185	10,284,856
Lambeth	53,241	55,471	12,361,000	11,512,900
LEA AND OTHER SOURCES.				
New River	123,915	125,011	26,160,000	24,132,000
East London	107,851	110,354	22,515,000	23,849,800
Kent	44,223	45,432	6,321,571	6,408,778

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for December, 1876, as compared with that for the corresponding month of 1875, shows an increase of 9879 houses, and a decrease of 997,001 gallons of water supplied daily.

Dr. Frankland, F.R.S., reports, as the result of his analysis of the waters supplied to the Metropolis during December, that, taking unity to represent the amount of organic impurity (on this occasion) in a given volume of the Kent Company's water, the proportional amount in an equal quantity of water supplied by each of the other metropolitan companies was—New River 3·1, East London 4·0, Lambeth 6·2, West Middlesex 6·7, Chelsea 7·0, Grand Junction 7·6, and Southwark 9·5. The Thames was in high flood during the greater part of December, and the water delivered by the five companies deriving their supply from this source was “utterly unfit for domestic use,” in consequence of its large proportion of “polluted organic matter.” The West Middlesex alone of these five companies delivered efficiently filtered water, whereas the four other waters were more or less turbid when drawn from the mains; all the Thames waters were, however, “loaded with organic impurities of the most disgusting origin.” An analysis of a sample of the Grand Junction Company's water, after filtration through spongy iron, showed that nine-tenths of the organic matter, and more than one half of the hardness, had been removed from the water. The water supplied by the New River and East London Companies, principally from the River Lea, showed less pollution than the Thames water; the proportion of organic matter in the New River Company's water was, however, nearly three times greater than in November. The Kent Company's deep well water, on the other hand, was entirely unaffected by the heavy rains, and was even purer in December than in the preceding months.

RICHMOND WATER SUPPLY.

At a Meeting of the Select Vestry of Richmond on Tuesday, Jan. 9, the following report of the Water Supply Committee was adopted:—

“The committee, acting in pursuance of the resolution passed at the vestry meeting held on Dec. 19, 1876, which directed that ‘the letter from Mr. Rumble, chief engineer of the Southwark and Vauxhall Water Company, dated the 15th of December last, should be referred to them, with instructions to consult the engineers of the new works thereon, and to take such steps in the matter as they may think fit,’ beg to report as follows:—The committee met on the 20th of December last, and frequently since—namely, on the 21st, 23rd, 27th, 28th, and 29th of December, and on the 1st, 2nd, 3rd, 4th, 5th, 6th, and 8th days of the present month. From information obtained through the engineers the committee made application to Her Majesty's Office of Works for a temporary supply of water from the reservoir in Richmond Park belonging to that department, used for the supply of water to Kew Gardens. They also instructed the vestry clerk to lay Mr. Rumble's letter before counsel, and take an opinion on the rights of the inhabitants as regards the threatened cutting off by the Southwark and Vauxhall Company of the water supply to the town. Finding that delay was likely to take place in obtaining an answer from Her Majesty's Office of Works, owing to the absence from town of the First Commissioner, the committee directed the attention of the engineers to the existing artesian wells in the parish, with a view of ascertaining the capabilities of the same to afford a supply of water to the inhabitants. On the 27th ult. the clerk laid before the committee the opinion of counsel, which was to the effect that the Southwark and Vauxhall Water Company could discontinue the supply of water to the town as they proposed to do, and that the Court would not grant an injunction to restrain them from so doing, because the supply by that company to Richmond was beyond their parliamentary limits, and, therefore, *ultra vires*, and for the same reason he could not advise the vestry to enter into any arrangement with the Southwark Company for a supply of water to the town, as, in the event of any breach by the company of such arrangement, the vestry, if attempting to enforce it, would

only involve the parish in somewhat uncertain litigation. The committee having received a report from the engineers that they had obtained information from the most reliable sources that the artesian well sunk some years since by the late Richmond Water-Works Company was capable of affording, with proper engine power, an ample supply, equal to at least 20 gallons per head per day for the inhabitants, they opened negotiations through their chairman and clerk with the lady whose newly erected residence is over this artesian well, and such negotiations having resulted in your committee obtaining possession of the premises, they at once gave orders for the erection of the necessary engines, &c., which works are now all but completed. The committee also carefully considered the rate of charges which it would be desirable to make to the consumers, having due regard to the interests of the parishioners, as well as making ample provision for every possible expense likely to be incurred in affording the supply, and they confidently recommend the adoption by the vestry of the following rates, viz.:—1. Private houses and shops, 6d. in the pound per annum on the rateable value, with no extra charge for baths, &c. 2. Breweries and the like to be supplied by meter, at a rate not exceeding 6d. per 1000 gallons, or by special agreement with the vestry. 3. The water-rate to be collected quarterly, together with the poor and highway rate. 4. The Vestry to make the necessary change from the Southwark Company's main without expense to the consumer, and with as little delay as possible. Acting under the advice of their counsel, the committee issued a circular to the inhabitants, stating the position of the matter and the proposed charges; and the result has been most gratifying to the committee, inasmuch as they have received nearly 2000 individual applications for a supply from the vestry, many of such having reference to three and four different assessments, and in some cases even more. The committee being fully alive to the great importance of economy in the supply, advertised for an inspector of fittings and turn-cock, in answer to which they received ten applications, but eight of the applicants appeared to be wholly unacquainted with the duties, and of the two others they selected George Stribling, a resident in this town, who has had many years experience of the work. The committee also issued invitations for tenders for the making of the connexions between the parish mains and the houses of the residents, and were pleased to find that eleven local tradesmen came forward and placed their services at the disposal of the parish, thereby enabling the committee to retain this part of the work in the hands of their fellow-townsmen. The committee have also to report that the laying of the mains, with a few exceptions, will be completed before the end of the week. In presenting this report, the committee recommend the vestry to continue to watch the works through a committee as heretofore, such committee being empowered to take such steps in the matter as they may from time to time think fit.”

BOLTON CORPORATION GAS-WORKS.

The Abstract of the Annual Accounts for the Borough of Bolton has just been issued by Mr. G. SWAINSON, the borough treasurer, from which we make the following extracts relating to the affairs of the gas undertaking:—

GAS-WORKS FUND ACCOUNT, FOR THE YEAR ENDING JUNE 30, 1876.

Dr.—Revenue Account.	
To Gas and meter rental—	
358,171,000 cubic feet of gas supplied to consumers during the year	£71,886 15 0
One year's rent of meters	761 0 11
	£72,647 15 11
Less discounts allowed	£3,942 6 0
Ditto, bad debts	269 0 2
	4,211 6 2
	£68,436 9 9
Residual products—	
Coke sold	£4,066 7 10
Tar ditto	3,523 18 0
Spent lime sold	127 15 2
Ammoniacal salts and liquor sold	2,793 10 1
Retort carbon and sundries sold	30 15 6
	10,547 6 7
Fitting trade—	
Total of fittings and meters sold	£7,201 3 6
Less cost of wages and materials, &c.	5,691 2 9
	1,510 0 9
Chief rents, &c.	195 2 7
Miscellaneous receipts—Transfer fees	7 2 6
Interest account—Bank interest allowed	143 6 8
	£80,844 8 10

Cr.—Revenue Account.	
By Gas manufacture—	
Carbonization—	
Cannel and coal consumed	£35,071 10 9
Stokers wages	3,279 12 1
	£40,351 2 10
Purification—	
Lime	£768 15 8
Wages of workmen	808 2 8
	1,576 18 4
Retorts, materials, and labour—	
Wages of workmen	£485 15 9
Gas-retorts, fire-bricks, tiles, clay, &c.	1,298 17 11
	1,694 13 8
Repairs of works and services, &c.	3,574 8 4
General expenses	295 1 6
Chief rents, &c.	152 2 5
Salaries	1,959 0 11
Meter inspection	708 4 0
Rates and taxes	1,205 10 9
Office and miscellaneous expenses	504 8 6
Law charges	360 16 11
Interest and annuities	17,126 0 7
Sinking-fund account—	
Amount transferred towards redemption of annuities and debt, being 1½ per cent. on mortgage debt of £54,704	£683 16 0
And 1-75th part of capitalized value of annuities at 25 years purchase	4,820 1 6
	5,503 17 6
District-rate account	3,000 0 0
Renewal-fund account—Amount set apart to provide for renewal of works and plant, &c., being balance of profit for year 1875-6	2,832 2 8
	£80,844 8 10

Dr.—Renewal-Fund Account.	
To Balance, June 30, 1875	£8,564 9 10
Revenue account—Amount transferred, being balance of profit, 1875-6	2,832 2 8
	£11,396 12 6

Cr.—Renewal-Fund Account.	
By Expenditure for the year	£6,328 10 2
Balance, June 30, 1876	5,068 2 4
	£11,396 12 6

Dr.—Deposit-Fund Account.		
To Balance, June 30, 1875	£4,223	1 0
Amount received from sundry depositors, as security for payment of gas-rent	1,899	0 0
	£6,122	1 0
Cr.—Deposit-Fund Account.		
By Deposits repaid—Amount returned to sundry depositors during the year	£1,293	15 0
Balance, June 30, 1876	4,828	6 0
	£6,122	1 0
Dr.—Sinking-Fund Account.		
To Balance, June 30, 1875	£696	0 0
Revenue account—		
Amount transferred towards redemption of annuities and debt, being 1½ per cent. on mortgage debt of £54,704.	£683	16 0
And 1-75th part of capitalized value of annuities at 25 years purchase	4,820	1 6
	5,503	17 6
	£6,199	17 6
Cr.—Sinking-Fund Account.		
By Balance, June 30, 1876	£6,199	17 6
	£6,199	17 6
Dr.—Capital Account.		
To Balance, June 30, 1875	£8,066	8 10
Loans received	15,300	0 0
Extension of mains and services—Amount received for old metal sold	82	6 1
	£23,448	14 11
Cr.—Capital Account.		
By Loans repaid	£1,018	0 0
Extension of works	4,743	6 10
Ditto of mains and services	4,458	4 8
New meters	1,911	8 9
Balance, June 30, 1876, being the difference between the floating assets and liabilities, as per stock account	11,317	14 8
	£23,448	14 11
ASSETS.		
To Works and plant—		
As per last abstract	£253,603	1 3
Additions during the past year	11,030	14 2
	£264,633	15 5
Floating assets—		
Amount owing by sundry debtors, June 30, 1876.	£14,833	1 9
Stock of cannel and coal	800	0 0
Ditto of chemicals	360	0 0
Ditto of meters and fittings	4,924	1 0
Bank of Bolton, balance in hand	13,522	10 0
	34,439	12 9
	£299,073	8 2
LIABILITIES.		
By Old shareholders capital, converted into annuities amounting to £14,460 per annum	£205,947	10 1
Mortgages on credit of borough-fund	70,004	0 0
Floating liabilities—		
Renewal-fund account	£5,068	2 4
Deposit-fund ditto	4,828	6 0
Sinking-fund ditto	6,199	17 6
Amount owing to sundry creditors	7,025	12 3
	23,121	18 1
	£299,073	8 2

Mr. HARRISON VEEVERS, the engineer and manager of the corporation gas-works, has made a report to the Gas Committee upon the business of his department for the past month, which contains some interesting information. He says:—

The following tables give information on the manufacture of gas, &c., in the months of December, 1875, and 1876:—

	Dec., 1875.	Dec., 1876.
Gas made, in feet	64,763,000	68,078,000
Increase per cent.	512	512
Cannel used—tons	2,446	3,093
Coal used—tons	3,667	3,090
Cannel and coal—total	6,113	6,183
Make per ton, in feet	10,554	11,109
Retorts in use, Nov. 30	440	440
Retorts in use, Dec. 31	440	468
Stokers employed, Nov. 30	92	92
Stokers employed, Dec. 31	92	97
Artizans and Labourers	134	180
Clerks, meter inspectors, &c.	32	32

The continued use of a greater proportion of cannel referred to in the last report, has had the effect of improving the illuminating power, which has been better during this month than in either of the two preceding ones. Having the assistance of 28 of the retorts in the new stack at Lum Street, the manufacture of gas has been conducted much more satisfactorily than during the corresponding period of last year. With the exception of a stoppage of the centre-valve of one set of the purifiers at Lum Street for a few hours on the 27th, which caused a cessation of work of about 100 retorts, no irregularity has occurred.

The amounts of cash received are as follows:—

	Dec., 1875.	Dec., 1876.
Gas	£802	8 4
Meter-rents	22	16 4
Meters and fittings	639	7 3
Washing liquor	10	14 0
Ammoniacal salts	415	0 2
Tar	359	16 11
Coke	457	9 8
Spent lime	20	19 1
Deposits	236	5 0
Rents	17	11 9
Sundries	1	8 3
Transfer fees	0	2 6
	£2983	19 3
	£3352	1 5

The facts that in this month there were 412 cases of repairs, &c., attended, as against 330 in December last year; and 230 new meters fixed, against 154 a year ago, indicate a healthy activity in the fitting department. Of the 230 meters fixed 76 were renewals, and of the 154, 67 were to replace old ones. The principal work has been fitting the mills of Mr. Briggs, and of Mr. Constantine, the St. Bartholomew's Schools, and the new tramp ward.

In addition to the remedying of escapes and other defects in mains and services, the main-layers have done the following work:—

9-inch mains, cast iron,	90 yards.
4-inch „ „	171 „
3-inch „ „	3 „
2-inch „ „	1050 „

There were also laid the following services:—

4-inch lead	61
3-inch „	8
1-inch „	10
2-inch cast iron	2
	81

Being three more than in December, 1875.

During the years and half years ending Dec. 31, 1875 and 1876, the following results have been attained, which are satisfactory as indicating a progress in the manufacturing department as great as can be expected.

	Years ending Dec. 31, 1875.	Dec. 31, 1876.
Cannel and coal used—tons	35,248	38,947
Gas made, in feet	401,209,000	412,088,000
An increase of	—	2,71
Make per ton, in feet	10,489	10,580
		81
	Half years ending Dec. 31, 1875.	Dec. 31, 1876.
Cannel and coal used—tons	19,942	20,367
Gas made, in feet	212,509,000	220,175,000
An increase of	—	3,6
Make per ton, in feet	10,656	10,863

The last item is instructive, as it shows an increased average yield per ton on all the cannel and coal used during the half year of 202 feet, or a total of 4,094,000 feet. This may be accounted for by the facts that the retorts are in better order, and the cannel and coal of better quality.

During the past year the average price of sulphate of ammonia has been £17 10s. per ton, an increase on the price in the previous year of £1.

With reference to the extensions at Lum Street, it may be remarked that, with the exception of the delay of the contractors for the roof, the work has progressed as satisfactorily as the shortness of daylight and the unfavourable weather would permit.

The chimney and all brickwork are finished. The purifying-house is still waiting for the roof, as are also the smaller buildings. The condensers, scrubbers, one set of purifiers, and the connecting-mains, are nearly completed, and the purifying-house ground-floor is ready for paving.

The report concludes by stating that at the present time there are 88 men engaged on the extensions.

BILSTON GAS COMPANY.

The Thirty-first Annual General Meeting of the Shareholders of this Company was held at the Town Hall, Bilston, on Monday, Jan. 8—WILLIAM HATTON, Esq., J.P., in the chair.

The CLERK (Mr. J. S. Reeves) having read the notice convening the meeting, the following report and statement of accounts were presented:—

The directors herewith present to the shareholders their thirty-first annual report, together with statement of accounts.

The trade account shows a profit of £3933 1s. 10d. which, with £449 2s. 1d. brought from last year's account, makes a total of £4382 3s. 11d. at the disposal of the directors.

This sum they propose to appropriate as follows:—
Half year's dividend of 4s. per share paid Aug. 1, 1876 . . . £1200 0 0
Half year's dividend of 4s. per share payable Feb. 1, 1877 . . . 1200 0 0
Reserve-fund account . . . 200 0 0
Carry forward to next year's account . . . 1782 3 11

The various improvements which, during the past three years, have been made in the distributing plant are realizing the expectations of your directors, and have resulted in a large increase in the quantity of gas sold, giving to the consumers a more satisfactory supply, and to the company a substantial increase of profits.

These favourable circumstances, coupled with lower rates paid for coal, have enabled your directors to announce another reduction in the price of gas, varying in amount from 3d. to 6d. per 1000 cubic feet.

The erection of the new works was commenced in the spring of last year, and considerable progress has been made. The 100-feet gasholder, retort-house, coal-stores, and purifiers are approaching completion, but will not be available for use this winter.

The amounts expended in these erections are set forth in the annexed accounts.

To meet the cost of the new works, the directors have exercised the powers given them by the extraordinary meetings of shareholders, and have raised £5000 by the issue of debentures bearing interest at the rate of 6 per cent. per annum. They also have issued 1000 new shares of £5 each since the close of the financial year.

The directors who retire by rotation are Messrs. J. T. Field, T. Holcroft, and E. Hickman; Messrs. Holcroft and Hickman offer themselves for re-election.

One of the auditors, Mr. T. H. Hickman, having resigned during the year, Mr. Charles Hatton was appointed in his place. Mr. E. Ellis and Mr. C. Hatton retire, and are eligible for re-election.

The capital, works expenditure, and reserve-fund accounts are rendered herewith.

Dr.	Trade Account, from Oct. 1, 1875, to Sept. 30, 1876.				Cr.				
Stock		£846	10	0	Sales		£5,862	18	7
Purchases		3,126	19	9	Do.		5,530	2	10
Do.		2,678	12	11	Do.		2,614	14	6
Do.		1,863	16	3	Do.		2,873	12	0
Do.		1,625	10	9	Stock		424	3	9
Wages		2,498	19	10	Interest		36	19	3
Allowances and bad debts		204	19	7					
Deterioration of works for one year		564	0	0					
Balance (profit)		3,933	1	10					
		£17,312	10	11			£17,342	10	11

Capital Account—Cr.

6000 shares, at £5 per share	£30,000	0 0
100 debentures, at £50 each	5,000	0 0
	£35,000	0 0

Works Account—Dr.

Works, as per published statement, 1875	£28,383	13 6
Amount expended in purchase of land at Millfields, as stated in 1875 account	2,090	0 0
Amount expended on works, extension and enlargement of mains, in year 1876	877	18 10
Amount expended in the erection of new works at Millfields	6,494	15 1
	£37,846	7 5
Less deterioration of works for one year	564	0 0
	£37,282	7 5

Reserve-Fund Account—Cr.

Balance, as per statement published Sept. 30, 1875	£2,590	6 6
Amount brought from profit account, Sept. 30, 1876	200	0 0
	£2,790	6 6

The CHAIRMAN moved the adoption of the report, and said he thought the meeting would concur with him that the report was a very satisfactory

one. They were not only paying the usual dividend, but they had a larger balance than usual to carry forward. The alterations of the mains referred to in the report, though costly in the first instance, were repaying themselves rapidly. The increased quantity of gas sold during the past year had been upwards of 5 million cubic feet. With their increased prosperity the directors had not been unmindful of the interests of the consumers; but when the dividend was assured, they had, unsolicited, announced a reduction in the price of gas. The building of the new works was progressing, and they would be in operation next winter.

The report having been adopted, a resolution authorizing the payment of a dividend of 8 per cent. for the year was approved. Two of the retiring directors were re-elected, and Mr. Thos. Bradley elected in place of the third. The directors were thanked for their services, and, after some discussion, it was unanimously resolved that their fees in future be £200 per year.

The clerk and manager (Mr. J. S. Reeves) was complimented on the manner in which he had discharged his duties, and a vote of thanks to the chairman brought the proceedings to a close.

CARLISLE CORPORATION GAS AND WATER WORKS.

The Abstract of the Gas and Water Accounts of the Corporation of Carlisle, for the year ending June 30, 1876, has just been published. The following are the statements of capital and revenue in each department:—

GAS.		
Dr.	Capital Account.	Cr.
Total expenditure on permanent works to June 30, 1875 (less annual depreciation) . . .	£34,331 5 0	
Less one year's depreciation, at 3 per cent.	1,029 18 9	
	£33,301 6 3	
Expended in extensions during the year—		
Lamps and fittings	72 16 5	
Mains	2,067 7 11	
Service-pipes	88 12 11	
	£35,530 3 6	£35,530 3 6
Profit and Loss Account.		
Stock account, June 30, 1875 . . .	£4,253 9 10	Gas sold in year . . . £15,468 6 4
Ditto of coal, ditto	326 5 0	Coke 2,741 6 8
Cannel, coal, and cartage	9,547 0 3	Tar, ammoniacal liquor, &c. 1,924 0 9
Purifying material	331 4 1	Mortar 448 15 7
Salaries—		Meters, fittings, castings, old metal, &c. . . . 7,646 6 3
Manager	300 0 0	Interest from bank . . . 47 11 8
Accountant, clerks, and collectors	360 5 6	Ditto from reserve-fund . 300 7 0
Auditors	44 2 0	Stock account, June 30, 1876 . 6,361 15 3
Wages	4,483 14 11	Ditto of coal, ditto . . . 76 16 0
Meters, fittings, and castings . .	7,801 18 9	
Retorts and fire goods	302 0 3	
Rents, rates, and taxes	289 13 11	
Printing, stationery, postage, &c. .	171 9 1	
Tradesmen's accounts	852 2 8	
Incidentals, &c.	52 1 1	
Bad debts	38 2 9	
Interest on deposits	31 0 4	
Ditto mortgage bond	396 5 0	
Legal expenses	33 5 6	
Balance, being profit for the year .	5,401 4 7	
	£35,015 5 6	£35,015 5 6
Appropriation of Profits.		
Corporation (annual payment) . .	£200 0 0	Gross profits £5,401 4 7
Amount expended on extensions .	2,228 17 3	
Set apart for interest on deposits .	150 0 0	
Mortgages paid off	999 0 0	
Balance	1,833 7 4	
	£5,401 4 7	£5,401 4 7

WATER.		
Dr.	Capital Account.	Cr.
Total expenditure on works to June 30, 1875 (less annual depreciation) . . .	£43,600 5 11	
Less one year's depreciation, at 3 per cent.	1,308 0 2	
	£42,292 5 9	
Extensions during year—		
Mains	741 4 5	
Service-pipes	121 1 3	
	£43,154 11 5	£43,154 11 5
Profit and Loss Account.		
Stock account, June 30, 1875 . . .	£619 9 11	Water sold in year . . . £5,414 8 6
Coal and cartage	341 17 3	Pipes, castings, service-pipes, &c. 1,051 16 11
Salaries—		Interest from bank . . . 32 1 9
Manager	50 0 0	Stock account, June 30, 1876 958 11 7
Accountant, clerks, and collectors	96 5 0	
Auditors	18 18 0	
Wages	710 7 9	
Pipes, castings, sluices, &c. . . .	1,114 9 9	
Rents, rates, and taxes	124 3 4	
Printing, stationery, postage, &c. .	36 11 6	
Incidentals, &c.	1 3 4	
Bad debts	1 1 11	
Tradesmen's accounts	279 13 11	
Legal expenses	53 9 3	
Interest on mortgage bonds . . .	1,636 11 2	
Balance, being profit for the year .	2,372 16 10	
	£7,456 18 9	£7,456 18 9

PROPOSED PURCHASE OF THE WARRINGTON GAS-WORKS.—The *Warrington Guardian* states that an informal meeting of the council was held on Tuesday, to confer on the feasibility of a proposal to submit the vexed question of the gas purchase practically to the arbitration of some engineer of eminence. The following resolution was adopted:—"The Mayor having submitted to the council a proposition for the engagement of Mr. Hawksley to report further on the terms of purchase of the gas-works, it was resolved—That, on the Chairman of the Opposition Committee undertaking on their behalf to withdraw from further opposition to the purchase of the gas-works if Mr. Hawksley should advise that the purchase is a good one, the council assents to the employment of Mr. Hawksley to advise on the terms, on the distinct understanding that no instructions be laid before him beyond the simple terms of the purchase, and such other information as he himself may require."

LEEDS CORPORATION GAS SUPPLY.

At the Annual Meeting of the Leeds Chamber of Commerce on Wednesday, the 10th inst.—the PRESIDENT (Alderman Barran, M.P.) in the chair,

The SECRETARY read the 26th annual report of the council, which contained the following paragraph referring to the quality of the gas supplied to the town:—"The council are sorry to have observed that the quality of the gas now is much inferior to that formerly supplied by the companies. Instances have been known of work occasionally having to be stopped from sheer want of light, and much inconvenience is daily felt by consumers."

The CHAIRMAN moved the adoption of the report.

Mr. WHEELHOUSE, M.P., in seconding the motion, said, as regarded the question of the supply of gas, he could not understand why, since its manufacture had got into the hands of the corporation, it should have been neither what it ought to be, nor yet equal to what it used to be. Personally, he might state that years ago his bill for the consumption of gas was only one-half what it now was, and yet he did not consume by any means so much as formerly. He had not put one single additional light into his house for years. He hoped that the question would be inquired into, an opinion in which he knew he was largely supported by his fellow-citizens.

Mr. TENNANT, M.P., said he was not aware what provisions were made when the gas companies transferred their works to the corporation, but surely there were some restrictions introduced, under which action might be taken. If there were any such provisions, he thought they ought to take advantage of them, and endeavour to get a remedy—securing a better supply, and also enforcing that reduction for large consumers which was certainly an understanding, if not absolutely binding between the companies and the large consumers. He hoped that some representation would be made to the Town Council, and, if need be, action taken, both by the Chamber of Commerce and on behalf of the inhabitants.

The report was adopted.

FATAL GAS EXPLOSION AT PIMLICO.

On Sunday evening, the 31st of December last, an alarming explosion of gas took place in the cellarage of a house, No. 48, Stanley Street, Pimlico, by which considerable damage was done to the premises, and a woman and child residing there were fearfully burned. These unfortunate people were immediately conveyed to St. George's Hospital, where, after lingering until Saturday, the 6th inst., the woman died. The accident, as will be seen from the evidence given at the inquest, is almost certainly attributable to the use of the steam-roller, by which the main running beneath the roadway was fractured. The ground in this locality is very loose, the whole district not many years ago having been a marsh, and the late excessive rains have contributed to increase the softness of the soil.

On Thursday evening last, Mr. Bedford, the coroner for Westminster, held an inquest, at St. George's Hospital, on the body of Mrs. Frances Pitcher, whose death took place under the circumstances just named.

The jury having viewed the body, the following evidence was given:—

Mary Prescott said: I am a lodging-house keeper, residing at 166, Warwick Street. The deceased was my sister. She was the widow of Robert Pitcher, formerly a solicitor's clerk. Her age was 35. She was in a nurse's situation at 48, Stanley Street, at the time of the explosion.

Mrs. Ellen Henney: I am a widow, residing at 48, Stanley Street. I have lived there 12 months. The gas-fittings in the house were new when I went in, and nothing in the way of repairs has been done to them since. I have never perceived the smell of gas in any part of the premises. On Sunday, the last day of December, we were sitting at tea at about a quarter to seven, and Mrs. Pitcher's little girl, who was there on a visit, went to the larder to put away the bread and butter, and her mother took a little spirit-lamp to show her a light. The larder is close to the coal-cellar door, but inside the passage, the coal-cellar itself being in the area. I was in the kitchen at the time, and heard an explosion, and saw a flash of light. I was not thrown down by the concussion, and I ran upstairs and out into the street, calling for assistance. Mrs. Pitcher was brought up by the police, and taken to the hospital. I did not go down stairs afterwards. The gas-meter was close to the cellar door. I had never turned off the meter myself, and I had never perceived the smell of gas there. I have smelt it very slightly in the coal-cellar during the last six months. Mrs. Pitcher has asked the gas man several times, and I asked him once, whether there was any danger—that is, the man that came to see the meter. I was in the area at the time, and called his attention to a smell being in the cellar. He went into the cellar, and then said there was no danger. I sent to the Board of Works on the Saturday before the explosion, thinking it was the drainage. After the explosion, six or seven men came to repair the damage. There was no work going on with the gas-pipes in the cellar before then.

By Mr. HUMPHREY (who attended to watch the proceedings for the Chartered Gas Company): I cannot exactly say, but I think it was nearly six months ago since I spoke to the man about the smell in the cellar. He told me there was no danger, and that it had nothing to do with my meter in the house. I think it was the sewer that we smelt on the Saturday after the steam-roller had been over it. The roadway of Stanley Street has been under repair lately. It was being repaired at the time of the explosion, and the steam-roller was used on the Saturday exactly opposite my house. The explosion took place on the following Sunday evening. I saw Mrs. Pitcher lying in the passage of the basement after the explosion, but I did not see her little girl. She was injured at the time, but is still alive. Mrs. Pitcher had been living with me about 10 months. She came first of all to nurse me, and has since been looking out for a situation. She took care of the house for me meanwhile, as I had been away two months, and I paid her for doing so.

By Mr. CASS (who appeared for the friends of the deceased): The meter was not at all affected by the explosion. I had the gas burning in the house next day.

Police-constable Tuffin, 35 P Reserve: About a quarter to seven on the evening of the 31st of December I was in Clarendon Street, Pimlico, and was informed that an explosion of gas had occurred at 48, Stanley Street. I immediately proceeded there, and on entering the hall passage I saw the deceased sitting on a chair, supported by persons on each side. I inquired if the daughter had been seen after, and received an answer in the affirmative. The medical man having arrived, she was ordered to be removed to the hospital immediately. I procured a cab and brought both mother and daughter here. The deceased was sensible at the time, but she and her daughter were much disfigured in the face and hands. She said nothing whatever to me in reference to the explosion. I afterwards returned to the house, and found that the windows and door in front had been blown out. I did not make any further examination of the damage done.

Mr. Kay Shuttleworth: I am one of the house surgeons of the hospital. I saw the deceased on admission. She was quite sensible, and able to answer rationally, but suffering from shock. She was burnt all over the head and face, and her hair dropped off when touched. Every part of her body not covered by her dress was burnt, and her clothes were almost entirely destroyed, and fell into rags. She was immediately put to bed

and wrapped in cotton wool, opium and stimulants being administered. She recovered rapidly from the shock, and went on well for the first two or three days. On the Wednesday she became feverish and delirious. On Thursday I found her in an exceedingly weak state, and though she recovered by the use of stimulants, she remained delirious, more or less, till the Saturday evening, when she died between 7 and 8 o'clock. I should say the cause of death was evidently the shock produced by the burning. There has been no *post mortem* examination, as such extensive burns were quite enough to account for death.

Mr. W. Millwood: I am an inspector of gas in the employ of the Chartered Gas Company. I examined the premises in Stanley Street after the explosion the same evening. I found the pavement in front damaged; there was glass broken, and a great amount of disorder in the basement. I immediately reported the case at the works in Horseferry Road to Mr. Pierson, the foreman, and requested him to send men to repair the damage, which he did. I saw the men open the ground down to the main, which was found to be fairly broken through. It was a fracture of the iron itself, and not a breakage at the joint. It must have been broken with violence, and the escape of gas from it would cause an explosion on getting into the lower part of the house. The opinion I formed directly was that the passage of the steam-roller caused the fractures. I cannot account for it in any other way. I observed that the meter in the house was not injured at all. I examined that and the connecting-pipes.

Mr. Cass: You say the main was broken. Was it crushed in or broken quite across?

Witness: It was dark at the time, but it seemed to me that it had sunk a little, and then snapped fairly in two.

Mr. Cass: How long had this main been down?

Witness: I do not know; many years, I should think.

Mr. Cass: Did the pipe seem brittle at all?

Witness: No, it seemed a very good pipe.

Mr. Cass: What depth was it in the ground?

Witness: I should imagine, speaking from memory, somewhere about 3 feet.

Mr. Cass: What was the soil above the pipe?

Witness: The usual earth.

The CORONER: Was the pipe afterwards repaired?

Witness: The part was cut out and a new length put in. I do not know how much was cut out.

A JUROR: What was the size of the pipe?

Witness: It was a 3 or 4 inch pipe; about the usual size employed for a private street, where the consumption is moderate.

Mr. Samuel Pierson: I am the foreman at the Westminster station of the Chartered Gas Company. On the 31st of December I was called to No. 48, Stanley Street, about half-past 7 o'clock, and went there with five men. I set them to work opening up the main. I then went into the premises. The gas was at that time alight, burning through the back of the vault—through the brickwork from the street. When we got down to the main we found it broken clean in two—not smashed in. It was out of its position, having sunk down about 8 inches from the level. I did not notice particularly, as it was dark, whether the ground above had sunk down. We tied up the broken main with a cloth and white lead, and left everything secure temporarily before going away. As soon as we stopped the fracture in the main, the light in the vault went out. No doubt the fracture was the cause of the escape of gas in the cellar. From the way in which I found it, I should say the fracture was caused by the steam-roller going over it. The roads are very soft there in wet weather.

The CORONER: Perhaps a heavy waggon going over it would do the same?

Witness: There are not many heavy waggons in that neighbourhood.

The CORONER: Would not a heavy furniture van do it?

Witness: No; I think not. I do not think anything would do it but the steam-roller.

Mr. HUMPHREY: Was the pipe, otherwise than being cracked, in good order.

Witness: Yes, in every appearance.

Mr. HUMPHREY: Afterwards you cut the piece out, and put in a new length?

Witness: Yes.

Mr. HUMPHREY: But that night being New Year's eve, you repaired it temporarily, and kept a watchman on all night?

Witness: Yes.

Mr. HUMPHREY: When was the pipe cut out?

Witness: We had the main entirely stripped on the Monday, and thoroughly repaired it.

By the CORONER: The pipe seemed to be in a good condition, and not rusted or cracked.

Mr. HUMPHREY: The steam-roller has a very concentrated weight over a 4 feet span, whereas a waggon distributes the weight.

A JUROR: Have you ever known cast-iron pipes break in a similar way?

Witness: Yes, on several occasions, but they were not brought under notice.

The CORONER: Did you ever trace them to their particular causes?

Witness: We never traced it.

Mr. HUMPHREY: Probably in those cases there was no explosion?

Witness: No.

A JUROR: When you took the pipe out, could you tell whether it had been recently cracked, or whether it had been cracked some time?

Witness: It was a new break.

A JUROR: Can you account for the smell of gas in the cellar six months prior to this?

Witness: No.

The CORONER: The smell was so slight that the witness was doubtful whether it arose from the gas or the sewer.

A JUROR: Are you satisfied that this was a fracture all at once, or that it had taken place gradually?

Witness: It is my opinion, from the look of the metal, that it was a snap.

A JUROR: Did you notice any subsidence of the soil?

Witness: It had gone down eight inches. The ground was very soft and wet. The heavy rains had made the road very soft, and more liable to sink than in dry weather.

By Mr. Cass: The pipe at the point of fracture was 8 inches lower than the level of the other parts. It was a 3-inch pipe, and taking a span of 30 feet, it had dropped 8 inches. The gas passed just the same. There would be two or three joints in that span, and no doubt the joints had sunk with the main. The pipes are about 9 feet long. We stripped five or six of these lengths.

The CORONER: Might not the joints be a little drawn, so as to allow of a little escape of gas beforehand?

Witness: There was no smell at all.

Mr. Cass: How far are these pipes laid below the surface?

Witness: Three feet three inches; and there was a drop of 8 inches where the fracture was.

Mr. Cass: How far was the pipe from the kerb?

Witness: From 2 feet 6 inches to 3 feet. The steam-roller comes into the kennel, which runs 15 inches from the kerb.

By the CORONER: The pipe was 2 feet 5 inches from the wall at the back of the vault. It would depend upon the nature of the soil how long the gas would be in percolating through. I should not judge that this fracture had existed for a week. No complaints had ever been made to me of a smell of gas on the premises. I have had charge of the district for seven years. If there had been complaints made to any of the men they would be reported to me.

Mr. Cass: Do you think it possible that this fracture might have existed for six weeks?

Witness: No; the iron was too clean for that. The wet would have made it rusty, but it did not look rusty.

The CORONER then summed up the case; and the jury, having consulted for a short time, returned as their verdict—"That the deceased came to her death by an explosion of gas, caused by the fracture of a main-pipe, but as to what caused such fracture there is no evidence to show."

ON THE BEST AND MOST ECONOMIC METHOD OF LAYING MAINS GAS-TIGHT, AND OF DISCOVERING AND REMEDYING LEAKAGES.

By M. MONNIER, late Engineer of the Marseilles Gas-Works.

[Mémoire to which a Premium of 250 francs was awarded by a Member of the Comité of the Société Technique de l'Industrie du Gaz en France.]

This work is divided into two parts.

In the first are given the principal sources of loss of gas, designated by the term "leakage."

In the second are indicated the precautions to be taken, or the rules to be followed, in laying mains and keeping them in repair.

PART I.

We designate generally by the term "leakage" the difference existing between the quantity of gas produced by the works and that which is actually charged to the various consumers. This difference is the result of numerous causes, which we are now about to analyze.

1.—Errors in the Valuation of the Quantity of Gas Manufactured.

If we wish to form a correct estimation of the actual extent to which leakage takes place, it is evident that the first condition to be fulfilled is to measure with precision the amount of gas made and the amount sent out for consumption.

As the valuation of the make of gas by means of the gasholders gives only erroneous and uncertain results, we shall here simply speak of measurement by the station-meter.

Station-meters are but little liable to derangement, and, once regulated, do not generally require any further attention than the maintenance of the water at its normal level. The errors which occur in the registration of the amount of gas made most frequently arise, not from the inaccuracy of the measuring apparatus, but from the influence of the temperature upon the volume occupied by the gas, of which generally we do wrong not to take account. It is understood, in fact, that if, as is ordinarily the case, the gas is measured at the works and in the town under different conditions of temperature and pressure, the valuations can do longer be directly compared one with the other, and it will be absolutely impossible to form even an approximate idea of the extent of the actual leakage or loss of gas.

If we let

V represent the volume which a certain quantity of gas occupied at the works, at the temperature of 5° , and under a manometric pressure of p_1 millimètres of water (0.0735 p_1 mm. of mercury), the barometer standing at H_1 mm.;

V_2 the volume the same quantity of gas occupied in the town at the temperature of t_2° , and under a manometric pressure of p_2 millimètres of water (0.0735 p_2 mm. of mercury), the barometer standing at H_2 mm.;

Z_1 Z_2 the tensions at t_1° and t_2° of the vapour of water contained in the gas, which may be considered as saturated with vapour;

we shall have, according to Gay-Lussac's law—

$$\frac{V_2}{V_1} = \frac{(H_1 + 0.0735p_1 - Z_1)(1 + 0.00336t_2)}{(H_2 + 0.0735p_2 - Z_2)(1 + 0.00336t_1)}$$

For example, if we let

$$\begin{aligned} H_2 &= H_1 = 764 \text{ millimètres,} \\ p_1 &= 150 \text{ millimètres of water,} \\ p_2 &= 25 \text{ millimètres of water,} \\ t_1 &= 35^{\circ}, \text{ whence } Z_1 = 41.8 \text{ mm.,} \\ t_2 &= 15^{\circ}, \text{ whence } Z_2 = 12.7 \text{ mm.,} \end{aligned}$$

we shall find

$$\frac{V_2}{V_1} = \frac{733 \times 1.0549}{753 \times 1.1281} = 0.91$$

That is to say, that if the gas made has been measured at the works at 35° C., which may occur in the spring, and when it arrives at the consumers meters its temperature has been lowered to 15° , 100 cubic mètres of gas measured at the works will not represent more than 91 cubic mètres measured in the town, and the apparent loss will be 9 per cent. It is evident that the difference will not always be so great; but the example cited shows clearly that if we wish to arrive at an exact estimation of the actual extent of the leakage, we must first of all consider the methods of measuring the gas made and the gas sold under conditions of temperature and pressure as little dissimilar as possible, and making certain corrections in the volumes of gas registered by the meters. These corrections, moreover, do not present any difficulty, as it is unnecessary to seek to give them an exactness of which the other data of the question do not admit. The following mode of operation is very simple, and gives results sufficient for all practical purposes.

It will be admitted, perhaps, that the gas in its passage through long pipes acquires the temperature of the soil through which it passes, and that consequently it is at this temperature when measured by the consumers meters. Let us suppose, for example, that the average temperature of the town in which we are now assembled is 14.1° C.; it will be sufficient to bring to this temperature all the volumes registered by the station-meter, so that it may be possible, at the end of each year, to ascertain the quantity of gas really lost. It is true that we could go through this process each month, bringing the volumes to the mean temperature of the month; but that would be of no use, on account of the difficulty of taking the registrations of all the consumers meters coincidentally with the closing of the monthly account-sheets of the gas made and sent out. Moreover we shall take for the height of barometer the average pressure of the place where we now are, which in the case under consideration is 760 mm. The mean manometric pressures under which the gas is measured at the works and in the town being known (here 150 and 25 mm. of water), it will only remain to note the temperature of the gas as it passes into the station-meters. This observation is within the capacity of every foreman of works, and may be made four times a day—at six in the morning, midday, six in the evening, and midnight—concurrently with the reading of the index. The mean of these four observations is taken as the mean temperature of the gas made in the 24 hours.

The volume V_1 registered by the meter, is corrected to the theoretic volume V , at the standard temperature and pressure, by means of Gay-Lussac's formula given above:—

$$V = V_1 \times \frac{(H_1 + 0.0735p_1 - Z_1)(1 + 0.00366t)}{(H + 0.0735p - Z)(1 + 0.00366t)}$$

in which we make

$H = H = 760$ millimètres,
 $p_1 = 150$ millimètres,
 $p = 25$ millimètres,
 $t = 14.1^\circ$, whence $Z = 12$ millimètres,
 Z_1 and t_1 being alone variable.

In calculating once for all the value of the second factor for different values of t_1 we shall only have to multiply V_1 by the coefficient corresponding to the mean temperature observed, to obtain the volume V_1 corrected.

The following extract from the table in question is given as an example:—

Temperature of Gas at Station-Meter.	Coefficient of Correction.*
10 deg. C.	1.030
15 "	1.007
20 "	0.985
25 "	0.960
30 "	0.950
35 "	0.906

Instead of making every day the calculation we refer to, one might be satisfied, without great inconvenience, with inscribing the coefficient of correction corresponding to the mean temperature observed, and making the reduction at one stroke at the end of the month, by applying to the total make the mean coefficient of the month.

We here mention the advantage this method of proceeding presents, even from the point of view of the control of the manufacture, only as furnishing a certain basis for the comparison of the yield of gas in different months of the year.

2.—Errors in the Valuation of the Quantity of Gas Sold.

Gas is sold either by burner at so much an hour, or by meter. The former mode, which is now scarcely ever adopted for the sale of gas to private consumers, being the only one applicable to the public lighting of towns, it is unnecessary here to insist upon the importance of keeping the consumption of these burners within the strict limits corresponding to the stipulated price per burner and per hour.

The various arrangements adopted to obtain this result may be divided into three groups:—

- (a.) Stopcocks.
- (b.) Pressure-regulators.
- (c.) Regulators of consumption, or rheometers.

Each of these arrangements possesses advantages and disadvantages to which we shall content ourselves with calling attention, without entering into amplifications which would be beyond the scope of the present memoir.

The employment of the stopcock permits the consumption to be kept constant only when the pressure behind the stopcock is very nearly invariable during the continuance of lighting, which is not generally the case; neither is it applicable except when the Municipality allow variations in the amount of gas consumed at the burners during the evening hours, provided the mean consumption remains within the prescribed limits. This method of proceeding presents the incontestable advantage of allowing a more rational distribution of the light over the hours of the evening and night with the minimum consumption of gas. The employment of the stopcock allows, in short, of the almost instantaneous modification of the intensity of the light by a change in the initial pressure, thus providing the works with the means of concealing, in certain cases, an accidental defect in the quality of the gas, until the remedy could be applied. On the other hand, the employment of stopcocks for regulating the flames requires a practised and attentive staff of servants, and constant supervision, under the penalty of soon seeing the consumption of the burners exceed the regulation limits. It is, moreover, to be rejected at all points of the mains where the pressure is subject to considerable variation in the course of the same evening, on account of the necessity which would arise for regulating the flames to an average consumption higher than the amount stipulated for, under penalty of having at certain hours absolutely defective lighting.

The object of the pressure-regulators, as their name indicates, is to maintain beneath the burner a constant pressure, which, however, it is possible to vary by modifying the weight on the inlet-valve. As, notwithstanding all the care that has been bestowed upon their manufacture, burners of the same size do not consume exactly the same amount of gas at a determined pressure, there is generally given to the regulator a weight slightly above that which corresponds to the normal consumption of the burner, the consumption of the latter being regulated by means of a stopcock placed between the burner and the regulator. Beyond irregularities which may occur in the action of the apparatus, in consequence of the alteration of the flexible membrane forming its essential part, these regulators present the disadvantage of requiring to be adjusted afresh each time the burner is changed. Their only advantage is that they allow variable pressures and rates of consumption to be obtained from the same apparatus by modifying the weight on the membrane or the opening of the stopcock.

The object of the regulators of consumption, or rheometers, is to ensure the constancy of the volume of gas consumed, whatever kind of burner may be employed, and at whatever pressure the gas may be supplied, so long, be it understood, as such pressure does not become too low to stop the action of the rheometer. These apparatus are called upon to render great service to gas industry, and their application to public lighting purposes cannot be too strongly recommended, as their employment would result in the complete removal of one cause of considerable loss, and at the same time do away with a subject of frequent contests between companies and municipalities. Whichever of these systems be employed, the work of successively inspecting and cleaning, at least twice a year, all the rheometers placed upon the mains, ought not to be neglected; it does not present any difficulty, and occasions only an insignificant expense.

We will now make a few observations on the sale of gas by meter. Although this question is closely allied to that of leakage, we cannot, without exceeding the limits of this paper, enumerate and discuss here the various arrangements which have been proposed or adopted to effect the removal of the causes of error in the measurement of gas at the meter. Let it suffice for us to say that the meter, as at present sold by the majority of French manufacturers, renders frauds very difficult, if not impossible. Practice, however, has not yet definitively sanctioned any of the arrangements proposed to prevent variations in the level of the water in the meter, or to render the correctness of the measurement independent of the constancy of this level. Let us add, however, that in well-organized gas-works care will always be taken to remedy this relative imperfection

* To bring the volume observed to the temperature of 14.1° and to the manometric pressure of 25 millimètres.

by constant supervision, the expense of which is largely compensated for by the augmentation of the receipts which results from it; for, while the errors that may be committed in the measurement of the amount of gas made cause no other inconvenience than the prevention of an exact estimation of the leakages, without in any way modifying their absolute value, the differences resulting from incorrect measurement at the point of consumption may be of much greater importance.

3.—Loss of Gas from the Mains.

If, on the whole, it is not very difficult to lay a service of mains gas-tight, it may be said that it is not possible to preserve it, for any length of time, in that state of perfection. But the inconveniences and damage of every kind resulting from a defective service of mains are so serious that all the efforts of intelligent gas managers should be directed to reduce these losses to a minimum.

Before entering upon a discussion of the precautions to be taken and the rules to be followed in laying and keeping in repair, under the best possible conditions, a system of gas-mains, it is advisable to say a few words on the principal causes, permanent or accidental, under the action of which there is a tendency to the production of leakage.

Gas-mains being generally placed at a very slight depth, are subject to the influence of the changes of atmospheric temperature. The coefficient of lineal expansion of cast iron being equal to 0.0011 from 0° to 100° C. A difference of 12° in the temperature of the pipe, which may be considered as the minimum of the variations from one season to another, will give rise to an expansion or contraction of 13 centimètres (5 inches) per kilomètre (1094 yards). If any obstruction prevent this movement from taking place freely, the result will be either a rupture or a disjoining of the pipe. In the most favourable case—that is to say, supposing the variation of length to be distributed uniformly over all the pipes, these successive expansions and contractions would affect the soundness of the joints more or less rapidly, according to the system adopted and the care taken in their formation. The disturbance of the soil in streets where the traffic is great, acts in a similar way, and with so much greater force in proportion to the proximity of the pipe to the surface of the ground.

The works which are carried on under the soil of the public ways (such as the construction and repair of sewers, water-pipes, &c.) are a frequent cause of damage to the gas-mains, either at the time of their execution, or in consequence of the settlement of the ground which often results from it.

To these general causes there is sometimes added the accidental corrosion and decomposition of the iron mains by the influence of the chemical action set up by the special conditions of the soil wherein they are laid.

In fact, there is no doubt that the physical phenomenon known by the name of *diffusion* exercises over the leakage an influence so much greater because of the extent to which the preceding causes, by disturbing the system of mains, will have augmented the porosity of the joints.

It is known that diffusion consists in the property gases possess of mutually penetrating from their surface of contact, until the density of each shall have become the same in each point of the total volume occupied by the mixture. Experience has shown that even when the two gases are separated by a diaphragm, the pores of which offer considerable resistance to their passage, reciprocal diffusion nevertheless takes place through this diaphragm with tolerable rapidity, which is proportional (1) to the difference of the pressures above and underneath the diaphragm; (2) to a coefficient of friction depending upon the nature of the diaphragm, but which is sensibly proportional to the square root of the product of the specific gravities of the two gases in contact.

In the particular case under consideration—that is to say, illuminating gas and air—this coefficient will be proportional to $\sqrt{\frac{1.000}{0.420}} = 1.54$; in

other words, there will come out 1.54 volumes of gas, and there will re-enter one volume of air, the absolute quickness with which the diffusion will be produced depending besides upon the nature of the partitions through which it operates.

It is to diffusion that to a great extent may be attributed the rapid impoverishment of the gas which has been stored for some time in a gasholder, as well as the diminution observed in its volume, although no apparent escape can be detected.

If in a main-pipe that is not kept constantly charged, the gas loses its illuminating power, it is because through the joints and pores of the pipes there occurs an exchange of gas and air at the rate of about $1\frac{1}{2}$ volume of the former to 1 volume of the latter.

(To be continued.)

"COMMISSIONS."

The following letter has appeared, amongst others, in the columns of *The Times* during the past week:—

To the Editor of "The Times."

Sir,—If anything can be done to stop the system of illegitimate commissions, it will be by letting in the light upon it through your powerful journal. It is not for me to assume a tone of "virtuous indignation" at the state of things so disclosed, for I am a member of a firm which, in its transactions with public companies (chiefly gas companies) and corporations, has for more than 20 years paid large sums in this way, and whose business would not probably have grown to its present dimensions had these payments been refused. I have always exerted myself to prevent the extension of the system, but have only succeeded to the extent of limiting and reducing these payments. I am far from satisfied with this, however, as the bad principle at the root of the system remains untouched till the system itself is utterly abolished.

I am able to state that in most gas-works (the exceptions being very few indeed) very little is purchased which does not pay a toll to one or more of the officials. Coals, pipes, fittings, meters, apparatus, and material of every kind are all subject to a "commission," and it is vain for the officers of any company to pretend (as is often done) that these payments are no loss to their employers, but merely a deduction from the profits of the seller—a statement so evidently absurd that I will not waste your space in refuting it. But these commissions indirectly produce losses far greater than their own amount. It is within my own knowledge that, with a view to their receipt, managers of gas-works are often induced to overstock with apparatus and material on leaving one situation for another, and that it is quite the rule for a new manager to find that his predecessor has provided him with everything likely to be required for months to come, and that some of the articles are not such as the newly-appointed manager would himself have purchased. But he can often make no complaint, for did he not do the same thing in the situation he has just left? These commissions also induce the purchase of new material and apparatus and the breaking up and disposal of old, merely to obtain for the manager the "usual commission," and for the same purpose extensions of works and alterations of plant are entered upon, either before they are called for, or to a greater extent than required, the fact being that the manager's interest is opposed to that of the company, as in most cases any increase of salary as a reward for good management would not nearly equal the amount to be received on commission.

When consulting engineers are called in, they receive a commission on

the outlay they incur, from the gas company for whom it is incurred (which may or may not be a wise mode of payment, but is perfectly legitimate), but it is not so well known that they also get a commission from the contractors who execute the work, and against this practice the system of tenders and contracts offers but a feeble protection, while "the lowest tender is not necessarily accepted."

It is often said that companies are to blame in paying small salaries, which have to be supplemented by the means referred to, and there may be some little truth in the remark; but I know of a few cases where poorly paid and thoroughly efficient men have resolutely declined commissions, and many cases where well paid and less efficient men have not only accepted them, but could not be approached on any other footing. Directors of public companies cannot raise their officials above temptation by simply increasing their salaries; but they would be great gainers were they to do so, on the distinct understanding, constantly kept in view, as a condition of the appointment, that commissions either in money or gifts were entirely to be declined, not only by the officials themselves, but also by members of their families, to whom these payments are sometimes made when the official himself desires to deny that he has received them.

It is probably impossible for any one firm to stop the system, as in doing so they would only stop their business and increase that of others, who would be willing to do what they declined. Such a proceeding, therefore, however honourable, would be merely an ineffective protest; and were persons who, like myself, feel strongly on the subject to withdraw from business where these payments are usual, they would not only lose personally (which it might be a duty to do), but would probably do more harm than good by their withdrawal of an influence, always ready to be exerted, for the limitation and abolition of this obnoxious system.

(Signed) A COMMISSION ABOLITIONIST.

IMPROVEMENTS IN STREET LIGHTING.

[From the *Manchester Examiner*.]

An improvement which is expected to yield important results is about to be carried out in the construction of the street lamps in the borough of Salford; and it is believed that it will prove that the gas manufactured by the corporation is much better than that used in many towns where at present the street lamps give a better light. In the eastern, midland, and southern counties, and in London, the streets are, generally speaking, better illuminated than in Salford; but we are informed that the gas used in these places is, as a rule, forty to fifty per cent. inferior in lighting power to that manufactured in Salford. The illuminating power of Salford gas is equal to that of about 20 candles, reckoning according to the standards of comparison universally adopted—namely, a jet consuming five feet of gas per hour, and candles each of which burns 120 grains of sperm per hour. Taking London as a fair sample of the places where the street lamps give more light than in Salford, and where, notwithstanding, the gas is of inferior quality to that in the latter borough, it appears that the illuminating power of the gas supplied by the producing companies varies from 12 to 16 candles. It may be mentioned incidentally that the chief reason of the superiority of the Salford gas is that cannel is used in making it, as is also the case in Manchester, while in the places with which the sister borough has been compared the gas is manufactured simply from coal. The explanation of the apparent inconsistency between the quality of the gas and the light given by the street lamps is very simple; and as Manchester occupies about the same position as Salford in relation to this question, it will probably be interesting to examine the explanation. The secret of combustion of gas so as to obtain from it the greatest amount of light is, we understand, that it should be burned at what has been called an inappreciable pressure at the point of ignition. To accomplish this object the burner should have a large opening as compared with the volume of gas which is to issue from it. In Salford, however, the practice has generally been to use small burners for the public lamps, and to force large volumes of gas through them, the result being that the fluid has actually passed through the burners faster than it could be consumed, and thus much of it has been wasted. After many experiments conducted by the Salford Gas Committee, with the assistance of Mr. Samuel Hunter, the manager of their works, the committee have decided that, to secure the greatest possible amount of light from the gas used, the whole of the street lamps in the borough shall be fitted with Sugg's patent lamp-governor, the cost of which is only about 3s. This invention is to be fixed just beneath each burner. All the gas consumed will pass through it, and it can be regulated so that, whether the pressure from the main be great or small, whether the tap which the lamplighter manipulates be wide open or only partially open, the amount of gas passed through towards the flame will not vary. Two lamps fitted with the new governor burners, as they are called, have been erected in New Bailey Street, one being near the station, and the other at the corner, a few yards away. The experiments made with the two kinds of burners at present in use, and with the governor burner, gave some interesting results. One of the existing burners consumes $3\frac{1}{2}$ feet of gas each hour, and gives a light equal to that of 5.4 candles. The other, burning $4\frac{1}{2}$ feet of gas, yields a light equivalent to that of 8.8 candles, while the new governor burner consumes $3\frac{1}{2}$ feet, with the illuminating power of 10.7 candles. Adapting these figures to the standards, as we have already described them, it appears that the light given by the two old burners respectively is equal to 8 candles and 9.3 candles, while that of the governor burner corresponds to 15 candles. The advantages, therefore, expected from the alteration about to be made are an increased amount of light from the street lamps, a saving of gas, and a saving in the ratepayers' money. Mr. Hunter further proposes to improve the lamps by reducing their height from 12 feet to 10 feet, so as to place the light nearer the traffic, by adopting a form of pillar which is more ornamental and casts the least possible amount of shadow, and by making the lanterns more graceful than at present, and marking the lanterns with the names of the streets in which they may be placed. He calculates that the cost of replacing every lamp in the borough with one of the pattern he recommends would not add more than 4d. a lamp per year to the expenditure of the corporation, including the price of the governor. No decision, however, has been come to by the authorities, excepting with respect to the governor.

BIRMINGHAM WATER SUPPLY.—Dr. Hill, the medical officer of health for Birmingham, reports that the water supplied to the town during December was slightly turbid, and the organic nitrogen and nitrates were higher in proportion than they have been for some time, probably owing principally to the late rains.

NEW GAS COMPANY.—A company denominated the "Improved Air Gas Company" was registered on the 23rd ult., with a capital of £10,000 in £10 shares, for acquiring and working certain letters patent, dated June 3, 1872, June 5, 1872, March 8, 1873, and Oct. 30, 1873, numbered respectively 1679, 1708, 843, and 3526, granted to Messrs. Charles Weightman Harrison and Alfred Horatio Harrison, for inventions relating to the manufacture and use of air gas. Also to take over the business of Harrison and Company, Limited, or any other business established for working the same.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The business of the week, although quiet and not of any particular magnitude, has been on a steady scale, and is thought to promise well for the immediate future. Pig iron is in especially good and firm request, some of the local and district makers being evidently determined not to enter into any forward arrangements unless at a clear advance of at least 1s. per ton all round. The periodical report of the Leeds Chamber of Commerce states that, although this disposition to advance pig iron exists, there is nothing whatever to warrant the advance. The same thing may be said of the local trade, so far as forge pig is in question; but the foundries are so well engaged, as a rule, that the steadiness of prices is explained.

At most of the leading foundry establishments in Derbyshire and South Yorkshire there is a good deal of work in hand, and a fair number of orders on the books, hence there are in several directions rumours of intentions to re-start additional blast furnaces. It, at any rate, appears certain that the present is a favourable time to place contracts for pipe and other work of that class, inasmuch as there is every probability that prices will go up somewhat in the course of the next three or four months.

The coal trade is quiet, and will, almost without doubt, remain so throughout the whole of the year. Taking into consideration the great number of new collieries which have just become productive, and the extensions of previously existing pits, it need be no matter for surprise that the competition should be keen, and prices ruinously low. There has been a rumour put in circulation, alleging that South Yorkshire steam coal is specially liable to spontaneous combustion and explosion, but investigation shows that the statement is baseless.

Several pits in both counties have been flooded by the late rains, and some remain so still.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Both the coal and iron trades of this district continue in a depressed condition; the supplies offering in the market are much in excess of the demand, notwithstanding it is only in exceptional cases either the ironmasters or colliery proprietors are working up to their full production, and although the quoted prices do not show any material reduction, there is a want of firmness in the market.

So far as coal is concerned, there appears to be more of the best qualities offering in the market than was the case a few weeks back, and for immediate deliveries sellers would accept rather lower prices to secure good orders; but, with the winter still before them, they are not disposed to enter into forward contracts at the present low prices. Manufacturing classes of fuel continue difficult to sell, both common round coal and engine fuel being very plentiful, and there is a considerable amount of competition in the inferior class of burgy and slack. In the Wigan district the average pit prices are about as under:—Best Arley, 11s. per ton; Pemberton four-feet, 9s.; common Wigan mines, 7s. 6d. to 8s. 6d.; steam coal, 6s. 9d. to 7s.; burgy, 5s. 6d.; and ordinary slack, 3s. to 4s. per ton.

In the iron trade the local smelters continue firm at late prices, as their present small production is pretty well sold for the next couple of months; but they are almost out of the market, owing to the low prices at which north country pig iron is being offered by merchants in this district. Lancashire pig iron delivered into the Manchester district is quoted at about 56s. 6d. to 57s. 6d. per ton for No. 3 foundry, and 55s. to 56s. per ton for No. 4 forge. The finished iron trade continues steady in price, local bars delivered into the Manchester district being still quoted at £6 17s. 6d. to £7 per ton, according to quality; but there is no push, and both founders and engineers complain that they are very slack.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England recovered last week from the depression of the previous fortnight. Nearly all the contracts for best gas coals have been concluded for the year. The latest were made at about 8s. 6d. per ton. During last week there were very heavy sailings of coal-laden vessels bound to all parts of the United Kingdom. Many small cargoes of gas coals which had been on board ship, bound to the bye-ports, from eight to ten days, were got away, and the steamers also cleared out, so that the coals in transit have been very heavy. Under these circumstances south country merchants keep out of the market, and a very limited business indeed was transacted last week for immediate delivery either in gas or house coals to be sent away in small cargoes. The price of gas coal remains about the same—namely, about 9s. for the best sorts, and from 6s. 6d. to 7s. 6d. for moderate qualities. The local demand for coals is not at all reviving, and one or two of the colliery companies which have been struggling on for the last two years against adverse times are likely to wind up. The main feature of interest in relation to the steam coal trade at present is the prospect of a reduction of the production of small coal, which may reach outside that trade and strengthen the value of inferior coals generally. But that will not take place just now if at all. The steam coal trade is in a very poor way. Most of the pits are working short time, and there is no prospect of improvement until the middle of March.

Notwithstanding the departure from the Tyne of 250 coal-laden vessels, the supply of tonnage has been quite in excess of the demand. Rates have hardly been maintained. For steamers they have fallen to the following low level:—London, 4s. 3d. to 4s. 6d.; Rochester, 4s. 9d.; Boulogne, 5s. 1½d.; Havre, 6s.; Dublin, 8s.; Rouen, 7s. 6d. per ton. On account of the bad trade, home outward coal business to the Mediterranean is pretty stiff, and the higher rate of freight has to be paid to induce steamers to proceed out.

The iron market is pretty firm in the Tyne. Common bars, £6 15s.; merchant bars, £9 per ton; ships plates, £7 10s.; angles, £7 10s.; rails, £6 5s. per ton; pig iron local make, No. 1, 55s.; No. 3, 48s. 6d., net cash; Scotch warrants, 57s. 4½d. per ton. The local demand is very well maintained. In the lead market here pig lead is sold at £22 10s. per ton; dry white lead, £26 5s.; red lead, £22 5s. per ton. In the chemical market prices still have a downward tendency, and the amount of business doing is very limited. For want of orders makers are obliged to warehouse largely.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Complaints were made at the last meeting of the Town Council of Hamilton that the town had been left in darkness two or three times during the last month or so. On the evening of Saturday, the 6th inst., not a lighted lamp was to be seen. Mr. Tainsh, convener of the Corporation Gas Committee, explained that the gasholders at the works were too small. About 130,000 cubic feet of gas were manufactured daily, and yet there was only accommodation for 90,000 feet; consequently at night they

had to change the holder, and he found that on the night in question, when the change was being made, one of the holders would not act. He sent a man to get the lamps lighted after they went out, and he could say, although it was bad enough, all the lamps were not out. In reply to the Provost, Mr. Tainsh said they would have to face the difficulty of providing against the risk of such a state of things again occurring by providing a much larger holder. Such a one as was needed would require to be 90 feet in diameter, and would cost £1000. He further said that the gas was costing for production only 1s. 1½d. per 1000 feet; and in reply to another member of council who expressed a desire for better gas, he said if they made it better it would not burn in the jets, its illuminating power being equal to 30 standard candles.

At the last meeting of the Town Council of Paisley Mr. G. R. Hislop, manager of the Corporation Gas-Works was in attendance to present and describe the plans which he had designed for a new gasholder, the erection of which he considered was imperative, in order to furnish the town with an adequate supply. The proposed holder would accommodate 670,000 cubic feet of gas, and the cost would be from £14,000 to £15,000. The work would require to be commenced at once, as it would need almost nine months to complete it.

The Gas-Works Committee of the Dumbarton Town Council reported, at a meeting held last Wednesday, that they had taken offers to telescope the old 50 by 16 feet gasholder, and to put in a new 10-inch inlet and 12-inch outlet-pipe in same, which was considered necessary by the manager, Mr. McGilchrist, as a matter of safety, to afford sufficient storage. The provost moved the adoption of the report. Several of the members thought the present an inopportune time to make the proposed alterations, but the members of the committee assuring them that the alteration were absolutely necessary, the Provost's motion was agreed to unanimously.

The Police Commission of Broughty Ferry met last week, when the manager of the gas-works reported that the average illuminating power of the gas supplied to the town was 29·13 candles.

Mr. J. F. King, city analyst, reported to the meeting of the Edinburgh Town Council held last week, that at his last analysis of the gas supplied to the city he had found that of the Edinburgh Company to have an illuminating power of 30·63 standard candles; hydrosulphuric acid, none; ammonia, distinct traces. The gas of the Leith Company had an illuminating power of 27·83 candles; hydrosulphuric acid, none; ammonia, present. Mr. Steel asked if the council had no power to compel the Leith Company to raise the quality of their gas, as it was always two or three candles below that of the Edinburgh Company's gas, and he did not see why that should be. The Lord Provost replied that the Leith gas was at one time above that of Edinburgh, but Mr. Steel affirmed that it had only occurred once.

The gas supplied from the Glasgow Corporation Gas-Works during the week ending the 6th of January had a maximum range from 25·89 candles to 26·04 candles. On one occasion the minimum was down to 24·30 candles at the Dawsholm station, and down to 24·59 candles on one occasion at the Dalmarnock station.

Last Tuesday evening a meeting of the Hawick Town Council was held, when Provost Ewen stated that in consequence of the complaints about the bad quality of the gas supplied to the town, he had made a representation to the directors of the gas company, and they had promised to give the matter their consideration.

The Lighting Committee of the Arbroath Police Commissioners have just reported to that body that there are 452 public lamps in the burgh, and with regard to lights on common stairs and in closes they recommended that the board should call upon all landlords to erect lamps, and cause the tenants to clean and light such lamps within the burgh.

It would almost seem as if the relative merits of dry and wet gas-meters had not yet been satisfactorily established, if we are to judge by the correspondence which has recently appeared in the leading newspaper published in Edinburgh, a town that is somewhat famous for the production of meters and other apparatus for the supply and consumption of gas. One correspondent, who signs himself "A Jumper," says: "I have just seen a circular that has been issued by a well-known London maker of dry gas-meters, in which it is said that two meters have been in use between 20 and 30 years, and are perfectly correct. If this is so, why need we be annoyed by continuing the use of meters which cause jumping lights? I address you upon the subject, as not long since a paragraph appeared in your journal upon this question, and some of your correspondents may be able to throw a steady light upon the matter." In reply to "Jumper's" remarks, at least three very interesting letters have already appeared, in which the merits of both dry and wet meters have been set forth. One correspondent, signing himself "A Steady Light," says, with regard to jumping lights, that the dry meter is more troublesome than the wet, though not affected in the same way.

The usual monthly meeting of the Dysart Town Council was held on the evening of Monday, the 8th inst., when an animated discussion arose on an intimation from the gas company that they were disposed to sell the gas-works to the Council. Seeing that the Kirkcaldy Gas Company had introduced a 6-inch pipe along the highway to the burgh, and that the Kirkcaldy Company could manufacture gas 2s. 6d. per 1000 feet cheaper than the Dysart Company, the question was postponed for consideration, the clerk stating that no sale could possibly take place until after December next, and that a public meeting would also be required to give an opinion of the inhabitants on the matter.

A moderate amount of business was done in the Glasgow pig iron market in the early part of the past week, but towards the end it began to waver, and steadily to settle down. The foreign demand is very limited in amount. Reductions in price were very general during the week, most of the leading makers taking off 1s. per ton. The market closed on Friday with buyers at 57s. 3d. cash, and sellers 57s. 6d. one month open.

The coal market has been idle during the past week, buyers being shy. There is only a moderate demand for house coal, and prices, as a rule, are unchanged.

SALE OF GAS SHARES AT CARDIFF.—A few days ago 57 shares of £25 each in the Cardiff Gas Company were sold by public auction, and realized £38 10s. per share. The dividend on these shares is limited to 7 per cent.

WASTE OF WATER IN DUBLIN.—The *Freeman* states that the average quantity of water sent into the city of Dublin daily, and accounted for in the week ending the 3rd, was 7,255,127 gallons, and the average quantity of water wasted daily in the same period was 5,043,777 gallons.

GLASGOW WATER SUPPLY.—Dr. Mills, of the Andersonian University, Glasgow, reports that during last month the water supplied to the city from Lock Katrine was of a pale yellow brown colour, and somewhat ferruginous. It contained traces of suspended fibrous matter.

BRADFORD GAS AND WATER WORKS.—At the meeting of the Bradford Town Council, on the 9th inst., the salary of Mr. Binnie, water-works engineer, was raised from £400 to £1000 per year; and that of Mr. David Swallow, gas-works engineer, from £800 to £1000.

ACCIDENT AT THE ROTHERHAM NEW GAS-WORKS.—For some time past the Corporation of Rotherham have been extending the old gas-works, and one of the principal new buildings is a purifying-house on the banks of

the river Don. Part of the house projects 15 feet over the water, and for the support of the outside wall, a set of cast-iron pillars rose out of the bed of the river. On the girders resting on the pillars was raised, about six weeks since, a brick wall 22 feet high, 14 inches thick, and 61 feet long. In the wall were four 8-feet openings, reaching to within a few feet of the top; and the whole was tied with stone, and bound with hoop-iron. The wall has been "green" ever since it was put up, and consequently it was not deemed safe to put on the roof. That there was ample ground for this fear was proved about half-past seven on Saturday night, Jan. 6, when, owing to the weak state of the wall, caused by the recent rain, and the prevalence of a gusty south-east wind, the whole fell with a crash. The top part fell into the water, but the lower portions, and the piers between the openings, bulged inwards, breaking two girders and two purifier plates. However, the pillars and girders over the water did not move in the slightest degree, proving that the weakness was confined entirely to the work above. The building work has been done by Mr. Jackson, Rotherham, under the supervision of Mr. Goodwin, the gas-works manager, the corporation finding the material. The damage is estimated at £120, which will have to be borne by the corporation. Until the weather becomes more settled, it is not proposed to complete the work.—*Rotherham Independent*.

THE PARAFFIN OIL TRADE.—Amid the dulness which prevails at present in our trades and manufactures, it is satisfactory to find unusual activity in one branch of them—namely, in the manufacture of paraffin oil. About twelve years ago there was great briskness in the trade of this article, and the price reached such a height as was never heard of before. This briskness, however, was but of short duration, though it stimulated the manufacture of the oil to an unusual degree. Works sprang into existence in all parts of the country, and the rents and royalties obtained for the shale from which the oil is made caused the proprietors of coal to wish that their minerals were shale instead of coal. Many circumstances at the time contributed to the increase of the manufacture, two of them being that coal and wages were so low as to make it more remunerative. The high price of the oil in this country brought many speculators into the field in America, and the most strenuous exertions made by them to discover petroleum were crowned with success to such an extent as to flood the market with the produce of the wells. District after district was found where lucky adventurers came upon wells which spouted out the oil in such abundance as to render it very difficult to find vessels in which to store it; the result was that a large quantity of it was allowed to run into the nearest rivers and to be carried off to the sea. It is now about three years since one of the most productive of these districts was discovered, which produced so much more petroleum than was required for the consumption of the world that the surplus was stored up; and about a year ago this amounted to about three or four millions of barrels of crude oil. Unfortunately for the manufacturers of paraffin oil in this country, this enormous produce in America took place at a time when coal, wages, iron, and other material required most in the manufacture of paraffin oil, reached an unprecedented price. The cost of production was, therefore, very much increased, while the price of the oil was greatly reduced from the large importations of petroleum from America. The consequence was that considerable losses were experienced by the manufacturers in this country, and some of them succumbed to the adverse circumstances. The survivors struggled on during these disastrous times, economizing in every way, improving the manufacture, and utilizing the waste products. The result was that, even with oil at so low a price as it never reached before, they were able to pay a dividend when the cost of manufacture was reduced by coal and iron, and wages being also reduced in value, though not so low as they were at the commencement of the manufacture of the oil in this country. These companies are, therefore, now in a good position to reap the advantage of the increased price of paraffin oil. Though this increase came rather late in the year for the full advantage of it to be felt this season, there can be no doubt that larger dividends may be looked for, with the certainty of a profitable trade for some time to come. The prospects of the manufacturing trade for the future are encouraging; for the great exertions made for the last year in America to discover more flowing wells, and another oil-producing district, have not been hitherto successful, nor is there any prospect of their being; and so long as petroleum cannot be produced, excepting at the expense of pumping, the manufacturers in this country will be able to compete with those in America, and the oil trade will be profitable. It is expected that in future the price will be a paying one; and, if we may judge from present circumstances, the profits for some time to come will be very large; for the production is not nearly equal to the present consumption, and the large stock of crude oil in America is being rapidly reduced, the reduction in some months being about 300,000 barrels per month. Those best able to judge, from their position, are therefore making great preparations to avail themselves of the expected continued high prices. The two large companies in Scotland have added, and are adding largely, to their plant. It is said that Young's Company have already added plant sufficient to increase their production of oil 25 per cent., and that the Uphall Company have similarly increased their production 40 per cent., and it is expected that there will be further additions. It is further stated that these additions are made without increasing the capitals of the companies. The larger production of oil in this way is not likely to affect the price, for the production in Scotland is so small, as compared with that in America and with the general consumption, that it will require a very large increase in the manufacturing plant to have any material effect. It was calculated a month ago that the whole production of Scotland for a year would not be equal to more than a week's consumption, so that there need not be any fear of over-production from increase of manufacturing plants for some time to come.—*Scotsman*.

COAL GAS AND ITS APPLICATION TO HOUSE LIGHTING.—A discourse on this subject has just been delivered in the theatre of the Royal Dublin Society by Professor Tichborne, F.R.S., M.R.I.A., gas examiner under the Board of Trade for the City of Dublin. The lecturer began by stating that lighting by coal gas was a comparatively recent invention. It was not until 1810 that a company was formed in London for the supply of the City with gas, and Paris was not lighted with gas until 1820. In those days nothing was heard about the purity of the gas, or about its illuminating power. So that they gave the consumer something at the end of the tube which would burn, that was all that was required. Passing to the composition of coal gas, he showed that it consists of—

	Per Cent.	Relative Weight.	
Hydrogen (H) . . .	45	1	Non-illuminating — Lightest substance known.
Marsh gas (CH ₄) . .	35	8	Slightly illuminating—"Fire-damp."
Carbonic oxide (CO) .	6·6	14	Non-illuminating—Poisonous.
Olefiant gas (C ₂ H ₄) .	6·0	14	Highly illuminating, being (and other olefants) very rich in carbon.
The impurities found in coal gas chiefly consist of ammonia (NH ₃) detected by Hematoxyline; sulphide of carbon (CS ₂), detected by Triethylphosphine; and sulphuretted hydrogen (H ₂ S) detected by acetate of lead. This			

last impurity is the most important, as it blackens the paint of the houses, discolours the silver plate, and affects the breathing of the inhabitants. The Dublin gas contains a small quantity of ammonia but it is entirely free from sulphuretted hydrogen. For the last two years on only two occasions had he been able to detect any indications of sulphuretted hydrogen. In fact, it was much purer than was required by the Act. On one of these occasions the defect had been discovered, and the remedy had been applied before his messenger got out to the gas-works. The lecturer then proceeded to refer to bye-products of general interest. These are—1, coal tar, the source of "coal tar colours," and carbolic acid. Coal tar colour industry represents now a money value of about £2,000,000 per annum; 100 lbs. of coal give 227 grains of magenta, which will dye 7 lbs. of wool, 2, coke; and 3, ammonium sulphate, which is used in making artificial manures. Passing from thence, he proceeded to speak of the structure of a gas-flame, and described the different burners in use. The Dublin gas, on an average, was 17-candle gas, but that might be burned so as to give only a light equal to four or five candles. He understood that the committee of the corporation, having the charge of the public lighting, proposed to use a No. 1 burner in the public lamps. But he was satisfied that although a slight saving might be effected, the public would not be satisfied. A much better result would be obtained by using an improved burner—a burner which would check the flow of gas to the orifice. Good burners are those in which the gas is checked at the base of the burner, and at some distance from the base of the flame—the orifice for the gas at the flame being greater than the check. The most economical way of burning gas was to have a perfectly free combustion at the tube, with a moderate pressure. If they could not check the pressure in any other way, let them do it at the meter. The lecturer then referred to the intensity of light, and the means of measuring it by the photometer; he then described Mr. Crookes' experiments with the radiometer, and dwelt on the quality of light and its effects on colour and fabrics, explaining how colours rich in the more refrangible or blue rays suffer most by artificial light. He also explained the effects of temperature and atmospheric pressure on gas, and how the increase of temperature decreases the illuminating power, but increased pressure augments it. He gave what he called golden rules for the consumer. These were—1. Read your meter once a month. 2. Never have an excessive pressure on the meter, but also control it, if possible, at the burner. 3. Never keep on old burners. 4. Always have your lights 11 to 12 feet from the ground. Passing on to the question of ventilation and the products of the combustion of coal gas, he explained the causes of gas explosion, and showed how, by a recent invention, the presence of leakage of gas at the meter, where explosions are most apt to occur, is at once made known, and explosions are avoided.

Register of New Patents.

397.—BARRETT, J. H., and HARGREAVES, L., Halifax, "*Improvements in apparatus for regulating, controlling, and directing the flow of liquids.*" Provisional protection only obtained. Dated Feb. 1, 1876.

This invention consists of two or more taps and pipes, which latter intersect each other and terminate in one outlet-pipe; the separate pipes or branches being connected with separate vessels, from which liquids are to be drawn. Inasmuch as these vessels may contain an unequal quantity of liquid, or be at varying levels, in order to prevent the flow of liquid from one vessel to another, it is necessary that means be adopted to prevent the back-flow, and for such purpose the apparatus as heretofore made and used was provided with a ball-valve contained within a cavity formed by an enlargement of a portion of the separate pipes, such enlargement being at a point between the vessel and the tap of each pipe.

The object of this invention is to so construct apparatus for these purposes as to dispense with the ball-valve, and to render an enlargement of the separate or feed-pipes unnecessary, whereby the construction of the apparatus is simplified, its bulk is greatly reduced, and the ordinary or "standard" unions are available.

In the construction of the apparatus a winged valve and screw-spindle are used, having a casing and entrance and exit ways, the valve and spindle answering the purpose both of tap and check to back-flow; the flow being from the vessel under the wing-valve (which is thus raised), and to the outlet or discharge-pipe, whilst the effect of back-flow or flow of liquid from another vessel is upon or on the top of the wing-valve, which is thus closed, and the entrance of liquid prevented.

401.—DUBOIS, J. L., Clapham, Surrey, "*Improvements in cocks or taps.*" Patent dated Feb. 1, 1876.

These improvements have reference to that class of cocks or taps in which valves are used, and the object of the invention is to secure increased efficiency in use.

The passage for the flow of the fluid is closed by a duplicate valve applied to and partly formed on a spindle, working between the parts of the cock or tap, and with a flexible diaphragm, the edge or circumference of which is secured by the securing of the dome or cover to such diaphragm and other parts of the valve. To this upper part of the spindle of the valve there is sometimes applied a disc or arms, to act as guides to that part of the spindle in the opening and closing of the valve. The spindle of the valve is acted upon for this opening by a scroll-formed cam turning upon an axis, and operated by a lever arm, mitre, or other tooth gear, or other suitable means. For this motion the scroll is formed so that the increase in the radius thereof is not more than about two-thirds of its smallest radius, and in place of acting by such scroll directly on the upper part of the spindle of the valve, there is applied thereto a rocking-piece, the surface of which, acted upon by the scroll, is extended, and of form corresponding with that of the scroll, so as to obtain sufficient holding for readily retaining the valve at any extent of partial opening; or the upper end of the spindle or the guide thereof acted upon by the scroll is formed of corresponding shape and extent of surface, or with rollers thereto of like correspondence, or with cup applied either above or below the diaphragm, or both; with the cup below the diaphragm the end of the spindle is formed to correspond.

In making the valve in two parts, one part is formed on or applied directly to the spindle, so as to operate in closing a comparatively small passage through the secondary part of the valve, which closes on to the valve-seat.

414.—ADAIR, W., Liverpool, "*Improvements in and connected with pumps.*" Patent dated Feb. 2, 1876.

In this invention, as means for obtaining a quick-closing valve of small weight, and for increasing the durability of valves used in pumps, where grit or other substances are liable to pass the valves with the liquid raised, a flexible disc valve of india-rubber or leather is employed, and a free feather-lift or like valve perforated, or with its top removed, combined together as one. The flexible disc valve, when the pump is in action, opens and closes quickly, so as to allow the liquid and grit, sand, or like substance to pass freely in an upward direction, but prevents the return of the liquid. The liquid in rising passes the flexible disc valve instead of flowing between the feather-lift valve and its seat as heretofore; hence all abrasion and wear of the valve and its seat are avoided. If, however, any large or bulky object, such as is too large to pass the flexible disc valve, is drawn up with the liquid, the feather-lift valve opens and allows free way to the object. The construction of the compound valve is such that it is complete in itself, and can easily be removed, should the pump become choked below the valve, or should its removal be desired from any other cause.

APPLICATIONS FOR LETTERS PATENT.

5035.—PAGE, W., Newcastle-on-Tyne, "*Improvements in valves, taps, or cocks.*" Dec. 29, 1876.

5051.—HART, W. H., Lewisham Road, London, "*Improvements in balanced valves for fluids, partly applicable to ordinary cocks or valves.*" Dec. 30, 1876.

5055.—GEDGE, W. E., Strand, London, "*Improvements in the manufacture of the hydrocarbons of coal tar, and of the amines derived therefrom.*" A communication. Dec. 30, 1876.

8.—STITCHBURY, F., Leyton, Essex, "*An improved method of heating box-irons by a mixture of gas and air.*" Jan. 1, 1877.

21.—PINTO, F. DE C., Kensington Road, London, "*Improvements in steam or other fluid motor engines or pumps.*" Jan. 2, 1877.

25.—THOMPSON, J., Camberwell Road, London, "*Improvements in apparatus to facilitate the cleansing of cisterns or tanks, and for trapping their waste pipes.*" Jan. 2, 1877.

54.—BAILEY, W. H., Salford, Lancs, "*Improvements in apparatus for raising or forcing fluids and liquids.*" Jan. 5, 1877.

57.—ANDERSON, J., Glasgow, "*Improvements in apparatus for the destructive distillation of shale and other substances.*" Jan. 5, 1877.

79.—TRUSS, T. S., Eastbourne, Sussex, "*Improvements in valves and their arrangement, and in the combination of mechanical actions for working, governing, and reversing the motion of the same as prime movers, and regulating the supply and discharge of fluids to and from the cylinders of fluid motive-power engines of every description, and reversing the motion of the same, parts of which are applicable to pumps.*" Jan. 8, 1877.

97.—COLLINGE, T. A., and PATERSON, T. O., Rochdale, Lancs, "*Improvements in the production of material for and method of purifying coal gas, and in apparatus used for that purpose.*" Jan. 9, 1877.

103.—SCOTT, H. Y. D., Ealing, London, "*Improvements in the treatment of faecal matters and ammoniacal compounds for the production of manures.*" Jan. 9, 1877.

108.—OSMOND, S., Bishopsgate Street Within, London, "*Improvements connected with supplying water to closets and for domestic uses.*" Jan. 9, 1877.

121.—DRONIER, P., Paris, "*Improved means for lighting gas by electricity.*" Jan. 10, 1877.

130.—BREEDEN, J., Birmingham, "*Improvements in valves and taps or stopcocks, and in hose unions.*" Jan. 10, 1877.

149.—EDE, G. W., Little Gray's Inn Lane, London, "*Improvements in valves.*" Jan. 11, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2870.—PRESTON, F. P., PRESTIGE, J. T., and PRESTON, E. J., Deptford, London, "*Improvements in pumps and their fittings.*" July 13, 1876.

2994.—MESSENGER, T. G., Loughborough, Leicester, "*Improvements in valves for the circulation of hot water, which improvements are also applicable to the circulation of cold water, gas, or other fluids.*" July 25, 1876.

3209.—PEYBOUSE, LOUIS DE LA, Finsbury Circus, London, "*Improvements in the manufacture of gas.*" Aug. 15, 1876.

3655.—FOULIS, W., Glasgow, "*A new or improved gas-governor.*" Sept. 19, 1876.

3792.—JOHNSON, J. H., Lincoln's Inn Fields, London, "*Improvements in apparatus for obtaining motive power, which apparatus is also applicable to the condensation and rarefaction of gases and vapours.*" A communication. Sept. 29, 1876.

4056.—TYLOR, A., and J. J. Newgate Street, London, "*Improvements in apparatus and arrangements for measuring and recording the movements, speed, and quantity of liquids and fluids.*" Oct. 20, 1876.

4381.—O'NEILL, A., Baltimore, U.S.A., "*Improvements in modes of constructing and laying mains and service-pipes for water, gas, and other similar purposes.*" Nov. 11, 1876.

4422.—LAKE, W. R., Southampton Buildings, London, "*Improvements in and connected with the pistons of air and gas engines.*" A communication. Nov. 15, 1876.

4585.—RUSSELL, T., Cleveland Square, London, "*A new or improved method of charging and drawing gas-retorts.*" A communication. Nov. 27, 1876.

4588.—LAKE, W. R., Southampton Buildings, London, "*Improvements in couplings or connexions for tubes or pipes.*" A communication. Nov. 27, 1876.

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TO CORRESPONDENTS.

J. H., TRURO.—We believe it is not correct to say that the Municipalities of New York and Philadelphia have resolved upon manufacturing their own gas, and that pending the completion of arrangements for that purpose they have determined to light the public streets with petroleum lamps. An agitation respecting the public lamps appears to be raging in New York, and tenders for lighting the streets for a period of three months only were opened at the Public Hall on the 28th ult. We shall probably be able to furnish more particulars next week.

CONRAD VOSS, Dessau.—Your communication is to hand, and shall appear as soon as the necessary engraving is ready.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 23, 1877.

Circular to Gas Companies.

It was only natural that the subject of "Commissions," ventilated in our columns last week, should attract a great deal of notice. Hence correspondence, for which we cannot find space, and should be indisposed to publish if we could. The writers deal in too sweeping assertions, and are sometimes disposed to defend their own honour, while implicating a large number of colleagues. That many managers, even of small country undertakings, who are said, by a correspondent, to be most accessible to bribes, resolutely refuse to accept them, we have good reason to know. Nevertheless, the temptation is strong, and the

tempter subtle. "With seven young children and a sick wife," a country manager said to us, some years ago, "I can't live on 'my salary,'" and we are bound to say that his legitimate emolument was most inadequate. His choice may be said to have lain between the acceptance of "commissions" or parish relief. The circumstances may have been somewhat exceptional, but the case will serve as an illustration.

It seems to be a common belief that all gas officials are highly paid, but no grosser delusion ever prevailed. There are a few—very few—who receive, well-earned, large salaries; but we repeat, without fear of contradiction, that a vast majority of gas managers are most inadequately rewarded. They are required to know something of many arts and several sciences; they can hardly be said to have peace night or day; and, at times, their duties are of a most onerous character; and when they have done all, they often receive less than a banker's or a merchant's clerk, who has only to make entries and add up figures from ten to four o'clock. Struggling companies may have some excuse for parsimony; but, if we might select some of the worst cases of inadequate payment, we should take them from our corporate towns. Here, too, it may be said, there is an excuse, for we have recently read of indignation meetings being held, to remonstrate against the addition of fifty pounds a year to the salary of a most valuable gas officer.

We feel bound to insist on this matter, for, in our opinion, it lies at the bottom of all the mischief of which complaint is now made. Pay a man well, and then you may expect or require him to be immaculate. It is, from a moral point of view, sad to think that men require to be bribed, as we might say, to be honest, but such, in a limited sense, is the fact. You must place men above temptation before you can expect them to resist it.

We insert Mr. G. Livesey's letter, inasmuch as it is a fitting answer to the letter of the "Commission Abolitionist," which we quoted last week. It will be seen that, practically, Mr. Livesey admits the truth of most of the allegations of the previous writer, and only controverts the too sweeping charges made in the letter. The offers of bribes are not universal, nor are their acceptance universal. Mr. Livesey agrees with us in putting the blame on the right shoulders. The old serpent has, in the lapse of time, assumed many forms; and if after, say, six thousand years, he reappears in what is called the nineteenth century in the shape of a coal-contractor or meter-maker, with a golden pippin in the shape of a commission, who is to blame? Certainly not the "innocent victim" who takes the pippin, and, it may be, gains a knowledge of good and evil in the columns of *The Times*, but the scaly monster who first offered the temptation, and then exposed his innocent victim. A curse was pronounced on the original old serpent, but we suspect that many curses will attend his representative of to-day.

We pointed out some months ago that questions might arise as to the validity of the gas testing in the Metropolis in consequence of the amalgamations which have taken place, and the conjunction of the mains from distinct manufacturing stations. Letters from the Gas Referees, addressed to the Board of Trade and the Metropolitan Board of Works, show that the Referees have become alive to the fact that the origin of the gas tested, at all events, at some of the testing-places, cannot be satisfactorily fixed. The consequences are somewhat important, seeing that no particular manufacturing station can be charged with default. The remedy for this state of affairs is partially perceived by the Referees, who have recommended two additional testing-places, one of which is to be at the offices (works) of the late Independent Company, and the other in the City. Now, it is certain that if any one station is to be held responsible for a default, the gas must be tested at that station. Without pretending to a perfect knowledge of the distribution of the trunk mains, we think we may correctly assume that the gas which would be tested in the City of London, would be a mixture of gas made at Beckton and at Bow. Hence a very important question might arise if an attempt were made to mulct the company in fines for a deficiency of illuminating power to be calculated on the quantity of gas made at one particular station. It would, no doubt, be very satisfactory to the Corporation of the City of London to have the gas tested where it is consumed, and not miles away. Not that it is a matter of any importance, for when the gas was simultaneously and independently tested at Beckton and in Cannon Street, it was made clear that only a very small diminution of illuminating power was occasioned by the journey. The true solution of the difficulty lies, as we have hinted, in the removal of all the testing-places to the works. In such an event no dispute could possibly arise. Each station would be made responsible for its own default.

After some delay, the testing-places for the two stations of the

Commercial Company are announced as ready for use, and we presume the Metropolitan Board of Works will presently appoint examiners, or an examiner. They recently tried to get one for the two stations—about three miles apart—for a hundred a year. Seeing that the examiner would be required to make at least three tests a day, and mostly in the evening, at each station, it is clear that it would require him to walk over about eighteen miles in the course of a limited number of hours, and, consequently, that for the efficient performance of his functions, the knowledge of a chemist would have to be combined with the physical endurance of a pedestrian like Weston, and all for a hundred a year.

We have before us a copy of the Bill promoted by the Ramsgate Local Board, and see that it is undisguisedly a measure for the confiscation of the Gas and Water Companies. Before we saw the exact terms of the Bill, we made some speculations as to its chance of success, and, supposing it successful, the cost it would involve to the Local Board. We see no occasion to alter any of the opinions already expressed in these columns; but further consideration has strengthened us in the belief, that the designs of the Ramsgate Board will be frustrated. They are desirous of purchasing the whole undertaking of the Isle of Thanet Gas Company, who supply Margate as well as Ramsgate. It cannot be disguised that there is no love lost between the two competing Cockney-frequented watering-places; and Margate, the Corporation of which promoted indirectly, a year ago, a filibustering Bill, and failed, could hardly regard with equanimity the success of the Ramsgate Local Board. The former, also, already resent the design of the promoters to saddle them with half the expenses incurred by the Ramsgate Board in their proceedings last year. Altogether, there are the elements of a very pretty quarrel between the two authorities, and we must wait to see whether the duel will take place.

The main objections raised to the Bills of the two Companies, are brought against the proposal to create "Improvement Stock"—that is, to capitalize profits. Now, on this matter the opinion of Parliament has always been very decided. The dividends on stock so created have been gradually cut down; but the justice or legality of capitalizing expended profits has never been questioned. On this point, therefore, we expect the decision of a Parliamentary Committee will be emphatic.

If we could find a blot in the Thanet Gas Bill, it would be in the maximum price proposed for gas, which is 5s. 6d. per 1000 feet, while the Bill of the Local Board proposes only 5s. A maximum price, everybody is aware, is not necessarily the selling price; but people are, nevertheless, frightened by a high maximum. This error can, of course, be remedied in committee. In the event of another great disturbance in the coal trade, a relief Act would certainly be passed, and, therefore, Companies need not be anxious about very high maximums. The Ramsgate Bills will give rise to most important proceedings in relation to Gas and Water Companies in the coming session of Parliament, and the result may be looked forward to with intense interest.

The Local Board of Burslem, at a special meeting held on Wednesday last, unanimously approved a resolution to the effect that the Board agreed in the propriety of promoting a Bill to acquire the undertaking of the Burslem and Tunstall Gas Company. There now only remains to be held the meeting of ratepayers and owners, required by the Borough Funds Act, and all the local formalities will have been complied with. No opposition is expected in the district, and therefore we may conclude that the undertaking will quietly pass into the possession of the Board. We shall presently have to notice at greater length the Bill promoted by the Board, but we may say now that the terms of purchase have been arranged with the Directors of the Company. The consideration to be paid is £80,000, the Board assuming all the debts of the Company.

On the following day, the Town Council of the neighbouring borough of Longton held their second statutory meeting, for the purpose of confirming, or otherwise, a resolution passed at the previous meeting, authorizing the Council to promote a Bill to acquire the undertaking of the Longton Gas Company. In this case, also, the terms of purchase have been arranged, and no opposition from ratepayers and owners is to be anticipated. The consideration to be paid is £73,150, in cash. By a special clause, it is proposed that the powers conferred by the special Act of the Company shall be carried over to the Corporation; but an objection has been raised to the maximum charge the Company have power to make. This is now 7s. 6d. per 1000 feet (only in out-districts, we rather think), and an amendment was carried suggesting that a maximum of 5s. per 1000 feet should be inserted in the Bill. There can be no doubt that the two measures here alluded to will become law, and thus two more

not inconsiderable undertakings will pass into the hands of local authorities. Where this absorption of commercial undertakings by municipal bodies will end, it is not easy to foresee. The Town Council of Birmingham have absorbed the gas and water undertakings, and Mr. Chamberlain, M.P., now proposes that they shall buy up the public-houses. What will follow? Will Corporations presently undertake the supply of bread and meat, and keep these articles of prime necessity at a low price, abolishing, once and for all, everything in the shape of the obnoxious rates?

Next week we shall have to report the decision arrived at by the owners and occupiers at Warrington. The voting papers were distributed yesterday, and will be collected the day after to-morrow. Excited meetings were held in some wards last week; but it is impossible to gather from them what the result of the poll may be. It is probable that at Warrington, as elsewhere, voters form but a fraction of the audiences who are called upon to decide a question by a show of hands.

Mr. M'Quie, the accountant appointed by the Recorder of Liverpool to investigate the accounts of the Gas Company, has made a report on the accounts for the year ending the 30th of June last. The most important part of the document appears to relate to the payment made in liquidation of the damage done by the fire at the Landing-Stage. The amounts already paid for this purpose, including law charges, make a total of £33,614; and the question now raised is, from what source this sum shall be taken? It appears to have been paid from the reserve-fund of the Company; but Mr. M'Quie argues that, according to the Gas-Works Clauses Act, 1847, no money from the reserve-fund could be appropriated to the purpose without, in this particular instance, the sanction of the Recorder. As the matter will presently come before the Recorder, we shall not here express an opinion on the question. For the present all risk of the Gas Company being made liable for a similar accident has been obviated by the formation, in March last, of a Gas-Fitting Company, who took over that branch of the business. We see, however, that the United Company have reserved power to take back the concern on giving three months notice. There are two other statements in the report worthy of remark. Mr. M'Quie gives the amount of deposit-money in the hands of the Company as £30,000, and he suggests, as we have done already, the payment of a minimum rate of interest to the depositors. Further, as showing the substantial character of the undertaking, he estimates that the prospective *surplus* profits—that is, we presume, the surplus profits of the current year—will amount to £28,000, which he, of course, contends should be applied in reduction of price.

The Vestry of Lambeth have just paid a little bill of £611, costs incurred in opposing Gas Bills last session. The members tried to look pleasant over the affair, and seemed to indulge the delusive notion that the expenditure had saved them threepence per thousand feet on the price of gas. We do not see it, but the Vestry are quite at liberty to believe it if they like. An amusing feature in connexion with this matter is, that the Vestry incurred the cost of £10 odd in the taxation of the bills of their own Parliamentary Agents, which resulted in getting £3 struck off.

Water and Sanitary Notes.

WE refer, with some degree of pain, to the proceedings which have taken place relative to the water supply of Richmond (Surrey). We have a strong feeling that both the Southwark and Vauxhall Company and the Richmond Vestry have been somewhat in the wrong. It was, of course, perfectly competent for the Vestry, after the Chancery proceedings, to undertake the water supply of their own district; and, being dissatisfied with Thames water, they were justified in resorting to another source. But, after having determined on the course to be pursued, they were bound, in the interests of their constituents, to do the work they undertook as cheaply as possible. They selected their sources, and made their reservoir, and then there was at their hand a complete service of distribution, which only required to be connected. Common sense, and a regard for economy, would certainly have dictated the purchase of this distributing plant, which, we are certain, might, if the negotiations had been opened in a proper spirit, have been acquired for a reasonable price. The Southwark Company were beaten on all points of law, and they could have done nothing but agree to reasonable offers from the Vestry. No offer, however, was made, and the Vestry proceeded to put the ratepayers to the unnecessary expense of a duplicate system; and they expected that the Water Company would stand quietly by and see themselves ruined (so far as Richmond was concerned) without

a sign of vexation. Conduct such as this is not to be expected even in a Christian or a Quaker. The Water Company did what the Richmond Vestry had gone to great expense to prove that they had a legal right to do, and cut off the supply of water. Hence many complaints of unwashed bodies and thirsty souls in the district, which is at present in straits for water, and will be for a considerable time to come. Confidence is expressed that the supply at the command of the Vestry will be ample for the district. We may be excused for doubting the truth of the opinion. But supposing the supply at command sufficient, the cost of collecting it from the several sources must be very large. We do not remember how many pumps the Vestry have now at work to furnish the supply they give, but we rather think they are numerous, and we know that pumping is expensive. There are at present only about 600 out of 2000 houses connected with the mains of the Vestry. When the whole number are joined, we cannot help thinking that the supply of water will be found utterly inadequate. Sufficient may, no doubt, be obtained in the district; but the cost of the undertaking, as estimated by the Vestry will, we expect, be doubled or even trebled.

The sewage farm of the Norwich Corporation is not alluded to in the Report recently issued by the Local Government Board Commissioners. We think we see that a power of selection of examples has been exercised (with discretion, no doubt), and that only the least unfavourable are brought forward in the report. A Corporation who aspire to the management of a Water and a Gas undertaking, may well be allowed to try their "prentice hand" at farming. Every man supposes he can farm to advantage, and the possession of 200 acres of meadow, and half as much arable land, has been the desire of our life. Well, the Norwich Town Council have tried their hands at farming, but, we are sorry to see, without achieving success. We do not come across the entire capital sum expended on the farms—for there appear to be two—but we gather, from a report of a recent meeting of the Town Council, that, during the past six years, the sum of £4321 has been sunk in improvements, that the value of the stock at present on the farms is £9762, and that there is now owing to the bankers, on account of the farms, a debt of £7049. Of course no blame is to be attached to the Council. They have had plague, pestilence, and famine to contend with. Their bullocks died of pleuro-pneumonia; they lost a flock of sheep from some cause or other; they sowed wheat, and reaped a crop just about sufficient to pay for the seed they planted. The farms are to be put up for auction next month; so the Town Council are not such fools, after all.

The "Troubles Caused by a Bundle of Old Hay" would have been a much more appropriate title to a lecture delivered by Dr. Tyndall at the Royal Institution on Friday last, than "A Combat with an Infective Atmosphere." We attended in the hope of gaining information on sanitary matters, but it is hardly necessary to say that we were disappointed. Dr. Tyndall has, within the last three months, attempted to repeat, in the laboratory of the Royal Institution, some experiments on the genera-

tion of bacterial life in infusions of meat and hay, which he made last year, and which were duly noticed in these columns. He could not succeed in Albemarle Street, so he went to Kew Gardens, and there was perfectly successful. The secret of his failure lay in the presence of a bundle of old hay in the laboratory of the Royal Institution. There is something very remarkable about the germs which this material gives off to the atmosphere. They cannot be filtered out; they are not killed by long boiling. Passing the air holding them through a white-hot coil of platinum only seems to warm them up into more active vitality. Clearly the Privy Council must look to this matter. Bacteria are charged with all sorts of crimes; Rinderpest may be one, and old hay must be looked after.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXVI.

MAIN-PIPES (continued).

Mr. R. C. Robbins's joint is shown in fig. 22. It is entirely of lead, without any other packing.

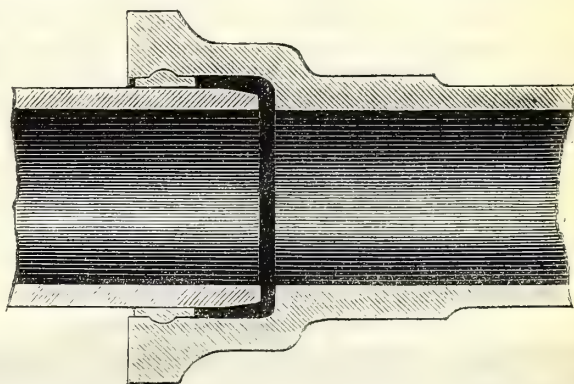


FIG. 22.

The lead is run into a groove round the inner part of the socket at the place of manufacture, a metallic ring, called a "former," being inserted in the socket while casting the lead packing. When being laid, the spigot end of the pipe, which is cast slightly tapering, is forced strongly into the socket by means of a hydraulic jack, as exhibited in fig. 23. The pressure against the soft metal thus fills



FIG. 23.

up all the interstices, and a perfectly tight joint is made, with a saving of material, and with the further advantage, in the case of gas-mains, of the avoidance of danger, by not requiring fire during the operation. The quantity of lead used is less than half that needed for the ordinary joint, it requires no caulking, and the rapidity with which the connexions can be completed is another recommendation in its favour. Some experiments were made in 1864, at the Phoenix Gas-Works, to test the power of the joint to resist the effect of sinking. The supports from two of the joints were struck away, leaving them unsupported, and the pipes were then weighted until they had sunk nearly half an inch. This severe test caused them to leak under the heavy water pressure of 200 lbs. to the square inch, to which they were subjected; but the leakage ceased when the pressure was reduced to 90 lbs., and a few blows on a lead set made the joints again able to resist the original pressure. Mr. George Bower, of St. Neots, is the owner of the patent in this country.

Mr. Somerville, of Dublin, in 1870, invented a joint which combines the principle of the turned and bored with the lead plugging. This is represented in fig. 24. At the time the pipes are being bored and turned, a double channel, wedge-shaped in section, is cut in the spigot, and a single channel, of larger size, in the socket, as shown. When the pipes are put together in the trench, molten lead is poured through a hole cast in the upper side of the socket, filling up the double recess between the pipes. Previous to running in the lead, a piece of resin or tallow is inserted in the hole, to serve as a flux to assist the metal in insinuating itself into the crevices. The lead,

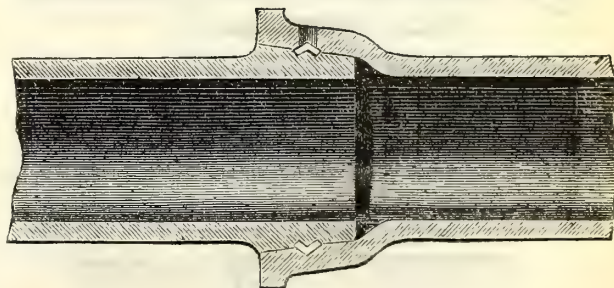


FIG. 24.

when cold, forms a double wedge, and in the event of the joint drawing a little by the contraction of the pipes, the edges of the grooves bed themselves in the soft lead and keep the joint tight. This joint, which presents several important advantages, would be greatly improved by being made less conical in form.

The joint shown in fig. 25 is the invention of Mr. William Williams, C.E., of Liverpool. By means of this, pipes can be laid in a curve as easily as in a straight line. It consists in the direct contact of a cylindrical socketed with a spherical butt-ended pipe, without the intervention of lead or other packing. The socket end of each length of pipe is made of uniform thickness with the pipe itself, but strengthened when required by an external hoop of wrought iron,

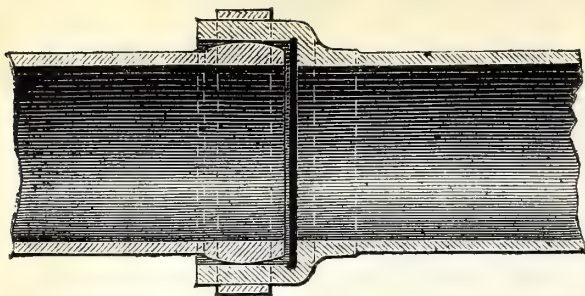


FIG. 25.

and it is then truly bored so as to form a perfect cylinder. Upon the butt end of the pipe a projecting boss is cast, the surface of which is turned so as to form a perfect zone or sphere, of an external diameter equal and proportioned to the internal diameter of the cylindrical socket. The union of the two metal surfaces is thus maintained throughout the circular ring or line of contact which is fixed within the cylinder, but varies on the spherical zone according to the angle of direction at which the pipes are joined, and with every change that occurs, while the tightness of the joint remains unimpaired by the alteration of position. The joint is, therefore, a moveable one, so that in case of change in level or direction by subsidence or disturbance, the pipe-line is self-adjusting, and distortion is unattended by leakage or fracture. The pipes are easily and quickly united, and in practice it is found expedient, in some instances, to make the diameter of the spherical zone about .05 per cent. in excess of that of the cylinder, and complete the union under the expansion of heat applied to the latter. In 1869, at Liverpool, the joint was subjected to a severe test to prove its value. A pressure of 50 lbs. on the square inch was put upon a series of pipes connected together, and whilst under that pressure the centre of the line was lowered 13 inches, without showing any signs of leakage, although it remained for a length of time in that position.

Expansion joints, which are necessary under some circumstances, may be of the form shown in fig. 26. These are bored and turned

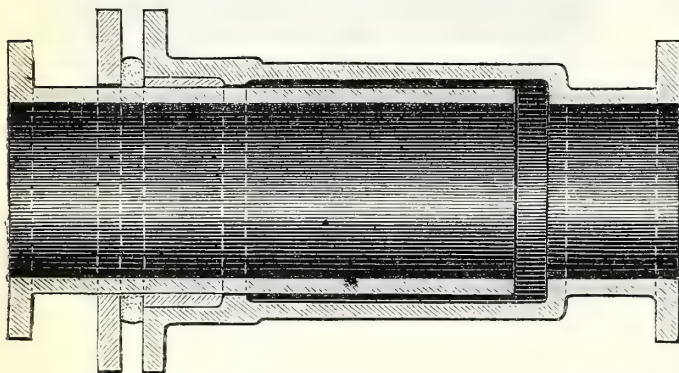


FIG. 26.

truly cylindrical, along a portion of their surface, and packed with hemp-yarn soaked in tallow, the packing being tightened by means of bolts and nuts.

But the simplest, and by far the cheapest, expansion joint is made as in fig. 27, by interposing a vulcanized india-rubber ring between

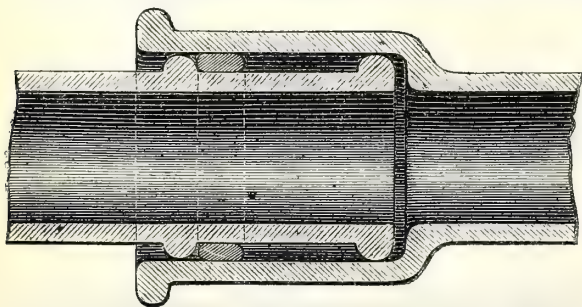


FIG. 27.

the socket and spigot of an ordinary open joint. This kind of connexion, though not much used in this country, has been extensively adopted in a modified form, as in fig. 28, in some foreign towns,

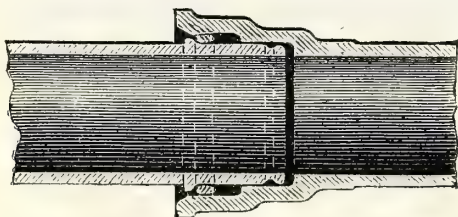


FIG. 28.

notably in the towns of Callao, Chorrillos, and Iquique, in South America. In Chorrillos the whole of the pipe-joints are of this character, and during the eight years the gas-works have been in existence, the leakage has been merely nominal. The public lamps are calculated to consume 2 cubic feet per hour, the quality of the gas

being 16 candles; and the only other unregistered gas that is consumed is that on the works, which is also estimated at the same low rate. It is clear, therefore, that the small per centage of unaccounted-for gas is not due to any exorbitant allowance in these respects. Pipes of this kind cost no more than the ordinary open-jointed sort, and the vulcanized caoutchouc rings are sold at the current market price per pound. Mains having this description of joint have been taken up after several years use, and the rings have been found in perfect preservation; their elasticity and impervious character being unimpaired by the action of the gas and moisture. For unstable ground this appears to us to be the best joint that could be adopted, its power of elongation, without danger of leakage, being greater than that of any other with which we are acquainted. It has been urged as an objection to the use of india-rubber for the jointing of gas-mains, that the naphtha and other hydrocarbons present have a tendency to dissolve it. If this were so, it would be a fatal objection to its use. It would appear, however, that this is true only in respect to india-rubber in its ordinary condition, and does not apply to that substance after it has been vulcanized.

In a report to the East London Water-Works Company on this description of joint, made as far back as 1848, by Mr. Arthur Aiken, F.L.S., the following remarks occur:—"The resilient spring of vulcanized caoutchouc is far more complete than that of the caoutchouc not vulcanized. In other words, the former is far more liable to *tire* than the latter. Caoutchouc is vulcanized by combination with a certain small proportion of sulphur. As long, therefore, as it remains vulcanized—that is, as long as it retains its sulphur—it may be expected to retain those qualities by which it is characterized. But iron has a strong attraction for sulphur. Is it not, therefore, probable that vulcanized caoutchouc, remaining long in contact with iron, may give up its sulphur to this latter, and thus be reduced to the state of common caoutchouc? The rings of vulcanized caoutchouc that I have seen taken out of iron pipes return to their original form as soon as the nip, or strong compression to which they are subject while in the pipes, has been relieved; and they are stained externally by a little oxide of iron rubbed off from the inner surface of the pipe, in consequence of the strong friction and compression to which they are exposed in the act of inserting one pipe into the other. Beyond this merely superficial attrition, I do not think that any sensible action would take place between the ring and the iron, even for a long time, at common temperatures.

"If the pipes are intended for the conveyance of water, the exposure of the projecting edge of the ring to this liquid at common temperatures cannot possibly have any injurious effect; for I have boiled vulcanized as well as common caoutchouc for an hour at 300 degrees, and the pieces, when they have become dry, have shown no diminution of their respective degrees of elasticity. If the pipes are to be employed in conveying coal gas, the original question becomes complicated with the consideration, how far the volatile products of the distillation of coal are capable of acting on vulcanized caoutchouc. The principal matters driven off from coal during its distillation are carburetted hydrogen and olefiant gas, sulphuretted hydrogen, ammonia, tar. I believe that in a very short time the projecting edges of the vulcanized rings would be covered with a thin layer of tar, which would effectually prevent their contact with the other matters, even assuming these latter to have any action on vulcanized caoutchouc. Naphtha, the product of the rectification of coal tar, is capable of dissolving caoutchouc; but the only effect that it has, even when boiling hot, on *vulcanized* caoutchouc, is to cause it to swell. If the crude tar should have any such effect (which I doubt), the consequence would be, that the projecting edge of the ring would swell, and thus render still more effectual a fastening which was sufficiently so before. The strongest liquid ammonia, as I know by experiment, has no solvent action whatever, even on common caoutchouc, by digesting in it for several months. Sulphuretted hydrogen has no sensible effect on common caoutchouc immersed in it for some days. If, by long-continued action on vulcanized caoutchouc, any sulphur was taken up, no injury to the ring would result from this; for vulcanized caoutchouc may contain a great excess of sulphur, without at all impairing its elasticity and other valuable properties. Caoutchouc, being without visible pores, and being of a perfectly uniform consistence, and possessed of great elasticity, will not only exclude air and moisture from the space which it occupies, but is scarcely susceptible of mechanical injury, even from the strongest compression.

"I do not, therefore, see any reason to doubt that rings of vulcanized caoutchouc, when used as a fastening of iron pipes employed in the conveyance of water or coal gas, would be at least as durable as the best of the methods now practised, and probably more secure from leakage."

The metal constituting the socket need not be thicker than that of the pipe itself. Either a groove or a bead is cast on the extreme spigot end, and a second bead about four inches from this; though these are not indispensable, as a pipe, whose end has been cut off can be as readily jointed as a whole one, and is quite as suitable for the conveyance of gas. In the case of water-pipes, the second bead is necessary to prevent the ring being forced out by the heavy pressure. The ring of india-rubber is placed in the groove, the spigot inserted in the socket and gently pushed home, when the ring, being compressed between the pipes, assumes the flattened form, and is rolled into the position shown in the engraving. The joint is thus complete without any other packing whatever. The ease with which pipes can be connected in this way, the facility which the joints afford for adjustment to suit curves, and the extent to which they can adapt themselves to subsidence and disturbance of every kind, are all obvious advantages of the system, which should commend it to the notice of engineers.

(To be continued.)

FRENCH PRACTICE IN THE CONSTRUCTION OF GASHOLDERS.

By M. ARSON, Engineer-in-Chief of the Paris Gas Company.

[Translated expressly for this JOURNAL by Dr. W. POLE, F.R.S., Mem. Inst. C.E.]

(Concluded from page 85.)

V.

INLET AND OUTLET PIPES.

The gasholder is connected with the gas-making establishment by an inlet-pipe, and with the town distribution by an outlet-pipe, both pipes being furnished with valves. These pipes should have diameters suitable for the capacity of the gasholder, and they ought to be properly protected against any accidents which might interrupt their action.

These conditions, simple as they appear, are attended with difficulties that give great interest to the diverse solutions they have received.

Size of the Pipes.—The inlet conduits ought to have sufficient area not to cause undue resistance to the passage of the gas, and so to diminish the available pressure. They ought also to be capable of being interchanged (*i. e.*, the inlet-pipe used as an outlet, and *vice versa*), and each, therefore, ought to be of such size as to serve for either purpose. And further, their diameters and forms should be such as to allow fully for the obstructions frequently caused by the deposit of naphthaline; and it is desirable to provide means of access for extracting these deposits without suspending the action of the gasholder.

For the fulfilment of these conditions it is desirable to give the pipes a diameter corresponding to a maximum velocity of 5 mètres (16½ feet) per second. If this size renders them inconveniently large, they can be increased in number. This rule has been followed for the holder No. 13, at La Villette, with perfect satisfaction.

Form of the Pipes.—Two systems are adopted in this respect—1. Fixed pipes in the form of inverted syphons, which descend to the level of the bottom of the tank, pass underneath the walls, and rise inside it to above the water level. 2. Jointed pipes which rise above the ground and enter the bell by the crown. These pipes, which have to follow the movements of the bell, must, of course, be jointed in three points of their length.

Each of these systems must satisfy conditions which it is desirable to examine.

Fixed Pipes.—The fixed arrangement consists of a vertical pipe outside, which descends in a well, where it is accessible; then there is a horizontal part, and finally a vertical branch contained in the

tank, the two latter portions being inaccessible. The elbow at the bottom of the well is the furthest point to which direct access can be obtained, and it is necessary to ensure this access by making the well perfectly tight against infiltrations of water from the tank, or from the soil. The top end of the pipe, inside the bell, forms also a means of access, but its use is very restricted, unless the manhole over it is removed, when the gasholder must, of course, be thrown out of use.

Two causes of obstruction in the pipes are to be feared—namely, the infiltration of water by a leaky joint, and the crystallization of naphthaline under the influence of cold.

To diminish the risk of the first, the horizontal pipe ought to be formed in a single piece, so as to avoid a joint, which is inaccessible, and in all cases difficult to make.

In order not to offer to the naphthaline a place of deposit where it may crystallize at rest, it is desirable not to have any sudden enlargement of section at the base of the vertical pipe inside the tank. An elbow, cast with a foundation-plate, which will spread the weight of the pipe over a large surface of masonry, satisfies this condition. The horizontal pipe, inclined as much as possible, and cast in one piece, connects the elbow with the base of the external vertical pipe in the well, and carries the condensed liquids there.

It is customary to place at this latter point a large cast-iron piece, destined to receive the products of condensation; this is of little utility, and is very cumbrous. A T-piece, giving free access to the horizontal pipe, is certainly preferable. In any case, a syphon and a pump ought to be attached to the pipe, the lower part of which, being always cold, condenses the last traces of moisture carried in the gas.

The naphthaline, which the gas always contains, and the crystallization of which arises under influences at present very obscure (cooling or drying, for example), often produces in the pipes obstructions which much reduce the area, or even stop it entirely. These crystallizations, in flakes extremely thin, are easy to remove by copious washing with cold water. The water may be introduced by the interior pipe, either by uncovering the manhole over it, or by using a syphon, which gives access to the water without emptying the gasholder; and by this means the naphthaline may be driven to the bottom of the exterior vertical pipe, where it may be pumped out. The ordinary syphon pump used for extracting the condensed liquid is not sufficient for this purpose; recourse must be had to a more powerful pump, specially adapted to the purpose. Letestu's pump is suitable, and preparations should be made for its application whenever necessary.

Articulated Pipes.—This system was used for the first time in the construction of the gasholder at Ivry, belonging then to Messrs. Pauwels and Du Bochet; it was designed in order to overcome the difficulties attending the access to these gasholders, the bottom of which was 25 mètres below the surface, and drowned in water. Its application proved so satisfactory that it has since been applied to ordinary gasholders.

The apparatus is formed of straight pipes of sheet iron, tolerably light, connected by joints in cast iron. Each joint consists of a pipe at right angles to the direction of the main-pipe, the two extremities turning in stuffing-boxes. The stuffing of these joints presents no difficulty during the movement of the gasholder, and requires only ordinary care. Yarn (*de l'étaupe*) soaked in melted suet, or even in oil, suffices to ensure the tightness of the joint during the action of the bell.

Naphthaline has not yet appeared in these pipes, although they have been in action more than 30 years at Ivry, and a long time elsewhere.

Gasholder No. 13, at La Villette, offers a very interesting example of the application of the system, as it has dispensed with the construction of four wells, which would have been much more costly.

[On a late visit to the Paris Gas-Works, I had an opportunity of seeing these articulated pipes at work on several gasholders to which they are attached. They appear to act very well; they are said to give no trouble, and to require only moderate attention to keep them in order. The authorities are so convinced of their advantages that they are now applying them to all new gasholders erected. —TRANS.]

VI.

GUIDES.

The stability of the bell of a gasholder constitutes a problem as difficult to realize as it is important to resolve.

The centre of gravity of the bell is much above its centre of figure; it is in a state of instable equilibrium, and it tends to topple over as soon as the two centres cease to be maintained in the same vertical line.

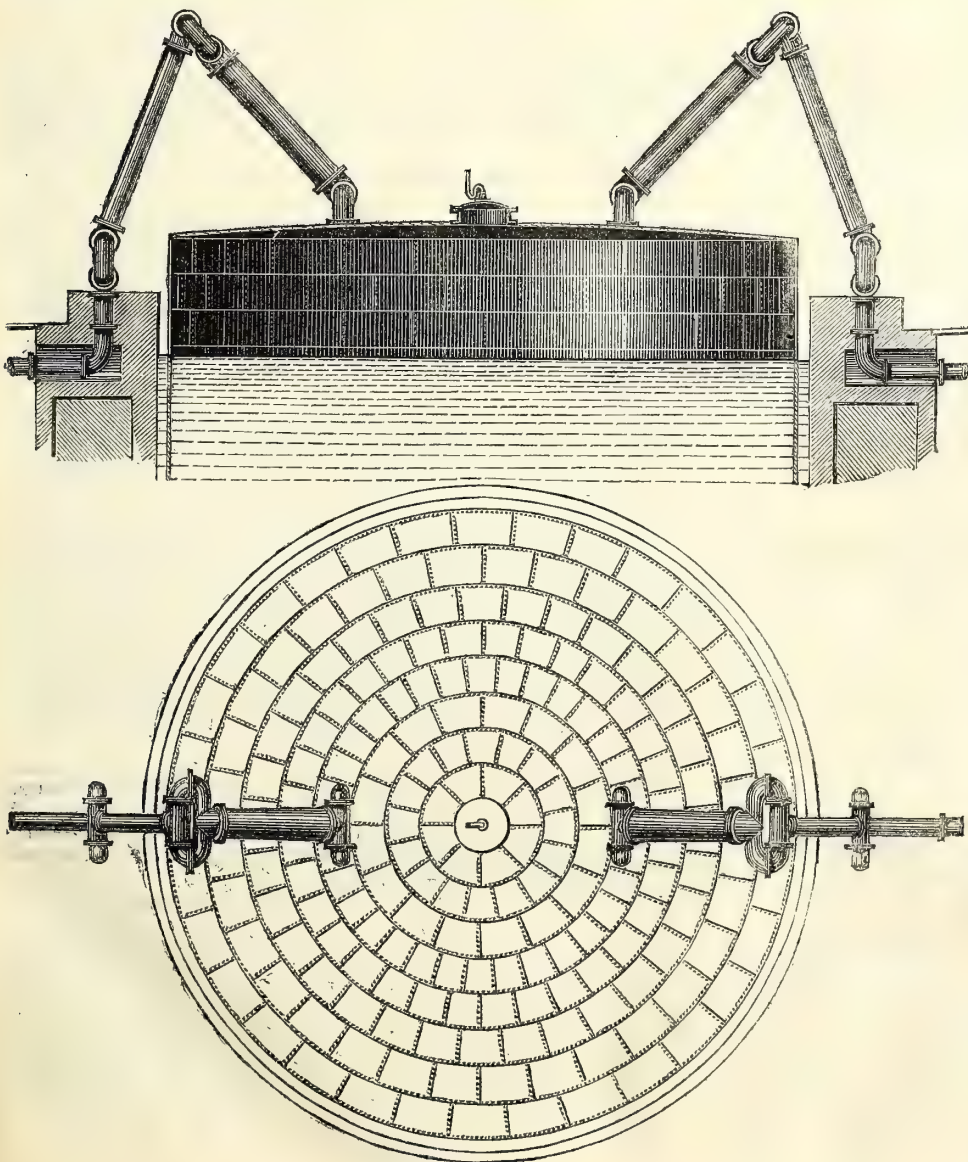


FIG. 8.

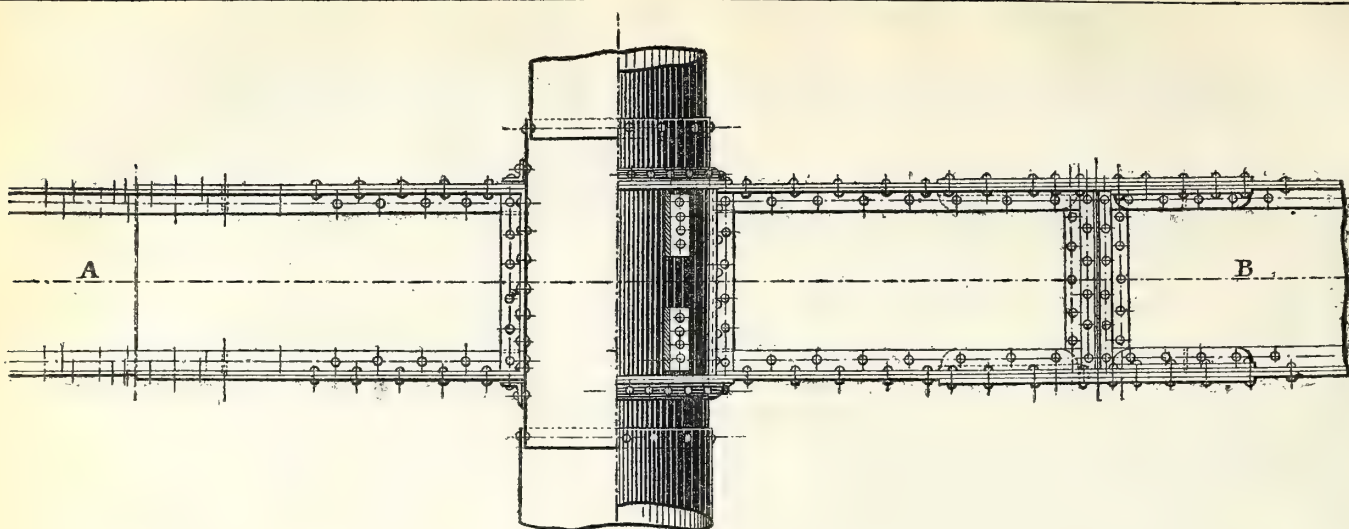


FIG. 9.—ELEVATION, THROUGH E, F, G, H.

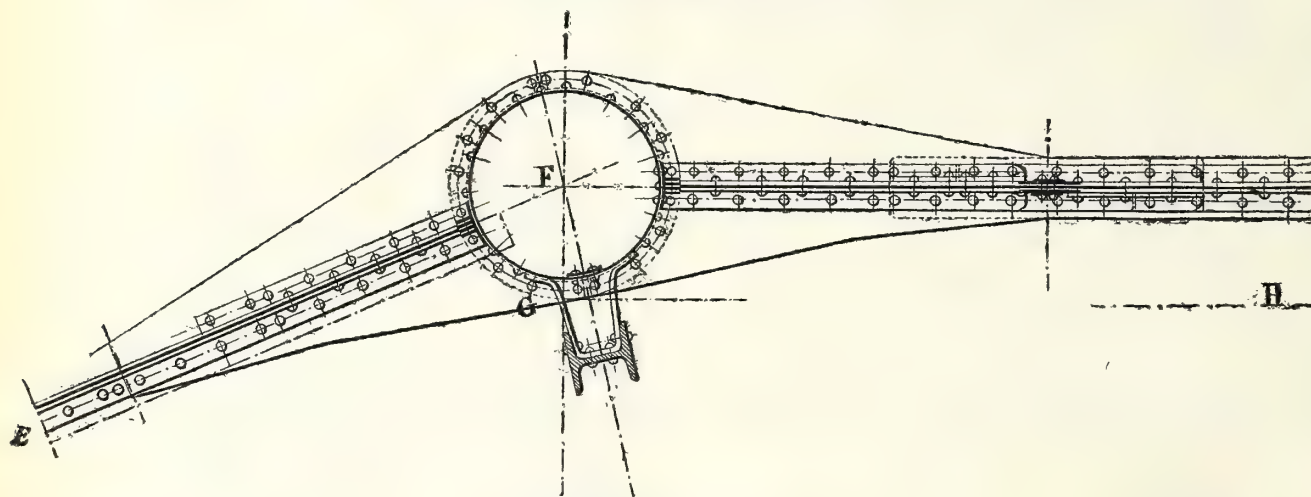


FIG. 10.—PLAN, THROUGH A, B.

The equilibrium during the rise and fall is not the only condition to be satisfied in order to ensure the stability; the apparatus ought to resist to the most perfect extent the disturbing action of all external causes—the wind, for example, which may exercise on the bell of a gasholder a very powerful force, against which it must be efficiently protected. This result may indeed be attained by the construction of a building surrounding the gasholder when its dimensions are small; but for the sizes required by large companies this is impossible, and the stability must be ensured by other means, even against the most furious winds.

It is not only the wind which menaces the stability of gasholders; there is another cause often more serious—namely, the accidental stoppage of one point of the bell; for if this takes place, the motion which tends to continue in the other parts may give rise to horizontal pressures of great magnitude.

Estimate of the Action of the Wind.—It is found, by special tables, that the wind in great hurricanes may attain a velocity of 45·30 mètres (150 feet) per second, and may exercise on a plane surface, which it strikes perpendicularly, a pressure of 277·87 kilogrammes per square mètre (50 lbs. per square foot.)

The cylindrical form of the bell of a gasholder has certainly the effect of diminishing this action in a great degree, but writers do not give any direct measure of the reduction, at least so far as concerns the wind.

For water, it is generally considered that the pressure exerted by a current of water acting against a right prism, preceded by a semi-cylindrical surface, is reduced in the proportion of 1·10 to 0·57. The form of the back part of piers has also been studied from the same point of view; and when this part is formed by two planes inclined at 45°, it reduces the pressure further by 11 per cent. The total force may, therefore, be considered to be reduced in a cylinder to 0·46 of what it is on a plane.

If these data are applicable to æriform fluids, we should be justified in estimating that the force of the wind per square mètre of the upright section of the bell of a gasholder would be reduced to

$$277·87 \text{ kilogrammes} \times 0·46 = 127·82$$

i.e., 26 lbs. per square foot.

[The author's data are, no doubt, taken from Smeaton's well-known table. The editor had occasion, a short time ago, to make inquiries with a view to determine what would be the greatest pressure of wind likely to act sideways on an engineering structure, and for this purpose he was favoured by the Astronomer-Royal with some very valuable data from the records of the Greenwich Observatory. The result of the inquiry was that, although the pressure of the wind does sometimes amount to 40 lbs. per square foot, yet that this is only upon very limited surfaces, and for very limited times. Over a large surface a much more moderate estimate will suffice.

As to the reduction for the shape, Professor Rankine estimates

the effective pressure against a rounded surface, like a circular chimney, at half what it would be against a flat surface of equal sectional area.

No doubt, therefore, the rule in the text is on the safe side. —TRANS.]

Distribution of the Pressure on the Rollers.—The total pressure of the wind will be distributed on four rollers—two in the tank, and two acting on the guides. Hence, if D be the diameter and H the height of the bell, in feet (supposed all above the tank), the horizontal force with which each roller will be pressed against its guide will be—

$$F = \frac{26 DH}{4} \text{ in pounds.}$$

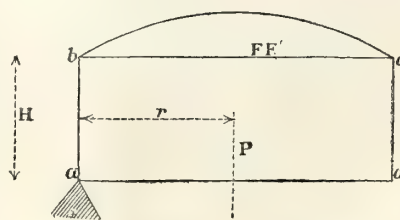
[The author goes on with a mathematical investigation of the strength of the column-guides and framing to resist the pressures which may come upon them. He takes several cases; first, a system of guides formed of four columns, with accessory bracing; next, a similar system of six columns; and then a system of eight or more; after which he shows an application of the calculations to one of the gasholders at La Villette. The calculations are complicated and elaborate, and their general applicability appears to me doubtful. There is such great variety in the construction of gasholder-guides and framing, as designed by different engineers for different circumstances, that no general formulæ could be universally applicable; each case must be studied according to its own design, and for this purpose the ordinary principles of mechanics, as applied to the strength of structures in iron, will serve. If it is desired to follow out the mode of investigation adopted by the author, the original can be referred to.

The construction of a part of the columns and framing, as adopted by the Parisian Company, is given in figs. 9 and 10.—TRANS.]

Effect of an Obstacle to the Descent of the Bell.—The following figure represents the bell of a gasholder, supposed to be arrested in its descent by an obstacle acting at one point a :—

In this case, to ensure stability, an equilibrium must be established between the weight, P , of the bell acting in its centre of gravity, and the horizontal resistances, $F F'$, furnished by the columns. The extreme limit of this equilibrium is given by the expression.

$$Pr = (F + F') H.$$



VII.

SCAFFOLDING FOR THE CONSTRUCTION AND SUPPORT OF THE BELL.

The framing of carpentry, shown in the drawing of the tank,* serves several purposes. It was used during the construction of the cylinder of the bell; it was necessary for the construction of the crown, and it will serve during the use of the gasholder as a support to the crown, to prevent its deformation at any time when the pressure is removed.

These three conditions determine the design and dimensions of this part of the work.

The first necessity is that the external parts of the framing should approach so near to the cylindrical sides of the bell, that the workmen may be supported by them in fixing the sheets. This may be done easily by means of suspended platforms, the chains of which are shortened in proportion as the work rises higher.

The second condition requires that all the horizontal surface of the tank shall be provided with vertical piles equally distributed, offering a sufficient number of points to support the weight of the floor of planking and of the crown of the gasholder. The planking destined to support the workmen ought to be stronger than is usually thought necessary. It happens that during the construction the spherical plating of the crown requires to be stretched; the workmen, to do this, raise the plating by means of the stays resting on the planking, and which exert considerable pressure thereon.

To fulfil the third condition, the part of the scaffolding which will serve to form supports, uniformly distributed, should be left permanently standing. The vertical piles, which have been laid out in concentric circles, are connected at the top by timber rings, which approach as nearly as possible to the surface of plates, and offer under it a series of concentric rings, which will support the weight of the iron as soon as it falls a few centimetres.

Considering what has been said as to the possibility of constructing the gasholder exactly according to the prescribed dimensions, it will be understood that the heights of the various rings of this permanent scaffolding might be fixed in advance. But it is better to leave the upper timber rings till the work arrives at them, when their proper height can be exactly fixed.

Further, the upper part of this carpentry framing should be composed of two distinct parts—one formed of straight pieces crowning the piles, and situated at such a distance from the plates as not to interfere with the execution of the rivetting; the other parts, formed of pieces cut into a circular form, constitute the packing pieces, which fill the space left between the straight pieces and the crown plating. These latter pieces add nothing to the strength of the framing, and are only attached thereto by lateral iron fastenings.

After the iron plating is all finished, the stays which supported the crown and kept it in a spherical shape are removed, and the plating is allowed to rest on the rings of the timber framing; then the floor of planking is removed, proceeding from the circumference to the centre, the timber pieces being drawn out through an opening left in the centre of the crown. This opening is then closed up, and the tank may be filled.

INSTITUTION OF CIVIL ENGINEERS.—At the monthly ballot, on the 16th inst., Mr. Walter Scott, general manager and engineer of the Bombay Gas Company, was elected an associate of the Institution.

QUALITY OF THE NEWCASTLE-ON-TYNE GAS.—Mr. John Pattinson reports the following as the results of his examination for the past week of the quality of the gas supplied to this borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Date—1877.	Illuminating Power in Sperm Candles.	Grains of Sulphur in 100 Cubic Feet of Gas.	Sulphuretted Hydrogen.
Jan. 16 . . .	14.8 . . .	19.15 . . .	Nil.
„ 19 . . .	15.2 . . .	19.67 . . .	Nil.

A Sugg-Letheby standard Argand burner is used in testing. According to Act of Parliament the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas.

PROPOSED PURCHASE OF THE EYESHAM GAS-WORKS.—An inquiry was held on Tuesday, the 16th inst., by Mr. C. N. Dalton, one of the Local Government Board Inspectors, in reference to an application from the Town Council to extend their borrowing powers, under the Local Improvement Act, from £5000 to £15,000, in order to purchase the gas-works from the gas company, in accordance with an agreement entered into 21 years ago. The town clerk gave evidence in support of the application, and was cross-examined by Mr. Cooper, parliamentary agent, on behalf of the gas company, who contended that the council had no power, under the local Act in its present state, to purchase the works, inasmuch as nothing was said about the purchase of the existing works in the Act, and that if they had power to purchase they had no means under the Act to pay for the value of the works, their borrowing powers being limited to £5000. He asked the inspector to report unfavourably on the application of the Town Council. The inspector promised to lay the views of both parties before the Local Government Board, and the inquiry then terminated.

BREAKING AND EXTINGUISHING PUBLIC LAMPS.—Two boys were taken before the Bristol magistrates on Wednesday last, charged with having broken a lamp on the afternoon of the 8th inst. Mr. Brittan, who appeared for the gas company, stated that during the week ending the 13th of January 47 lamps had been broken, the damage of which was estimated at £2 15s., and that offences of the kind were becoming so frequent, that the company had no alternative but to press the charge, and to ask for the infliction, under the company's Act, of a penalty of such a sum not exceeding £5, in addition to the amount of damage, as the magistrates might determine. The magistrate inflicted a penalty of 10s. for the offence, together with the amount of damage and costs of summons, and, in default, imprisonment for seven days.—At the Southwark Police Court, on Friday, a man 35 years of age, named Thomas Curtis, who described himself as an engineer, was fined 21s., or 21 days imprisonment for being drunk and wilfully extinguishing four gas-lamps in the Tower Subway.

* This drawing is not given.—TRANS.

Correspondence.

LEEDS GAS SUPPLY.

SIR,—I shall feel obliged if you will favour me by inserting a few lines in explanation of the frequent complaints as to the supply of gas in Leeds, especially as repeated comments in your columns seem to call for them. It is no secret now that, at the time of the transfer to the corporation, the several works of the two companies were in anything but good condition, nor will this be surprising to those who have had any experience of the disastrous effects of competition between gas companies. In Leeds the strife was of the fiercest, and the public of to-day are paying the penalties of the benefits (?) formerly received. In their haste to acquire custom, the companies could have had little time for systematic work in any department, while the sweet simplicity of 2-inch mains under such circumstances must be manifest to all. As a consequence of all this, we now have 300 miles of 2-inch mains and under, out of a total of 500, and probably not less than 40,000 duplicate service-pipes. But, perhaps, even a worse evil came of the system of allowing plumbers to fix meters at regulation prices, regardless of materials employed, or quality of workmanship; $\frac{1}{4}$ -inch connexions to meters, and main-taps of even smaller dimensions, having been regarded as the "proper thing." A 50-light meter connected with $\frac{1}{2}$ -inch lead to the outlet, and 20 or 30 lights to a 3-light meter, would be interesting phenomena to me, were they not quite so common.

Again, and as another consequence of the recklessness of former days, there are thousands upon thousands of small-sized union jet burners in use, defrauding all who use them of, at least, 50 per cent. of the light they pay for. I have done my best to remedy this evil, but still I receive occasional indignant letters from parties, who, having five burners, cannot see to read. I generally find them to be rusty number twos or threes. That the latter are to blame for most of the complaints is evidenced by the fact, that it is rarely the case that a remedy is not found by merely a change of burner.

With an extraordinary increase in the sale of gas—bad trade taken into account—I fail to see how matters are to improve until our projected works are completed, seeing that already I am making an extra 200 millions per annum, with the same plant that I found on my appointment as engineer. As to pressures, I can confidently assert that, during two winters, during the hours of greatest consumption, they have never been reduced below two inches at any station (and we have six) on more than half-a-dozen occasions, while the average is from $2\frac{1}{2}$ inches to 3 inches.

On one very foggy day, about three weeks ago, I could not maintain more than 7.10ths during the day (on which occasion I sent out 6,100,000 cubic feet of gas, as against a possible eight millions), and I fear I shall never hear the last of it, as people persistently refer to it as a thing of yesterday.

In conclusion, I trust you will pardon my having written so lengthily on these matters; for, however much I may regret the criticisms to which I am subject at home, I should regret much more to lose the good opinion of the members of my own profession.

Leeds, Jan. 21, 1877.

HENRY WOODALL.

QUANTITY OF BRICKWORK IN RETORT-SETTINGS.

"Du choc des opinions jaillit la vérité."

SIR,—Notwithstanding that your correspondent, "S. N. A. P." (*vide* JOURNAL, Jan. 2), demurs to my conclusion that it is an error to believe that the quantity of internal brickwork should be advantageous, or even indifferent in regard to the consumption of fuel for carbonizing, my conviction in this important question has not been shaken. As your correspondent refutes my conclusion by referring to a letter of Mr. Newbigging (vol. xxiv., p. 538), I may answer his by a refutation of some arguments quoted in the letter he refers to. I suppose that at the time the letter of Mr. Newbigging appeared I was accidentally hindered from giving it the consideration which the name of the author made it deserve; otherwise I would probably earlier have satisfied the desire expressed in it, that the subject might receive further ventilation.

1. Mr. Newbigging confesses that thin retorts are advantageous in regard to the consumption of fuel, because the heat passes more readily to their interior, but opines that the circumstances attending the retort, as the vessel containing the material for distillation, are not to be confounded with those appertaining to the adjacent brickwork. Now, I cannot understand why the surplus material of thick retorts should not act as a reservoir of heat, just as the rest of the fire-clay in the oven is supposed to do. Moreover, by the supporting walls a considerable part of the surface of the retort is withheld from the direct action of the heated gases, and the acknowledged advantage of the thinness of the material is of no use, where it is covered with the same non-conducting material.

2. I agree with Mr. Newbigging as to the irregularity of the temperature of an oven with little brickwork when in use; but it is not the temperature of the oven which must be considered, but that of the inner surface of the retorts. Now, it is due to the nature of the material (fire-clay), which is a non-conductor of heat, that the temperature of the oven may be materially different from that of the interior of the retort. If the material were a good conductor of heat, the temperature of the oven would be still more irregular, but the heat in the interior of the retort would be sooner restored after it had been cooled by a new charge, and this would be sooner carbonized. The great regularity of heat, in an oven with much internal brickwork, proves that the magazines of heat deliver their heat too slowly to be of material use to carbonization.

3. I agree with Mr. Newbigging as to his statement that when two benches, one with more, the other with less internal brickwork, were brought up to the required temperature, both being made equally hot, and charged with an equal quantity of coal, the former would longest continue to afford the required heat for efficient carbonization, after the firing of the furnaces had been stopped simultaneously. The same non-conducting material that was an impediment to the heat generated on the outside of the retorts reaching the interior, is now an obstacle to the cold air entering the furnace to exert its cooling influence on the interior of the retorts. Moreover, the quantity of heat in the first furnace being greater at the cost of a greater expenditure of fuel, a greater quantity

of heat can be lost without altering the temperature of the whole. Thick retorts, also, brought to the same temperature as thin ones, would longer continue to afford the required heat for efficient carbonization, after stopping the firing, and still Mr. Newbigging acknowledges the superiority of the latter to the former.

The causes of the disadvantage of internal brickwork in regard to the consumption of fuel are—

1. The supporting walls and all other brickwork covering part of the retorts withhold this part from the direct action of the heated gases of the furnace.

2. The total quantity of heat in the interior of the oven being greater at the same temperature in proportion to the quantity of internal brickwork, the loss of heat by radiation will be more considerable in settings with much internal brickwork.

3. The heated gases of the furnace (the same draught existing) will pass the swifter through the oven the less free space there be in it, and will, therefore, in an oven with much brickwork, be for a shorter time in contact with the retorts.

To your correspondent, "S. N. A. P.," I must still answer that I never was a defender of the no-support theory, but that I only combat the magazine-of-heat doctrine. My advice is, put in your oven the least brickwork that may be agreeable with the quality of your retorts.

As for the comparisons of the light of lighted candles, sponges with water, fly-wheels, &c., they may by some means elucidate your correspondent's meaning; but, certainly, comparisons are no arguments.

In the JOURNAL of the 9th of January your correspondent, "Zeno," says that when the internal brickwork was reduced to a minimum, the temperature of the air escaping by the flue would be greatly in excess of that from another setting having a moderate quantity of brickwork. I do not agree with him as to this opinion, for the following reasons:—

1. The temperature of an oven will be more equalized in all its parts when less internal brickwork is used, while with much of this brickwork and thick retorts the temperature of the interior of the retorts will remain lower than the rest for a longer time after a new charge. Therefore, the temperature of an oven may be lower in the first case in order to have the same temperature in the interior of the retorts as in the second case.

2. The heated gases remaining for a longer time in contact with the retorts will communicate more of their heat in the first case, as is already stated.

As to your correspondent, "G. E. S.," I may mention that when the names of Belgian retort manufacturers are given, that of Jean Sugg, of Ghent, should not be forgotten.

C. T. S.

R., Jan. 12, 1877.

THE EXPLOSION OF A GAS-METER.

SIR,—In answer to the query of "S. E." in your "Notices to Correspondents" on the 2nd inst., respecting the cause of the sudden explosion in the meter referred to, allow me to suggest another theory following that which appeared in your JOURNAL of the 9th inst.

Supposing further information could be given by the owner of the meter, as to the rule observed in turning on and off the gas, I suggest the following was the cause of the explosion, as it presents itself to my mind:

The gas was turned off at the meter (as is usually done by many consumers). Through unsound joints in the fittings, part of the gas held in the meter gradually escaped into the shop, and in its place air would lodge, the relative difference in the specific gravity of the two favouring this exchange.

The gas is suddenly turned on at the meter, and almost as suddenly a light is applied to the burner in the shop, and it flames, owing probably to an accumulation of gas at that elevation; but before the drum of the meter has got fairly to work, so as to exercise any amount of pressure, the light at the burner communicates the spark to the now explosive mixture (air and gas) through the lower pipe and meter body, and hence the explosion.

If no flame touched the meter externally, the explosive gas must have been ignited by the flame from the burner travelling downwards, in the absence of any pressure from the meter being at work to prevent it.

Jan. 18, 1877.

J. U.

COMMISSIONS.

SIR,—I have read with much interest your comments on the letter of "Commission Abolitionist," in your issue of the 16th inst., and as I am a contractor, as well as a shareholder in several gas companies, I trust you will find space for a few remarks by me on this subject.

"Commission Abolitionist" makes a sweeping charge against a highly respectable class—viz., "gas managers and consulting engineers." I have been on intimate terms, for years, with many of both classes, and should be sorry to insult any of them by offering a commission, which I feel would be indignantly refused. I may say that I have also for upwards of 20 years done a large business with gas and water companies, principally in the London district, in the supply of mains and plant, without the payment of any commission whatever.

That commission is paid in some cases, principally to the managers of small country works, I have no doubt, but I am disposed to think this is the exception and not the rule, and that the system is fostered by contractors who supply materials which would not otherwise pass inspection. It may be safely assumed that when a commission is paid to the officers of a company, the materials supplied must be inferior in quality, or the price will be in excess of their market value.

I can mention the names of more than one firm who absolutely refuse to pay commission to the officers of any company or corporation (and who only allow it in the case of commission agents and brokers). Whether they would do a more profitable business by adopting the course pursued by "Commission Abolitionist" is a matter for speculation. Speaking from experience, I should say that a contractor who supplies good sound materials, at moderate prices, can always command a fair business without the necessity of offering a bribe.

In many country works the purchase of materials is often left in the hands of the manager or secretary, who is, in most cases, inadequately paid for his services, and it is here, I suspect, where the commission system obtains.

You have suggested a remedy, a course I have long advocated as

sound in principle. The gas manager is the life and soul of the business, and he should be paid in proportion to the success attained; give him an interest in the business, a share of the profits, and we shall hear no more of "commissions."

Jan. 18, 1877.

FOUNDER.

SIR,—It is to be feared that *The Times* correspondent, "A Commission Abolitionist," is not the only individual who lacks the courage to tackle this now formidable commission business. This is hardly to be wondered at, as it is well known there are influential men filling positions in gas companies, who are also directors of manufacturing concerns, which freely pay commissions to gas managers to advocate the use of their articles. Is it surprising, therefore, that a system encouraged and sanctioned by such high authority and powerful influence should have become so widespread and general? If the large and wealthy establishments would take up the cudgels against this pernicious practice of bribing, they may safely rely on the assistance of the smaller fry to follow their example, but the risk to the latter of losing their trade is too great for them to commence the war.

London, Jan. 19, 1877.

FAIR PLAY.

SIR,—Mr. Livesey's letter to *The Times* will, no doubt, be reproduced in your next issue.

I recollect some 28 years ago, when I first entered the service of the Dover Gas Company, I was called on by a meter maker (now deceased) late one night, on the arrival from London of the boat train. He pressed me to accept a commission on the meters sold to the company during the previous year, which I declined; but in the morning I found he had slipped a bank-note in my letter-box, the upshot being that the money was returned to him, and his account with the company closed. I mention this to show that the system of "commissions" is not one of recent growth.

But there is another side to this question. I have been compelled to pay commission to obtain outlets for my residual products, although I know the prices I have quoted have been lower than other offers, but without the payment of commission the business could not be secured.

My experience has, therefore, been that while I have steadfastly refused to receive, I have been compelled to pay, commissions.

Dover, Jan. 20, 1877.

R. H. JONES.

On this subject Mr. G. Livesey has addressed the following letter to the Editor of *The Times* :—

"Sir,—In making the bold request for a portion of your valuable space, I rely on your universally recognized sense of justice to repel a general charge of dishonesty.

"On the question of 'Commissions' I agree entirely with the views expressed in your notice on the subject on the 13th inst., and I thank you for having opened your columns for the discussion. This letter is not sent for the purpose of re-opening the question, but, lest judgment against the whole body of officials connected with gas-works should go by default, I ask you to permit me to utter a protest against the sweeping charges made by your correspondent, who has most inappropriately signed himself in *The Times* of last Friday as a 'Commission Abolitionist.' His letter contains the following sentence:—'I am able to state that in most gas-works (the exceptions being very few indeed) very little is purchased which does not pay a toll to one or more of the officials. Coals, pipes, fittings, meters, apparatus, and materials of every kind are all subject to a commission.' In this statement the writer has gone beyond the range of his own experience, and has stated as fact that which he knows only by hearsay; for, if he is, as his letter indicates, a member of some manufacturing firm, he has nothing whatever to do with coals. The coalowner never sells pipes, the pipe-founder does not make or sell meters, the various trades being in separate hands. As to coals, at least 1½ million tons are used in the gas-works of London, and, excepting a very small portion, the whole is purchased by contracts made direct between the large coalowners in Durham and the gas companies; and I, who have been engaged in the business all my life, and have for years negotiated these contracts, never heard of a single instance of a commission in any form being either asked or offered. For the remaining portion of coals, perhaps 5 per cent. on the whole quantity, there is a keen competition carried on by agents in London, and these men in some cases to my knowledge offer a commission.

"As to all the other articles mentioned, it is an undoubted fact within my own knowledge that there are firms who make it a rule either to offer commissions when seeking orders, or to give them when asked; but I can name firms who have created and maintained good businesses in all the various branches who never would descend to this dishonest means of obtaining a connexion.

"The 'Commission Abolitionist' writes as if he were the victim. I think I can place the matter in another light. In nine cases out of ten—if not in every case without an exception—the first move comes from the contractor, or the principal, or his agent or traveller, seeking a business connexion; and I can assure you, sir, that these men use very subtle arguments to induce the man recently appointed to a position of trust to accept a commission. They assure him it is perfectly usual and legitimate, and that it is a gift from them to him, which in no way affects his employers, and so on. When the barrier is once passed, it is to be expected that the state of things described by your correspondent will happen in some cases; but the origin of the mischief rests with the seller, who thus reminds one of the circumstances of the first great temptation—of the subtle tempter and his innocent victim. One very effective means to get rid of the canker will be for all honest officials to decline absolutely to do any business with men who would tempt them to do wrong.

"In the paragraph referring to consulting engineers, the 'Commission Abolitionist' makes the absolute assertion, without any qualification, that, in addition to their legitimate commission from their employers, 'they also get a commission from the contractors who execute the work.' This sweeping assertion includes every man in the engineering profession who acts in this capacity, from Mr. Hawksley and Mr. Bramwell downwards. It is probably based on some limited experience with men—half engineers, half contractors—who may act thus; but I, who have had some experience in this direction, have never even heard it hinted that any consulting engineer acts in this way.

"In conclusion, I can only regard the 'Commission Abolitionist' as one of the greatest culprits in this matter, who has built up his business on this system, and who now endeavours to throw all the blame on the victims whom he has been instrumental in tempting to a course of dishonesty. I claim the right to know something on the subject, having been for nearly 30 years in the gas world, and as proof of good faith I append my name and business address.

GEORGE LIVESEY.

"South Metropolitan Gaslight and Coke Company,
589, Old Kent Road, S.E."

Parliamentary Intelligence.

GAS AND WATER BILLS, 1877.

THURSDAY, JAN. 18.

The Examiners commenced their sittings this day, and found that the Standing Orders had been duly complied with in respect of the unopposed petitions for the Leicester Gas, Heywood Water, and Burslem Local Board Bills.

The consideration of the Londonderry Gas Bill was adjourned until the 30th inst.

In the case of the Bolton Improvement Bill, the allegations of non-compliance were not sustained.

FRIDAY, JAN. 19.

The petitions for the North-East Worcestershire Water, Thanet Gas, Ramsgate Water, and Croydon Commercial Gas and Coke Bills—all unopposed—were passed by the Examiners.

The Carshalton Gas Bill (unopposed) was postponed to the 23rd inst.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

WEDNESDAY, JAN. 17.

(Sittings at Westminster, upon Appeals from the Common Law Divisions, before the Lord Chief Justice, and Lords Justices BRETT and BAGGALLAY.)

ATKINSON v. THE NEWCASTLE AND GATESHEAD WATER-WORKS COMPANY.

Mr. GAINSFORD BRUCE and Mr. SHIELD appeared for the plaintiff; and Mr. HERSCHELL, Q.C., for the defendants.

In this case, which was reported in the JOURNAL, vol. xx., p. 151, an action was brought by the plaintiff, the owner of extensive saw-mills, against the defendant company, who laid down certain pipes in the premises for the purpose, in case of need, of extinguishing fire, the company being bound by Act of Parliament to keep the water at sufficient pressure for that purpose. A fire did break out on the premises, which were entirely consumed, and it was alleged that on that occasion the company neglected to have the water at sufficient pressure to be of efficient service. The case was tried at the Spring Assizes at Newcastle in February, 1871, before Baron Martin and a special jury, and the trial lasted three days. The learned judge did not think the action maintainable, and the jury found a verdict for the defendants, on the ground that there was no contract creating the obligation alleged, and also on the ground that the want of a sufficient supply of water arose from causes over which the defendants had no control. There was an application for a new trial on the ground that there was no evidence to support the defence, and in June, 1871, the application was dismissed. The judges, however, were divided in opinion, and no reasons were given for the result, nor was any judgment pronounced. Notice of appeal was at once given, and attempts were made by the parties to settle a "special case," on which under the old system such appeals were brought; but the parties, as usual, differed in their statement of the case, and it was found impossible to get it settled by the judge, in consequence (as was said) of his not having taken full notes of the evidence. After some years, the case was still not settled, and last July there was an application by the plaintiff, the appellant, at Judges Chambers, for an order to allow him to bring the appeal upon the shorthand-writer's notes; but the application was refused, and the judge's decision was upheld.

Mr. BRUCE, for the plaintiff, now appealed against that decision, urging that the judge's notes were imperfect, and that it would be difficult to argue the appeal upon them under the new system. The rules, he urged, allowed the Court of Appeal to take the evidence either from the judge's notes, or from the shorthand-writer's.

Mr. HERSCHELL opposed the motion, arguing that the learned judge's notes would be amply sufficient, and that the time for appeal ought not to be extended, inasmuch as after the special case was settled his clients heard nothing of the matter from December, 1874, till June, 1876. The Judicature Act laid down that every appeal was to be brought within 12 months.

After some discussion,

The LORD CHIEF JUSTICE said there had been such delay in the case, and it had slept so long, that the Court were not disposed to afford any facilities for it. If the appeal could now be prosecuted under the new system, let it be so; they would give no directions about it.

The motion was dismissed with costs.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

WEDNESDAY, JAN. 17.

(Before Vice-Chancellor HALL.)

FOLJAMBE v. THE WORKSOP LOCAL BOARD.

Mr. EADES, Q.C., and Mr. CRACKNELL appeared for the plaintiff; Mr. DICKINSON, Q.C., for the defendants.

The plaintiff in this suit sought to obtain a perpetual injunction against the Worksop Local Board of Health to prevent them from fouling with sewage a river, on the banks of which his residence is situated. The motion came before the Court in November last year, and it was then ordered to stand over until the hearing. The matter now came before his lordship as a motion for judgment. The plan before the Court showed a small tortuous river, running into a lake known as the Osberton Lake, on which was situate the residence of the plaintiff, who was tenant for life of a large property in the neighbourhood, and the riparian owner of the river very nearly down to the town of Worksop. The river in question was a very small one, being not more than from 10 to 15 feet in width, and not more than 5 inches in depth, until just where it expanded its water into the Osberton Lake. The house of the plaintiff was 150 yards from the water of the lake, and was about three miles from the town of Worksop. Worksop now had a population of about 11,000, but it was constantly increasing. In 1860 the Local Board of Health constructed a drainage system, and under that system the sewage was carried from the town of Worksop by a main drain, which emptied itself into the first of a series of six settling-tanks, through the whole of which the sewage matter passed, being purified as it went, and the purified water ultimately found its way into the river. Unfortunately, there was no provision made for the flushing of the tanks, and in consequence they became very foul and polluted, and at last fell into a sad state of disrepair. In order to remedy the mischief, in 1875 the local board made an open drain outside the tanks, and between the hours of ten at night and six in the morning had been in the habit of closing the tanks and allowing the sewage to pass along the open drain. This was the state of things at present, and the evidence on this point was uncontradicted.

Mr. DICKINSON admitted the facts contained in the evidence, but complained that the plaintiff had been hasty in filing his bill, the local board now doing all in their power to carry out a sewage irrigation scheme. The difficulty was that they wanted land which the plaintiff would not sell.

After some discussion,

The suit stood over for four months, with liberty to either party to apply to the Court in the meantime if necessary.

THURSDAY, JAN. 18.

(Before Vice-Chancellor Sir JAMES BACON.)

ASHBY v. THE CROYDON UNION RURAL SANITARY AUTHORITY.

Mr. KAY, Q.C., and Mr. NALDER appeared for the plaintiff; Sir HENRY JACKSON, Q.C., and Mr. JOHN HENDERSON for the defendant corporation.

This was a suit instituted by the owner of a house and grounds called Wandebank, near Wimbledon, on the banks of the Wandale, to restrain the defendants from discharging sewage into the stream, so as to cause a nuisance and injury to the health of the plaintiff and his servants. The evidence established the existence of the subject of complaint, and although some attempt was made to disprove the right of the Court to interfere, in view of the powers conferred by Act of Parliament on the defendants, in the end the main discussion related to the extent and nature of the injunction to be granted, the defendants seeking to show that as the sanitary authorities of adjoining districts discharged their sewage through the defendants system they might be punished for the acts of others.

The VICE-CHANCELLOR granted an injunction. He allowed three months to the defendants to take steps to get rid of their sewage, but as to new drains and sewers the injunction to come into operation immediately. To a strenuous appeal for further time he replied that at the end of that period, when the defendants had shown what steps they had in the meanwhile taken, it would be open to them to apply for further time.

FRIDAY, JAN. 19.

(Before Vice-Chancellor MALINS.)

Re THE CADIZ WATER-WORKS COMPANY, LIMITED.

This was a petition, presented originally for the compulsory winding up of the company on the ground that they were unable to pay their debts. The company were formed in October, 1871, with a capital of £150,000, divided into 15,000 shares of £10 each, to supply the city of Cadiz and its district with water. The company soon after their formation issued 12,000 of their original shares, and proceeded to carry out their objects. They afterwards increased their capital by the issue of 20,000 preference shares of £10 each. Nearly all the original and preference shares had been fully paid up, and the company were still in operation, but had become indebted, in consequence of loans and other debts, to the extent of about £40,000, which, having regard to the expenses of working, they could not satisfy. A petition was accordingly presented by a holder of 25 fully paid-up preference shares, praying for an order to wind up the company compulsorily with a view to reconstruction and more efficient working.

Mr. COTTERELL, for the petitioner, said the company had, since the presentation of the petition in October, 1876, passed a resolution for a voluntary winding up under the supervision of the Court, and appointed official liquidators, and that that mode of winding up the company was the one which the majority of the parties interested wished.

Mr. HIGGINS, Q.C., and Mr. GROSVENOR WOODS, for some of the parties, supported that view.

Mr. ALEXANDER C. NICOLL, for Mr. Del Cacho, the equitable owner of 600 fully paid-up shares, also asked for a voluntary order under supervision.

Mr. BUSH, for a creditor for £250, supported the prayer of the petition as originally framed, and in asking for an order to wind up the company compulsorily, strenuously opposed the supervision order.

The VICE-CHANCELLOR said that where, as in this case, an immense majority of the creditors and others interested in the company asked for an order of a particular kind, and the only person who opposed that request was a creditor for the small amount of £250, the Court could not listen to his opposition. The order to be now made would be one that could not but be beneficial to all the creditors, large as well as small, and it must be this: Continue the voluntary winding up under the supervision of the court, and let Mr. Bush's client be at liberty to apply in chambers to add to, or change, the liquidators already appointed. There must be the usual order as to costs.

ASTON PETTY SESSIONS.—FRIDAY, JAN. 19.

(Before Messrs. HILL, HOUGHTON, and FOWLER.)

NEGLECT OF WORK BY A STOKER.

John Wright, a stoker at the Salfley Gas-Works, summoned his employers, the Birmingham Corporation, for the sum of £3 10s., which he claimed in lieu of a fortnight's notice. There was a cross-summons against Wright by the corporation, charging him with neglect of work, and claiming 10s. damages.

Mr. W. H. PHILLIPS, who represented Wright, stated that the latter was employed by the corporation at a salary of 35s. per week. It seemed to be the custom among the workmen to do work on each other's account, and if Wright desired to absent himself from his work for three or four hours he might do so by an arrangement with his fellow-employees. On the 30th of December, Wright having worked that week for a time equal to eight days, provided two substitutes. On presenting himself at the works on the following morning he was refused employment, and as he was thus summarily dismissed, he sought to recover £3 10s. in lieu of a fortnight's notice.

On behalf of the corporation it was stated by Mr. HERBERT, who appeared for them, that Wright went to the manager of the works slightly intoxicated, and said he wanted to go off. The manager told him he could not be allowed to do so unless he provided a substitute. He then went away, but shortly afterwards returned, remarking that he could not find one, and that he should go as it was. The foreman then cautioned him that if he did so he would be breaking his agreement, and he would not be allowed to work again. Wright persisted in his refusal to continue his work, and went away. In consequence of his conduct it was necessary to get other men to do his work, and 17 retorts which should have been at work were left idle.

The summons against the corporation was dismissed, and Wright was ordered to pay 1s. damages and the costs.

COLNE POLICE COURT.—WEDNESDAY, JUNE 17.

ILLEGAL CONSUMPTION OF GAS.

Mr. James Banks Whittam, postmaster, Nelson, was summoned by Mr. Howarth Sagar, chairman of the Nelson Local Board, on behalf of the Nelson Local Board, for having, on the 29th of November last, in the township of Great and Little Marsden, within the district of Nelson, unlawfully caused to be laid a certain pipe to communicate with, and which did communicate with a certain other pipe for conveying gas to his premises, thereby preventing it from communicating with the meter. The local board were the undertakers within the meaning of the Gas-Works Clauses Act, 1847.

Mr. NOWELL, of Burnley, prosecuted on behalf of the informant, and Mr. HARTLEY defended.

On the information being read, the defendant pleaded guilty. The defence was that the gas from the meter had for a long time been very troublesome to business men, having flickered and burnt at times so badly that the defendant who was a printer and stationer as well as postmaster, had been left in total darkness. Although he had connected a gutta-percha pipe with another pipe, he had made it 6 feet long, and it was so conspicuous

continue distilling it at Rouen, this part of the company's business has been temporarily suspended, but may be resumed under circumstances more favourable to the manufacture.

In virtue of the powers conferred upon them by clause 67 of the regulations of the company, the board appointed Henry M'Lauchlan Backler, Esq., a director of the company at the close of the last annual meeting.

The usual interim dividend for the half year, at the rate of 8 per cent. per annum, will be paid on the 1st of February, by warrants to be forwarded to the shareholders on the previous day.

The CHAIRMAN: Gentlemen, we have rather a meagre report to lay before you to-day, and for this reason—that at this time of year we have no accounts to present; and we can, therefore, only give you a sort of outline of our proceedings during the previous six months. As far as the report goes, however, I think you will find it of a specially encouraging nature, remembering, as you must do, that trade for so long a period has been in a very dull condition in every country. If we had only succeeded in holding our own, we should have good reason to congratulate ourselves, but in this instance we have done considerably more. We have not only held our own, but we have made an advance, and I think that is a point of considerable interest and encouragement. The fact is, we have established our business upon such a substantial foundation, that it would appear as though the ordinary fluctuations of commerce, in the various towns in which we have stations, really have very little effect upon us; and even the serious depressions which come almost periodically over different countries seem, in our case, to produce very little impression upon our business. This undertaking has been so thoroughly established that it goes on and prospers, even in spite of the most adverse circumstances. If we have a little falling off at one station, we generally manage to recoup any loss it involves by advantages at another station; and this, as I have frequently remarked in this room, shows the great benefit of spreading our capital over six or seven stations, as, when we find a slight decrease at one or two, the probability is that in all the others we find an improvement. We, as is the case with all gas companies in a good position, are constantly receiving offers of new works and concessions in various parts of the Continent. We have hitherto, however, steadily shut our eyes to the very glittering terms in which these offers have been brought before us, and have generally refused every proposal of the sort. But Bolbec, which the report tells you was brought under our notice during the last six months, being so conveniently situated that it can be managed in connexion with our Havre station, we considered it worth more serious examination than we usually attach to offers of the kind; and having become convinced that we could obtain the lighting there upon terms which would render it remunerative, we resolved to make the purchase of the works. Accordingly, the bargain was completed, and we took possession on Sept. 1st last. I am glad to say that our short experience at this new station has shown that it is capable of considerable improvement, which will render the works more profitable in the course of time. Allow me to call your attention to an important point in connexion with our operations, and that is the application of gas to heating and cooking purposes. We mention the matter in the report, and state that it is becoming more and more general in various towns in France, and I think we may possibly find in this a source of much future prosperity to our company. Up to the present time gas has not been used there to the same extent that it has been in this country. There exists, therefore, plenty of room for the encouragement and development of the company's business, if our undertaking is limited to the seven towns we now supply. We are doing remarkably well with regard to freight and coal, although coke will not fetch quite such a price now as it did when other fuel was dearer. Having, as mentioned in the report, found means to sell the tar and other products at several of our stations on favourable terms, we considered it more advantageous to the concern to adopt that course, and discontinue the distillation of tar at Rouen. But this operation may, as we have stated, be resumed at any time when it is worth while, and will give us a better profit. As we have no accounts to lay before you at this period of the year, I cannot make any comment upon our financial affairs. I can only say, in general terms, that we are doing remarkably well, and that, large as our profits were last year, I shall be indeed surprised if it does not appear, on the 31st of March next, that the balance to the credit of our profit and loss account is still larger. I will now move—"That the report of the directors be received and adopted;" and when this motion is seconded, I shall be happy to hear any remarks which the shareholders may desire to make.

Mr. SOLOMON seconded the motion.

Mr. STOKES said he was sure every one present must have been pleased, in listening to the reading of the report and the chairman's speech, to find how satisfactorily the affairs of the company were progressing. Perhaps the chairman would kindly inform the meeting whether the directors were likely to call for any fresh capital; also, what the new concern at Bolbec had cost. He thought every shareholder would be glad to hear of the acquisition of those works, and he was sure that under the able management of the present board it would turn out a profitable purchase.

A SHAREHOLDER asked how far the new works were from Havre.

The CHAIRMAN said about 20 miles.

Mr. CHALONER SMITH said there was no railway there now, but it was likely there would be in two or three years time, and then it would be about an hour's journey by train.

Mr. LOVEJOY said the chairman had not mentioned the amount of the purchase-money, and if it was not desirable to give the information he would not press for it. But he would be glad to know whether the purchase-money, whatever it was, had been paid, and, if so, how the money had been raised. He asked this question as the holder of a class of shares upon which there were some outstanding calls, which he would like to have the opportunity of paying up.

The CHAIRMAN said, in reply to the questions put to him, he would state, in the first place, that the directors had no idea at present of making a call. Next, he was asked what the new works had cost, to which he replied that the purchase-money, with the necessary outlay upon the works themselves, was about £18,000. As to the means of paying this sum, the directors had provided them partly by the issue of debentures, and partly out of their surplus working capital. The price of coals and other things being so much lower than formerly, they found that their working-fund was much larger than they had any occasion for. They had actually paid for the property and were in possession of it, and had been working it since the 1st of September last. They did not, as he said before, think of making a call. The debentures issued by them had been taken up at 4½ per cent., and he thought while they were paying 10 per cent. to their shareholders, it might be considered a very good operation to raise money at that rate.

Mr. WHITEFOORD asked whether the board would entertain an offer of a concession in any other part of the Continent than France.

The CHAIRMAN said the directors might have a very different opinion about another offer to that which they held respecting their late purchase. Bolbec was a station so admirably got at from Havre that they could work it at a comparatively small expense; and being a large manufacturing centre—in the cotton trade—there was likely to be a very satisfactory return on their investment. He might say that hardly a month passed without the directors having some tempting offer made to them from various parts of the world; but when they came to look into them they usually found there were very good reasons why the parties desired

to part with their property, and that it would not answer the purpose of the company to pay the money demanded for it.

A SHAREHOLDER said he presumed the freehold of the new works had not been purchased.

The CHAIRMAN replied that the directors had purchased the freehold of the works and the concession; but the latter would, of course, have to be renewed at its expiration.

Mr. LOVEJOY thought the consent of a meeting of shareholders was required before debentures could be raised.

The CHAIRMAN said many years ago—perhaps twenty or more—when the concern was not in so good a position as at present, the shareholders, who were very tenacious about the power of the directors to raise money by debentures, limited that power to the issue of £75,000. But in subsequent years, and under the new Articles of Association, the directors acquired powers in this respect, and it was for them to determine what was the amount they thought it best to raise in the interest of the company, having regard to their means of paying off the debentures. The uncalled capital they had was a very large amount, and was an ample security for the payment of whatever debentures they required, and the directors thought they had adopted the best course.

Mr. BACKLER said when the new capital was issued it was understood that calls might be made, or the money required by the directors might be raised by debentures to the extent of the uncalled capital. A portion of the money was raised by calls, and the remainder the board had power to raise by debentures. Upon what they raised by calls they paid 10 per cent.; upon what they raised by debentures they paid 4½ per cent. The amount of debentures the directors could issue depended upon the amount of the uncalled capital, in addition to the £75,000 mentioned by the chairman. If they were about to enter upon any large undertaking requiring more capital than this, they would have to go to the shareholders for power to raise it.

A SHAREHOLDER asked whether the debentures just issued were offered to the shareholders. Many, perhaps, might be glad to take them up at 4½ per cent.

Mr. BACKLER said the money was raised in dribbles, a few thousands at a time, and not in sufficient amounts to make it worth applying to the shareholders for.

Mr. HILL remarked that at one time the debentures could not have been so readily placed. If, now, they had been offered to the shareholders and not taken, there might have been a difficulty in issuing them to the public.

Mr. BADDELEY said there were some debentures which originally were issued at 5½ per cent., and when these expired, offers were made to the shareholders to take them at lower rates.

The CHAIRMAN said the board always wrote to the debenture-holders, giving them the preference to renew if they chose to do it. But if the shareholders desired, the directors would send out circulars and invite tenders from them whenever they had any debentures to offer in the future.

The motion was then put and carried.

On the motion of Mr. STOKES, a very cordial vote of thanks was given to the directors for their able management of the company's affairs.

The CHAIRMAN, in acknowledging the compliment, said: I assure you, gentlemen, that these votes at our various meetings are always a great encouragement to us to persevere in the course which we have so long adopted. We give our whole heart and soul to your concern, and look after your affairs in every possible way—and, fortunately for you and for us, we have done it successfully.

Mr. BADDELEY moved a vote of thanks to Mr. H. M'L. Backler, the late secretary and general manager of the company, and congratulated that gentleman on his occupation of a seat at the board. Mr. Backler had done eminent service to the company in the past, and it was hoped that he would be spared many years to continue to give them the benefit of his judicious management in the affairs of the company. He (Mr. Baddeley) would at the same time ask the shareholders to include in their vote of thanks, "the gentlemen connected with the staff of the company."

Mr. STOKES seconded the motion, which was carried by acclamation.

Mr. BACKLER: Gentlemen, for my own part, and on behalf of my late brother officers, I have to thank you for the very kind expression of your good opinion. I am very glad to be admitted to the House of Lords, and hope to be useful in that position, and to remain in it as long as I possibly can.

The proceedings then terminated.

PROPOSED EXTENSION OF THE LEEDS CORPORATION GAS-WORKS.

A Special Meeting of the Leeds Town Council was held on Monday, the 15th inst.—The Mayor (Alderman Gallsworthy) in the chair—for the purpose of considering the Improvement Bill proposed to be introduced into the next session of Parliament.

Before the commencement of the discussion, a deputation of residents and property owners in the district of New Wortley was introduced, to protest against the extension of the gas-works in that neighbourhood.

Mr. EMMERSON said the deputation represented upwards of 200 property owners in New Wortley, and over 2000 occupiers. There was a population numbering about 10,000 surrounding the gas-works, who deemed the works an intolerable nuisance. He could speak from an experience of 21 years that the nausea, loathsome feeling, and squeamishness caused by the gas from the works was a source of general annoyance and inconvenience.

Mr. EDDISON remarked that the rateable value of New Wortley, in 1854, was £7621, and the number of occupiers 1280; in 1860 the occupiers numbered 1984, and the rateable value was £10,471; in 1865 the number of occupiers was 2864, and the rateable value £20,516; in 1870 the occupiers numbered 3300, and the amount of rateable value was £30,766; and in 1875 the rateable value was £46,703, and the number of occupiers 3950.

The Mayor promised that the statements of the deputation should receive every attention from the council.

The deputation having retired,

Mr. JACKSON, chairman of the Parliamentary Committee, moved that the council go into committee on the Improvement Bill. In doing so he expressed his satisfaction that the deputation from New Wortley had stated their views so definitely and clearly. He pointed out, however, that the figures which they had given rather tended to show the gas-works had not been so injurious and destructive to the growth of the district as they would induce the council to believe. The fact of the rateable value having multiplied very nearly seven times in 21 years, the number of occupiers having multiplied more than three times, seemed to him to be a very strong argument against the assertion that the gas-works were as unwholesome as represented. However, he supposed there could not be any doubt whatever that gas-works were a nuisance to those who lived near them. He took it that the views of the members of the deputation were in effect that it was desirable that the council, in dealing with the question, should bear in mind the enormous progress that had taken place in the population. In dealing with this bill, they were not simply dealing with the requirements of Leeds to-day, but for some time to come; and they must, in doing so, profit by past experience, judge of the progress which had been

made, and in some degree prepare for that proportionate increase in the future which it was only fair and proper to anticipate. In all these large undertakings, such as the provision and supply of gas and water, a considerable period of time was always necessarily required before works could be rendered available. It was therefore necessary that they should form some estimate, based upon past experience, as to what the requirements of the town would be some five or ten years hence. Referring to the borrowing powers proposed in the bill, he thought he should be able to show, with regard to the departments of gas and water, that if the money were wisely expended, and the works were ably carried out, the expenditure which they would be called upon to make would relieve the burdens of the town instead of adding to them. The powers asked for relative to gas were required to provide not only for the additional requirements which might reasonably be looked for, but for the present actual wants of the town. It would be within the knowledge of every member of the council that numerous complaints had been made from time to time within their memory, not only of the quality, but of the quantity of the gas supplied. The quality of the gas was simply a question of cost. If they chose to go to a larger cost, in buying coal to make better gas, or in the means of purification, the town could easily be supplied with an article possessing a higher illuminating quality than that supplied at present. As to the quantity, he was informed by their gas engineer, who had gone carefully into the question, that it was utterly impossible, with the present plant and system of mains, to provide, in the worst season of the year—that was in the darkest days—an ample supply for the various parts of the borough. He ought to point out another important matter. As the initial pressure was increased, so did the leakage, which at the present time was very large indeed. The engineer estimated it at 150 million cubic feet per annum. This, at 3s. per 1000 cubic feet, represented a loss of £22,500 per year. That loss, however, was less than it was some time ago, when the leakage was estimated at something like 20 per cent. The saving was due to new mains having been laid down in many districts, and to a registry now being taken of the gas consumed at the gas-works. No account was formerly taken of the latter. The council were asking for powers to extend the present works, and to obtain additional powers. The deputation put before them very strongly the undesirability of not extending the present works at New Wortley, but of removing into a less thickly populated district. That idea was much favoured by their own gas engineer, and by many members of the Gas Committee. The bill proposed to give the council power to purchase 130 acres of land at Bothwell, known as Haigh Park. The land was most suitable. It was on a low level, and had both railway and canal communication. It was also in the neighbourhood of considerable coal supplies. Another reason in its favour was that there were few dwelling-houses within the statutory boundary of 300 yards, and there would be ample scope for providing dwellings for the workpeople at the gas-works, who, he was told, would number about 500. For the purpose of showing the enormous extent of the works they had in hand, he might state briefly that the mains at present extended to something like 500 miles, of which it was estimated about 325 miles were 2-inch and under. There were also, it was estimated, something like 500 miles of service-pipes connected with the mains and places of consumption. It might be easily imagined, then, that with such an enormous length of pipes, leakage, which was absolutely unnecessary, and therefore absolutely waste, must be very much greater in corroded and leaky pipes than if their whole plant was in working order, and new mains had taken the place of the old ones, which had fallen out of order and become inefficient. To put it briefly, their engineer estimated that the present demand for gas was 25 per cent. in excess of the power of supply. The council must understand, of course, that the present consumption of gas was just about equal to the present powers of supply, or, in other words, that the whole of the gas which it was in their power to make they could sell. Their engineer, moreover, was of opinion that if they had the power to make 25 per cent. more gas than they did now, they could sell it all, and, consequently, very much increase their income. It was proposed, if they removed their works, or if they extended the New Wortley works, to supersede those in York Street. The reason for that could easily be pointed out by the fact that, as he was informed, the cost of the production of gas there was 4d. per 1000 cubic feet more than at the other works, although it was estimated that the 4d. would be reduced 1d. by the disuse of lime for purifying, and some other alterations. If the scheme for erecting new works were adopted, another advantage would accrue—the gasholders would be close to the place of manufacture, and thus the cost of independent and unnecessary mains, which tended to increase the amount of leakage, would be avoided. The independent mains, which were now necessary from the place of manufacture to the gasholders, would be dispensed with, and the cost saved. By substituting one main of larger capacity for the two smaller mains which were now in existence in every part of the borough, a less initial pressure would serve the purpose, and the result would be advantageous in this respect, that the less the initial pressure, up to a certain point, under which they could supply gas, the better the consumption and the better the light in proportion to the amount of gas consumed. There was another advantage. He was told that even at present their engineer was rather afraid to put on as much pressure as he was able to do, in consequence of the great danger there was from what one might call a “blow-up.” With the present condition of the mains in various parts of the borough, the increase of initial pressure increased the leakage, thereby increasing the risk and danger from explosion. With regard to the time that would be taken in erecting the works, at the least two or three years would be absorbed before they could have their plant ready to work. The bill gave them power to extend the present works at New Wortley, and for that purpose a piece of land was purchased some time ago. It might be desirable that he should state why the land was so bought. In the first place, it was considered very cheap for their purpose at the price which was paid for it; in the next, it was bought without the fact being known that it was for the corporation, and it was thought that Parliament might give powers to extend the existing works, when they might refuse the application for the erection of new ones. One answer to the complaints of the deputation might simply be that the owners of property came to the gas-works, but the latter did not go to the property. He did not mean to say all the property owners, because, as every one knew, some of the property existed when the gas-works were erected, and he was informed that in some instances, where real injury had been shown and proved, compensation had been given. With regard to the important question of finance, the gas capital account on June 30, 1876, was £915,887; they had also power to borrow £950,000, and the cost of the works up to June, 1876, had been £878,078. The net profit on working, after paying interest on capital and 1 per cent. to the sinking-fund, on the last two years was £25,200; the profit for the year ending June 30, 1871, was £13,803; 1872, £12,758; 1875, £3615; and in 1876, £21,587. The average yearly profit of those four years was £12,941; and with improved management and plant he thought that this profit might be fairly expected to increase. He had taken no account of the two years during which there was a loss on the manufacture of gas, because he considered, and probably the council would agree with him, that those years were so exceptional that it would be hardly fair to take them into account. The total amount of profit paid into the borough fund has been £51,764.

The net amount, deducting the loss upon the two years when the price of coal was so high, had been £24,254, besides paying £37,152 to the sinking-fund, and paying interest on capital. Taking the average capital engaged in the works and the average profits, the result showed a clear gain on ordinary years of about 1½ per cent. Therefore, with more efficient management, greater economy, and less cost of manufacture, the profit upon the additional outlay would be equal to that. If the profit were equal that would show an additional profit to the borough fund of about £4500 a year.

The motion having been adopted, the council went into committee upon the bill. With reference to the clauses bearing upon the gas-works extensions.

Mr. SCARR said he thought the present illuminating power of the gas—viz., 16-candle—was amply sufficient. If any consumer had a deficiency of illuminating power, it was in no instance the fault of the gas supplied. As a proof of this, he mentioned that hundreds of consumers had no complaint against the gas. Glasgow had been manufacturing gas of an illuminating power of 30 candles, but the inhabitants were now petitioning that it be reduced to 16 candles, which was quite sufficient to meet their wants. If the illuminating power of the gas was increased one candle, it added to the cost of production about 2d. per 1000 feet. He believed that any deficiency of illuminating power in Leeds was mainly due to defective fittings, and also, perhaps, in part to inadequacy of some of the mains, but this was being gradually remedied by the committee. He agreed with the Wortley deputation as to the desirability of keeping gas-works at as great a distance as was practicable.

Alderman GAUNT remarked that the population resident around the present gas-works had increased in spite of the alleged nuisance.

Alderman ADDYMAN believed that to be partly due to the corporation having freed the toll across the river.

No amendment being proposed, the gas clauses were approved after it had been explained that no power to erect new gas-works would be exercised until the consent of the council had first been obtained.

At a General Meeting of the Leeds Gas Committee on the 17th inst., Mr. SPARK directed attention to the numerous complaints made as to the supply and illuminating power of the gas. He specially noticed the remarks on this point made by the Leeds Chamber of Commerce, and urged that some explanation was due from the gas engineer, and that some improvement should be made in the gas if possible. Why could they not increase the illuminating power of the gas by, say, two candles? which would cost rather over 2½d. per 2000 feet, and not 2d. per 1000 feet, as stated at the council meeting on Monday, by Mr. Scarr.

Mr. WOODALL, in reply, stated that, in his opinion, the chief fault lay with the burners affixed to gas chandeliers and brackets. There was also a difficulty as regarded the mains, most of them being too small to carry the quantity of gas required by consumers. He desired to correct a statement made in the council as to the danger of increasing the pressure. The necessary pressure had always been put on, and there was no danger whatever of a “blow-up.” As to the leakage, great though it was, it was not large in proportion to the length of mains, and was really 112,000 feet per mile per annum less than that of a much larger town. During the month ending the 31st of December, the works had made 162,700,000 feet of gas, which was an increase upon the corresponding month in 1875 of 13,022,000 feet, or 8·7 per cent. This showed that much was being done to supply the growing demands of the town. They had, no doubt, arrived at nearly the maximum supply, and it was therefore necessary to see about the new works.

Mr. SPARK contended that, as they had arrived at the maximum supply, and could not increase the pressure, the only alternative was to increase the illuminating power. He was convinced that the public would rather pay a little more for their gas, if they could get better light, than be subjected to the inconvenience they had recently felt. He therefore moved—“That a special meeting of the Gas Committee be held on Friday, the 26th inst., to consider the advisability of increasing the illuminating power of the gas.”

Alderman LUPTON seconded the motion, which was unanimously carried.

LIVERPOOL UNITED GAS COMPANY.

REPORT OF THE PUBLIC ACCOUNTANT ON THE ACCOUNTS OF THE COMPANY.

The following report has just been issued by Mr. P. B. McQuie, the accountant appointed by the Recorder, to investigate the accounts of the Liverpool United Gas Company:—

“Sir,—Under my appointment, dated Oct. 19, 1876, I have the honour to submit to you my report upon the accounts of the Liverpool United Gaslight Company for the year ending June 30, 1876.

“To a considerable extent it must be taken as supplementary to the report I submitted under date of the 4th of July last, which I beg to confirm, and to which I respectfully refer.

“I propose, therefore, to follow the details of that report in the order in which they were then presented for your consideration.

“*Capital Account.*—I have examined all the accounts for the past year, which bear upon the question of the capital account of the company. The ‘capital received account’ remains the same as set forth in the appendix of my first report, statement No. 1.—viz., Ten per cent. A Stock, £561,000; premium on ditto, £178,548—£739,548; Seven per Cent. B Consolidated Stock, £136,475; Seven per Cent. C £7 10s. shares, £32,705—£169,180; total, £908,728; bond debt account, £160,000; the expenditure, as shown by the books, June 30, 1875, was £1,010,454 12s. 4d. The following payments have been made out of capital during the year ending June 30, 1876:—Linacre Station: buildings, £4500 1s. 1d.; apparatus, £739, 5s. 5d.; main pipes account, £4794 2s.—£10,033 8s. 6d.; balance of capital unexpended, £48,239 19s. 2d.

“*Main-Pipes Account.*—The expenditure on this account during the years 1875-76, chargeable against capital, was £5481 1s., which amount was transferred to the debt of pipe distribution account, and the sum of £4794 2s., part of the said sum of £5481 1s., was transferred from that account to the debit of capital account, leaving a balance of £686 19s., which I refer to in distribution of pipes account.

“*Pipes Distribution Account.*—This account is credited with £686 19s., amount of premium received from the late Charles Turner, Esq., deceased, on allotment to him of certain unissued £7 10s. shares. The effect of this entry is to credit capital account indirectly with the amount by reducing the main pipes transfer from £5481 1s. to £4794 2s., as mentioned in the previous paragraph of this report. I am of opinion that capital account is correctly credited with the premium, but there should have been a direct transfer of the amount to capital, and not through main-pipes account.

“*Main Service-Pipes Account.*—The cost of laying main service-pipes for the year 1875-76 was £1665 3s. 7d. I am of opinion that the amount is fairly chargeable against capital. It has, however, been charged against income, through repairing of service-pipes account.

“*Meter Account.*—The manufacture of meters account has not been credited with the value of meters made during the past year, and as the balance at the debit of that account—viz., £2501 11s. 10d.—has been

charged, through "repairing meters account," against income, credit must be given for the value of meters made during the year, which, per book, is £3038. Deduct value of condemned meters taken into stock at the price at which they were originally issued, £198 7s.—£2829 13s., less 12½ per cent., £355. To be charged to debit of capital and credit of profit and loss account, £2485.

"*Connecting Main between Athol Street and Caryl Street.*—The total cost of this main to June 30, 1876, as shown by the books, is £11,044 0s. 2d., of which the sum of £4187 18s. 8d. was charged against profit and loss, leaving a balance of £6856 1s. 6d., which has been carried to the debit of suspense account, to be dealt with at a future period. I confirm my objection to any portion of this expenditure being paid out of income, as it is clearly a charge against capital.

"*Eccles Street Station.*—The total cost of the reconstruction of Eccles Station has been considered by the company in the light of mere alterations, chargeable against income. I cannot accept this view of the case without some qualification. The present station and its belongings are not only of greater capacity and more commodious than the previous one, but altogether of superior construction. Some portion of the outlay should, in my opinion, be paid out of capital; but I have not before me the facts to enable me to say what would be a fair proportion. The particulars of the outlay are as follow:—New tank, £7662 6s.; new governor, £2431 4s. 11d.; new governor-house, meter-houses, &c., £1281 10s. 7d.; new station-meter, £514 9s. 2d.; gasholder No. 1, £10,688 4s. 7d.; extra work, £1648 14s. 7d. This amount of £24,326 9s. 10d. was transferred to the debit of the following accounts: Repairing of apparatus account, £15,117 1s. 1d.; repairs of building account, £9209 8s. 9d.—total, £24,326 9s. 10d., and afterwards charged to profit and loss by transfers from those accounts.

"*Fire at the Landing-Stage.*—In the profit and loss account for the year ending June 30, appears the first instalments paid to the Mersey Docks and Harbour Board, on account of the damage (yet to be assessed) done by fire to the landing-stage through the presumed negligence of the company's servants. The amount paid to them to June 30, 1876, is three instalments of £10,000—£30,000; interest at 4 per cent., £394 15s.; amounting to £30,394 15s.; legal and other costs, £3220 0s. 7d.; making a total of £33,614 15s. 7d. It is not within my province to determine whether the amount is correctly so charged or not, and for this reason. It is an 'extraordinary claim,' and for such there is an express provision in the Act of 1847, sections 31 and 32, which sets forth that the reserve fund shall be available:—(Sec. 31.) 'To meet any extraordinary claim and demand which may at any time arise against the undertakers.' (Sec. 32.) 'Provided always that no sum of money shall be taken from the said fund for the purpose of meeting any extraordinary claim, unless it be first certified in England or Ireland by two justices and in Scotland by the sheriff, that the sum so proposed to be taken is required for the purpose of meeting an extraordinary claim within the meaning of this or the Special Act.' And as the Special Act of 1848, section 40, recites: 'That the Recorder of the Borough of Liverpool shall have and exercise all powers given to the Court of Quarter Sessions by the clauses of the Gas-Works Clauses Act, 1847.' I think I am right in assuming that he also has the power to determine, upon inquiry, whether the damage done to the landing-stage should be a charge upon the reserve-fund or not. I am of opinion that the sum of £33,614 15s. 7d. should have been placed, in the first instance, to the debit of a suspense account, pending your decision as to its being legally a charge upon the reserve-fund. If your decision supports this view of the case, the surplus profits of the company would through that account have to be applied to meet the claim, and also any further payments made hereafter in respect of it. I submit, with all due respect, that the directors have exceeded their power in charging the amount, in the first instance, against the profits of the company.

"*Gas-Fitting Branch.*—This account was virtually closed on the 31st of March last by a transfer of the entire business of the department to the Liverpool Gas-Fitting Company, Limited, who took over the stock of the chandeliers at the price of £4380, and of other fittings at £4320, making a total of £8700. Nothing has been paid for the goodwill. The new company has a nominal capital of £10,000, in 10,000 shares of £1 each; and I understand there is a clause in the agreement of sale by which the directors of the Liverpool United Gas Company can, upon giving six months notice in writing, repurchase the business and take possession of the stock, &c. I believe the shares of the new Gas-Fitting Company are held principally by the shareholders of the Liverpool United Gas Company, so that they will not practically be prejudiced by the disconnection of this branch of the company's business—on the contrary, they will be benefited considerably, and, in my opinion, at the expense of the consumers of gas. The profits of the fitting department for the nine months ending the 31st of March, 1876, were £6324 4s. 2d. The question may arise whether or not the consumer has anything to do with the fitting branch and its disposal. The Special Act of 1848, section 5, sets forth that the 'Liverpool United Gas Company shall be established for the purpose of manufacturing gas, and for supplying and lighting with gas, streets, houses, shops, &c., within the town of Liverpool and the several townships, &c., and for doing and performing all other acts, matters, and things in anywise necessary or usual in or about, or for the purpose aforesaid, or any of them, or in anywise incident or relating thereto.' And in section 6 they had the power given them to acquire all the personal estate and effects of the dissolved companies. And in section 46 they have the power to recover any sum or sums owing to them for fittings. These clauses, in my opinion, sustain the view I take, that the fitting business formed part of the existing undertaking of the Liverpool United Gas Company, and that the directors had not the power to alienate the profits incidental to its working without a substantial consideration being paid for its transfer. It has been represented to me that the risk attending its working, as illustrated by the calamitous fire at the landing-stage, justified the board in dissociating the fitting branch from the general business of the company, and that no purchaser would undertake such a risk and pay a goodwill for it. These are arguments with which I have nothing to do, nor am I aware that the gas-fitting department was to blame in the matter; the fact before me is, that a large element of profit has ceased to exist, and that no consideration has been paid for its alienation from the general business of the company. The Liverpool Gas-Fitting Company, Limited, occupy rooms in the premises, Duke Street, for which they are to pay £590 per annum from the 1st of April last. No portion of this rent yet appears in the profit and loss account, as it does not fall due until the 1st of October.

"*Deposit Account.*—The deposits remaining at the credit of the gas consumers on the 30th of June, 1876, amounted to £32,505 7s. 2d.; the bad debts for the year ending the 30th of June, 1876, were only £421 9s. 3d. Through the courtesy of the treasurer of the gas company I am enabled to give a classified list of the deposits on the 30th of September, 1876, which shows that out of 23,004 depositors, from whom the total sum of £30,004 has been received, 12,071 represent deposits of 15s. and under; 8,862, £2 10s. and under; 1,703, £5 and under; 299, £10 and under; and 69 represent deposits above £10. Were a minimum rate of interest allowed on deposits in hand at the end of each year, much outside ill-feeling on this score would be set at rest.

"*Profit and Loss Account.*—I have carefully examined the profit and

loss account for the year ending 30th June, 1876, and, with the exception of the items referred to in this my report, subscribe to its general accuracy. The items referred to are:—Main service-pipes account, £1665 8s. 7d.; manufacture of meters account, £2,845; Eccles Street Station, proportion of, £19,326 9s. 10d.; Landing-Stage £33,614 15s. 7d. As the object of my investigation of these accounts has been to ascertain 'their actual state and condition,' I think it is within my province to report to you in what way and to what extent my objections—if sustained—will affect the affairs of 'the undertakers.' 1. In order to make the required transfers to the credit of the reserve-fund it may be necessary to call up the remaining capital of the company, namely, £130,820, the dividend upon which at 7 per cent. will be an annual charge against the future profits of the company. 2. Whether the reserve-fund, when credited with the transfers from capital account, to which I considered it entitled, will leave any surplus available for reduction in the price of gas to the consumer—and to what extent.

In conclusion, I beg most respectfully to observe that if my views are sustained, the reserve-fund—in the event of its being charged with the damage done to the Landing-Stage—will, in its amended form, not only be sufficient for such purpose, but that a considerable balance will possibly remain, which, with the surplus profits of the current year, may justify the directors of the company in considering whether they may not still further benefit the consumers by a further reduction in the price of gas."

PROPOSED PURCHASE OF THE WARRINGTON GAS-WORKS.

The following letter has been addressed by Mr. Spice to the Editor of the *Warrington Examiner* in reference to this matter. We publish it as being a fair statement of the principles which should govern negotiations for the transfer of gas-works to corporations:—

"WARRINGTON GAS.

"Sir,—I was agreeably surprised to find by the *Guardian* of yesterday that the Editor is become discreetly silent on this subject, and, after the noisy and discreditable proceedings at a recent ward meeting, about which, 'the least said is soonest mended,' I hope the undue excitement lately witnessed will subside, and that reason will resume its accustomed supremacy in your good old town.

"Certainly no one can regret more than I do the unseemly display of bad manners and the very unreasoning procedure which has been indulged in, by those who have set themselves up in opposition to the corporation, in respect of their carefully formed and deliberate opinion of the soundness of the policy and the favourable character of the terms of the proposed purchase of the gas-works. And as regards the part which I have taken in the defence of the right, and exposing the wrong, I have only to say that I shall be content to be judged by *future results*, let the issue of the contest be what it may.

"I was originally called in, as I understood, at the instance, and to meet the wishes, of those of the ratepayers who had doubts as to the expediency of the purchase, upon the terms assented to by the Town Council. I never heard a single word in the way of question concerning the soundness or otherwise of the principle of the corporation becoming the owners of the gas-works, in lieu of the company; if I had, I should have addressed myself to that question as well as to the one which was put to me—namely, is this a good contract for us as purchasers? or is it a bad one?

"I quite understood then, as I do now, and have done all the way through, that if I had reported against the purchase, on the ground of the terms being unfavourable to the corporation, the proceedings would have been terminated at the earliest possible moment, and the Town Council would have proceeded in the matter no further than legal forms would have required to enable them to put an end to the scheme.

"Whether it was a breach of faith or not, on the part of the opponents of the purchase, to decline to abide by the opinion given by me, after it had become known what that opinion was, I am not in a position to say, because I am quite unaware of the terms of the compact. All I can say on this point is that it looks like it.

"But, let that be as it may, when I heard, as I did from the Mayor, that it was thought desirable, in order and with a view to restore peace, and put an end to future contention, that a second opinion should be taken, as to whether the terms were good or bad, and that Mr. Hawksley should be asked to give such opinion, I at once said I, as the engineering adviser of the Town Council, had no objection to offer to that course and, further than that, I expressed my earnest hope that Mr. Hawksley's advice would be taken.

"I am sorry to find that after this had been assented to by the Town Council, it was repudiated by the opposition upon a matter of form. It would not suit them that Mr. Hawksley should be asked, as I was—Is this a good or a bad thing for us to carry out? He must not be left to make an independent examination in his own way; he must arbitrate, and hear what the Bleckleys, the Pierpoints, and the rest of the malcontents and self-constituted judges have to say; and go into details as to the quantity of gas to be got out of a ton of coals, and all the rest of it; and, in short, take a course entirely inconsistent with the simple issue between the two parties—viz., the gas company on the one side, and the corporation on the other.

"It is not for me to attempt to influence the ratepayers one way or the other; they are free agents in the matter. I have said and done that which I thought right in defending myself from the carping criticism of amateurs, and without stint have ridiculed and derided, twitted and roasted, those of my critics whom I have condescended to notice, and the ratepayers will form their own opinion of the whole matter; my deliberate opinion being that the contract is an exceptionally good one for the town; and, after an experience of thirty years in this special line of business, I cannot call to mind a single instance of a gas-work having been purchased by a local authority upon terms in all respects so favourable.

"As for falling back upon the rates of the town to make good any deficiency in the annual amount required to pay the interest on the debt and the sinking-fund, it is sheer nonsense and a mere bugbear, a false pretence, a weapon used to frighten the unwary, and those who use it ought to know better.

"The fair question is this—Is the present price a proper one? and whether it is or not is just now quite immaterial for the argument. If it is not, then let it be reduced and established upon a fair basis. Settle, to begin with, the proper, say average, amount of capital to be employed in relation to the quantity and quality of gas annually sold, and next the cost of the gas per 1000 feet delivered at the consumers burner. Conclusions upon these two fundamental principles being arrived at, it would be found what profit per 1000 feet would be required to pay, in the case of a company, its maximum dividends upon its 10 per cent. and 7 per cent. capital, the interest of its mortgage debt, if it has one, and to make provision for a reserve-fund.

"And now assume this state of things to be in existence at Warrington, as it is in very many towns, and the concern bought by the corporation. It is clear that if the full value was paid, the undertaking would yield no advantage to the purchasers to begin with, but as all such concerns grow, and as the town can always borrow capital upon the security of the rates at a minimum rate of interest (say, for argument sake, 4 per cent.), it is

clear that the margin of profit must increase year by year, and if the price remains at such a figure as a company must charge to enable it to pay its dividends upon its growing capital, no injustice would be done to the consumer, while the entire cost of the work was being paid off out of the profit remaining after payment of the interest on the capital borrowed for the purchase; and, in the end, the effect would be that the ratepayers would be the absolute owners of the works, with the capital extinguished, and entitled then to charge what would be a fair price for gas, if supplied by a company, to all consumers, and employ the profit in aid of the rates for the benefit of all ratepayers alike, gas consumers and those who are not gas consumers, except as regards the public lamps, towards the cost of which all contribute rateably.

"And thus it must be clear to the meanest capacity that no injustice need be done to the gas consumer to enable the ratepayers of any town or city to profit by making and supplying gas; but that, on the contrary, if the simple and equitable principle is observed, of selling the article at such a price as would meet all the requirements of a company established and regulated by the provisions imposed by Act of Parliament, the result must be the common good of all alike.—I am, sir, yours faithfully,

(Signed) "R. P. SPICE.

"21, Parliament Street, Westminster, S.W., Jan. 18, 1877.

ON THE PRODUCTION OF SULPHURIC ACID BY THE COMBUSTION OF COAL GAS, Etc.

By Mr. W. C. YOUNG, F.C.S.

[From The Analyst.]

It is the belief of many eminent gas engineers that the sulphur compounds in coal gas are converted into sulphurous acid by combustion in burners used for lighting purposes, and they are confirmed in their belief by the published opinions of several eminent chemists. The experiments which are the subject of this paper were made with the purpose of determining the amount of sulphurous and sulphuric acid respectively that is produced by burning coal gas in different burners, and were commenced nearly two years ago, their progress having been interrupted until lately.

The apparatus in use at the official testing offices, for the estimation of sulphur in gas, is that known as the Gas Referees apparatus, and is of the following description:—

The gas is burnt in a small Bunsen burner with steatite top, which is mounted on a short cylindrical stand, perforated with holes for the admission of air, and having on its upper surface a deep circular channel, to receive the wide end of a glass trumpet-tube. On the top of the stand, between the narrow stem of the burner and the surrounding glass trumpet-tube, are placed pieces of commercial sesquicarbonate of ammonia, weighing in all about two ounces. The products, both of the combustion of the gas and of the gradual volatilization of the ammonia salt, go upwards through the trumpet-tube into a vertical glass cylinder packed with glass balls, to break up the current and promote condensation. From the top of the cylinder there proceeds a long glass tube to increase the draught, and form an exit for the uncondensable gases. In the bottom of the cylinder is fixed a small glass tube, through which the liquid formed drops into a beaker placed beneath.

The condensed liquor contains the sulphur as sulphate of ammonia.

It is supposed by some that the complete oxidation of the sulphur is effected by nitric acid, formed by the oxidation of the ammonia vapours passing over the flame. The following experiments prove that this is not so, and that the Bunsen flame is sufficient alone to complete the oxidation.

The gas was burnt in a Gas Referees apparatus having no carbonate of ammonia round the burner. On the top of the glass balls a few crystals of pure carbonate of soda were placed, so that the interior of the cylinder was kept alkaline, and the absorption of the acid vapours assured. Care was taken that no ammoniacal vapour was present. Result:—

	Apparatus with (NH ₄) ₂ CO ₃ round Burner.	Apparatus with Na ₂ CO ₃ on top of Cylinder.
	Grains S in 100 Cub. Ft.	Grains S in 100 Cub. Ft.
1	9.27	9.65
2	10.30	10.60
3	9.40	9.75
4	11.20	11.60

Having found that the modified apparatus gave as perfect results as the original, the Bunsen was replaced by a common fishtail and other burners successively, and the gas burnt at the rate of about 1.25 cubic feet per hour (that being as much as the draught through the apparatus would permit). The condensed liquor was then made up to a known bulk, a portion boiled with hydrochloric acid, so as to expel any sulphurous acid that might be present, and the S estimated as BaSO₄. Another portion was acidified with nitric acid and set aside for 24 hours, and the S estimated as before; the difference between the two estimations being ascribed to sulphurous acid. The results are stated in grains of sulphur per 100 cubic feet of gas.

Fishtail Burner.			
	As H ₂ SO ₄ .	As SC ₂ .	S by Referees App.
1	11.1	2	10.9
2	12.1	3	11.7
3	9.3	0	9.1
"London" Argand Burner.			
1	12.7	4	12.6
2	11.3	2	11.1
3	11.4	4	11.3
Common Iron Argand.			
1	8.5	0	8.5
2	9.1	2	9.0
3	10.3	4	10.1

In these experiments the conditions were favourable to the production of sulphurous acid, as the supply of air to the burner was little more than sufficient to produce a steady flame, and, of course, would be less than when in ordinary use. As will be seen, however, the oxidation was as complete as in the Bunsen burner, and but a mere trace of sulphurous acid was obtained in either case.

There can be no doubt that the notion that sulphurous acid was the principal product of the combustion of sulphur compounds in coal gas, arose from the statements to be found in most text-books, that when sulphur or sulphuretted hydrogen is burnt with an excess of oxygen, the product is sulphurous acid. When sulphur is burnt in *dry* oxygen, sulphurous acid alone is produced, of course; but in *moist* oxygen, sulphuric acid will be found in addition. The statement is insufficient as regards sulphuretted hydrogen, as sulphuric acid may always be found in the product of its combustion.

In order to see how far the simultaneous production of water during the combustion of sulphur compounds affected the oxidation of the sulphur present, I burnt sulphuretted hydrogen, a mixture of hydrogen and sulphuretted hydrogen, and coal gas charged with bisulphide of carbon, respectively under a trumpet-tube fixed to a vertical cylinder, 2 feet high and 4 inches in diameter—about twice as large as the condenser in the Referees sulphur apparatus—differing in shape from the latter in having

two necks at the top. In one of these necks was fitted a separating funnel, through which a strong solution of pure caustic soda was slowly run on to the glass balls with which the interior of the cylinder was filled; to the other was fixed an eduction-tube. In the bottom of the cylinder was fitted a tube through which the liquid ran into a vessel beneath. In this way a large alkaline surface was obtained, which was being constantly renewed from the stoppered funnel.

One portion of the liquor obtained was boiled with HCl, another diluted very considerably with water, acidified with HNO₃, and set aside for 24 hours; the S estimated in both as BaSO₄.

The H₂S was burnt at as low a rate as possible, and the result showed that very nearly 1 per cent. of the S was converted into H₂SO₄.

A mixture of H and H₂S containing 4 per cent. of the latter produced no sulphurous acid during its combustion.

The coal gas was charged with bisulphide of carbon, by passing it over a solution of the latter in olive oil. In the first experiment, the gas was burnt at the rate of .5 cubic feet per hour, the result showing a total of sulphur amounting to 444 grains per 100 cubic feet, of which 422 grains (95 per cent.) had been converted into H₂SO₄.

In a second experiment the solution of bisulphide used was very much stronger, and the gas was burnt at the rate of .2 cubic feet per hour. The result was as follows:—Total sulphur, 1644 grains per 100 cubic feet, of which 1260 (or 76.7 per cent.) was converted into H₂SO₄.

It is evident from these experiments that the presence of aqueous vapour, or its simultaneous production, does very materially affect the oxidation of sulphur, and that, practically, the sole product of the oxidation of the sulphur in coal gas is sulphuric acid, even if that impurity be present in very large quantities.

ON THE BEST AND MOST ECONOMIC METHOD OF LAYING MAINS GAS-TIGHT, AND OF DISCOVERING AND REMEDYING LEAKAGES.

By M. MONNIER, late Engineer of the Marseilles Gas-Works.

[Mémoire to which a Premium of 250 francs was awarded by a Member of the Committee of the Société Technique de l'Industrie du Gaz en France.]

(Concluded from page 95.)

PART II.

Having considered the causes which more or less affect the soundness of gas-pipes, we are now about to enter upon an examination of the precautions to be taken and the rules to be observed in order to obtain a good system of mains.

1.—On the Pipes employed for the Distribution of Gas, and on the Various Methods of Connecting them.

For some time past the use of pipes made of earthenware, stoneware, cement, or wood, has been discontinued for the supply of gas, either on account of their porosity, or because of the difficulty of making and keeping the joints sound.

Pipes of lead, composition pipes, and copper pipes are only employed for branches, or for the distribution of the gas in the interior of houses.

For the system of mains, properly so called, pipes of cast or bituminized sheet iron are employed.

Cast-Iron Pipes.

The joints of these pipes may be flanged or socketed.

The rigidity of the flange joints would not allow the pipes sufficient flexibility to permit of their yielding to the movements of the ground, for, besides the rapid oxidation, in the soil, of the bolts which form the essential part of the joint, the employment of this system is limited to a few special cases.

The socketed joints may be divided into three classes:—

- Ordinary sockets with yarn and lead joints.
- Turned and bored joints.
- Connexions with india-rubber joints.

Ordinary Sockets with Yarn and Lead Joints.—This method of jointing is rendered sound by means of tarred yarn. To effect this, the male end of the pipe is inserted as far as possible in the socket, and having so fixed the pipe as to ensure a uniform space all round it, a strand of tarred yarn is, with the aid of a caulking-iron, wedged as tightly as possible into the cavity, until the annular space between the two pipes is filled to about two-thirds of its height. Care, however, must be taken that the yarn is compressed uniformly all round the pipe. This delicate operation requires strict supervision, especially for the under part of the joint, which the workmen have a natural tendency to neglect, on account of the greater difficulty of execution. The soundness of the joint should be obtained by the yarn alone, independently of the lead or mastic with which the socket is filled up, and which can have no other object than the maintenance of the hempen packing, and its preservation from contact with the earth. The strand of yarn having been well pressed down, the entrance to the joint is surrounded by a layer of clay, upon which a small lip is arranged, serving for the introduction of the lead, which is all run in at one pouring, and in a sufficiently molten state to prevent its solidification before the joint is quite filled. The clay having been removed, the button of the pouring-hole is detached, and the lead allowed to cool, after which it is well beaten up all round. Very pure, soft pig lead should be exclusively used. The coefficient of the dilatation of the lead being three times as great as that of the cast iron, it will be understood that when the temperature of the pipe is lowered, the lead will not completely fill the joint, and if the tarred yarn has not been well rammed in, leakage will be the consequence. The lead being inelastic, it may happen that a movement of the soil, by compressing the joint on one side, will cause it to open, thus giving rise to an escape of gas. Some persons substitute iron cement for the lead, which, while being less expensive, answers the same purpose of maintaining and preserving the yarn joint.

The system of jointing we have just described presents, as will be seen, several disadvantages. It is expensive, requires skilful and conscientious workmen for its proper execution, as well as very careful supervision. Pipes jointed in this manner are wanting in flexibility, and easily lose their soundness under the influence of variations of temperature and movements of the soil. If, notwithstanding these defects, which are admitted by all, this system of joint is still the one most generally employed, it is owing in great part to a natural apprehension felt at running counter to certain preconceived ideas, and assuming the responsibility of a less known system, however rational it may appear. It is moreover incontestable that, with money and more care, the socket joint may, notwithstanding its imperfections, give a sufficiently sound main service; but, in our opinion, that is not the question. The thing is to ascertain whether the same capital and the same care, employed under another form, would not constitute a more advantageous investment.

Turned and Bored Joints.—This system of joint was invented in England, where it is known under the name of the "Turned and bored joint." The two parts of the joint are slightly conical in shape, and turned. Jointing is effected by forcing into the socket of one pipe the turned end of the next, it having been first coated with a little white

lead. For pipes of large diameter the operation is commenced by slightly dilating the socket by heat, before inserting the male end of the next pipe; on cooling, a tightly-compressed joint is obtained. This joint is very quickly made, inexpensive, and perfectly hermetic the moment the pipe is laid. Pipes jointed in this manner, however, are wanting in flexibility, and, owing to the conical form of the parts in contact, the slightest backward movement of the pipe causes an escape.

With regard to the attempts that have been made to adapt turned cylindrical joints to cast-iron pipes, up to the present time they have not been successful.

Connexions with India-rubber Joints.—Elasticity being one of the essential conditions of a good joint, it was natural to seek to apply india-rubber for the connexions of gas-mains. The first attempts were made in England by Messrs. Mackintosh and Co. in 1847, and since that time a great many arrangements of joints have been proposed, based upon the employment of this material. The texture of india-rubber being liable to more or less serious modifications by oxidation, or by the action upon it of certain compounds of illuminating gas, the best joint will be that which shall reduce to their minimum the surfaces in contact with the causes of deterioration, and at the same time present the greatest resistance to diffusion. Further, the joint must be a simple one, and easily made, and not admit of the employment of any material susceptible of deterioration by contact with the ground. The system of joint patented by M. Somzée, of Brussels, which is sanctioned by several years practice, fulfils tolerably well the conditions enumerated above. It is less known in France than in Belgium, where it has received numerous applications, the most important being in connexion with the new main service for the city of Brussels.

The male end of the pipe terminates in a flange of a size almost equal to the space left between the outer surface of the pipe and the inner surface of the joint. The object of this flange is to keep the play of the joint sensibly equal over its entire circumference, and to prevent the crushing of the india-rubber ring. The plug-ring is composed of vulcanized india-rubber, circular in section, the inner diameter of which is less than the outer diameter of the male end of the pipe. The thickness of the flange is equal to double the play allowed between the male end and the female end. This ring is placed upon the flange, which, acting in concert with the hollowing, clips the india-rubber by a simple rolling movement.

It will be seen that this system fulfils, better than the lead and yarn joint, the conditions of elasticity and soundness sought for in connecting main-pipes, and is at the same time simple, rapid, and moreover more economical of execution. Several years experience has shown that when the india-rubber is of good quality—and this should always be ascertained previous to its employment—its condition changes only at the points directly exposed; that is to say, on account of the form of the joint, only a small portion of its total thickness is affected, while the body of the ring remains absolutely sound, preserving all its elasticity.

Pipes of Bitumenized Sheet Iron.

The pipes composed of bitumenized sheet iron, the invention of which is due to M. Chameroy, consist of two principal parts:—

- (a.) Sheet iron leaded on its two faces, riveted and soldered with care, which forms the gas-tight passage of the pipe.
- (b.) A thick layer of bitumen enveloping the pipe proper, which it protects against oxidation, while affording a larger area for sustaining outward pressure.

The first system of connexion employed by M. Chameroy was the screw-joint, but that has been entirely abandoned on account of its inconvenience, both as regards the making of the joints and their soundness, and replaced by the exact joint ("*joint précis*"), which, besides affording greater facility in execution, possesses the advantage of allowing the pipes to expand or contract freely; they may even become partially disjointed without the connexion ceasing to be sound.

Of all the various kinds of pipes applicable commercially for the conveyance of gas, those of bitumenized sheet iron present the greatest amount of impermeability, and with them the loss of gas by diffusion will consequently be least.

The elasticity of the sheet iron, as well as that of the bitumen, renders them less sensitive than those of cast iron to the causes of deterioration arising from the shifting of the ground. All connexions, and particularly the branches, are quickly and easily made; in short, they offer a notable economy over the cast-iron pipes with lead joints, when the prices are compared after the execution of the work.

Notwithstanding the incontestable advantages which have caused these pipes to be adopted by a large number of gas companies, at the head of which the Paris Gas Company has just placed itself, the employment of this system still gives rise to certain objections founded upon the rapidity of oxidation of the sheet iron when it is no longer protected by the bitumen. Except, however, in the very rare case of finding oneself in presence of a soil of a nature exceptionally capable of exercising a dissolvent action on the bituminous crust, the inconvenience here pointed out is more apparent than real; for, in order to dispel any fear on that ground, it is sufficient, on the one hand, to verify the exact condition of the exterior of each pipe before laying it, and on the other to carefully re-bitumenize all those parts where the iron may have become exposed in the course of making junctions with the main.

The laying of these pipes is effected with the greatest facility. The exterior and interior joints are cleaned with a hard brush, after which the shoulder of the interior joint, as also the circular groove, is surrounded with fine yarn saturated with wax-tallow. The two portions forming the joint are afterwards coated with a mixture composed of plumbago and lard; the pipes are then brought together by inserting the joint bearing the packing, in the end of the pipe already laid, care being taken to place the rivets underneath; the pipes are then driven one into the other by striking with a mallet or ram (according to the diameter) a wooden buffer shouldered against the taper until the neck of the pipe presses the packing. The pipes, when laid, are consolidated by a filling-in of earth.

2.—Laying and Testing the Mains.

Whatever may have been the system of pipe and joint to which preference has been given, a certain number of precautions have to be taken, in order that the mains may be laid under the best possible conditions.

First of all it is necessary to make sure that the pipes are of the prescribed thickness over their entire circumference; that their section is circular, not oval; that the material of which they are composed is sound in all its parts, and presents sufficient resistance. It should be ascertained whether these conditions have been fulfilled, first by a careful examination of the pipes, and afterwards by a trial with an hydraulic press under a pressure of from 10 to 12 atmospheres.

The best way of testing the soundness of the pipes is to try them when under water, by means of air, at an effective pressure of one atmosphere; the slightest escapes are then disclosed by the appearance of air bubbles.

All these trials should be made upon the bare pipes, and those which do not thoroughly satisfy all conditions should be rejected.

The trenches in which the pipes are laid should be perfectly levelled at the bottom, to the inclination adopted for the execution of the work, in

order that the pipes may be supported along their entire length. The deeper the trenches are, the less will they be affected by exterior disturbing causes, and we consider it would be very advantageous to excavate the trench to a depth of 1·8 or even 2 mètres (6 feet or 6 feet 6 inches). In support of this opinion we will cite a fact which appears to us thoroughly characteristic. At St. Petersburg, where, in consequence of the severity of the winters, the pipes have to be placed at a depth of 2·15 mètres (7 feet), the leakage amounts to scarcely 5 per cent., although the main service is very extensive, and is laid in a peaty soil little favourable to laying pipes gas-tight.

The pipes having been laid and jointed with all requisite care, it is necessary, before filling in the trench, to ascertain by further trial that the pipes are sound. This is done by compressing air to a pressure of 25 to 30 centimètres of mercury, and observing whether the pressure-gauge remains stationary for several minutes after the pumping has ceased. If there be any escapes, they will be indicated by the whistling of the issuing air. This verification, which offers no difficulty, and entails only a slight expense, is of the highest importance, since by it alone can it be proved that the joints are sound, and that the pipes have not sustained any injury from the time of their reception until they are brought into use.

When it is a question of mains already in action, the trial may be made with gas. For this purpose, after having completely expelled the air from the portion to be tried, it is, if necessary, isolated from the rest of the mains by means of plugging-bags, and the gas is conveyed in through a meter of suitable size, under the highest pressure at command. The equilibrium once established, the quantity of gas which passes through the meter in a settled time is measured. Escapes are indicated by the odour of the gas. By wetting the joints or doubtful parts with soap and water, the places where the escapes occur may be recognized by the formation of soap bubbles.

The mains may be considered as being in good condition if the amount of leakage registered by the meter does not reach half a litre ('0175 cubic foot) per hour per square metre (10·76 square feet), under a pressure of 25 to 30 millimètres (10 to 12 tenths).

Branches.—Branches are capable of exercising so important an influence over the total loss by leakage on the mains, that it is highly necessary the greatest care should be taken in their attachment and maintenance. They are generally made of lead, or of wrought or cast iron.

Lead is very easily fixed, is, so to speak, of unlimited durability when pure, and retains a great portion of its value even after it has been thrown out of use. The principal objection made to its employment is that it is more easily pierced than wrought or cast iron, either by an accidental blow from a pick-axe, or sometimes even by the attacks of rats; but these accidents occur so seldom, and are so readily repaired, that they do not appear to us to constitute a sufficient reason why lead should lose the preference it enjoys in France for making branches, especially those of small diameter.

With regard to branches made of rolled iron, although offering greater resistance to external blows than those of lead, they do not generally last very long, on account of their rapid oxidation in the soil. At the utmost their duration does not exceed five or six years, and rarely attains ten.

It will be readily understood that some of these branches may be causing considerable loss of gas before the time arrives when the necessity for replacing them by others is recognized.

There is a tendency also to substitute for this kind of branch-pipe those of lead or cast iron, which, notwithstanding their higher first cost, are, in the end, less expensive than wrought-iron ones, on account of their much greater durability. Cast or bitumenized iron are to be preferred to lead in the case of branches of large diameter and great length, and where there are but few deviations from the straight line.

If the material of which the branch is composed is of great importance from the point of view of leakage, the method of its junction with the main is no less so. In this respect, it may be said to be preferable to reject every system into which forge iron enters, whether in the form of collars, flanges, or even studs, as at the expiration of a few years, traces only remain of the pieces of iron employed. With regard to the branches of "Chameroy" pipes, the junction is made by simply soldering the lead to the leaded sheet iron, and that is not one of the least advantages of this system of pipes. The only precaution to be taken is to carefully re-bitumenize the part of the sheet iron exposed by the operation, so as to avoid all solution of continuity in the protecting material in which the pipe is enveloped.

3.—Searching for Leakages on Mains already Laid.

Notwithstanding all the care taken in laying mains, leakages will occur, sooner or later, a great number of which will be more or less rapidly perceptible by the odour of the escaping gas passing through the soil, out of sewer openings, or into the cellars or wells of houses; sometimes also by the damage caused to the plantations in the public thoroughfares. All the company's outdoor servants, and especially the lamplighters, should be induced to call attention immediately to all escapes discovered by them in their daily rounds, as well as to all communications made to them in that respect by the public.

As soon as the odour of gas is perceived, its origin should be at once sought for. Having tested the soundness of the exterior apparatus in the neighbourhood, a search should be made for leakages underground, by first directing attention to the joints of the mains themselves as well as of the branches. Any information it may be possible to obtain as to the various sewerage operations carried on within a recent period in the neighbourhood of the pipes will, in many cases, facilitate the discovery of the weak point.

The labour of searching for underground escapes may be very much shortened by the use of a small probe, which is forced into the roadway or in the space between two flagstones at various points in the immediate neighbourhood of the suspected pipe. Into the hole thus made is passed an iron tube, long enough to rise about 1·30 or 1·40 metre (4 feet 3 inches or 4 feet 6 inches) above the ground. On placing the nose to the upper orifice of the tube, one could easily ascertain whether any smell of gas was issuing from it, and would thus be enabled quickly to determine the points where a trench would have to be opened. All these searches should, as far as possible, be made during the hours when there is least traffic. Of course, when the escape has been found, all necessary repairs should be made at once.

When we have to deal with a main service upon which the amount of leakage exceeds the limits that may be considered allowable, it is necessary to proceed to a thorough trial of all the mains, first in their entirety, and then in successive sections, so as to limit the field of operations proportionately with the extent of the evil and the difficulty of discovering its locality. The operation is performed by means of a meter, as in the case of the testing of newly-laid mains.

It will be easily conceived that it is impossible successfully to carry on searches of this nature without having a detailed plan of the mains, giving for each street the diameter of the pipe and the depth at which it is laid, also indicating its exact position, and the position of all its connexions, by means of distinctive marks. This plan should likewise show the situation of branch-pipes. In all well-organized main-laying operations this

plan of the pipes is drawn by the aid of memoranda made upon the spot when each pipe is laid, and it is constantly open to all changes and additions made in the network of mains. When such a plan does not exist, the first thing to be done is to prepare one, and it will be a loss of time and money to undertake work connected with the maintenance and repair of a main service without having before one's eyes an exact representation of the pipes upon which operations are about to be directed.

4.—On the Best Dimensions for Main-Pipes.

Up to the present we have spoken only of the precautions to be taken for laying the mains and keeping them in repair, and we have seen that if it is not possible to suppress leakages entirely, they may at least be considerably reduced by intelligent supervision. It now remains for us to say a few words on the relation that may exist between the loss of gas and the diameter of the pipes.

The larger leakages, those assimilable to an outflow from a narrow slit, or in fitting, are probably proportional to the square root of the pressure in the pipe. With regard to leakage arising from diffusion, we have seen that it is proportional to the fourth power of this pressure.

It is therefore probable that the coefficient of leakage on a main service may be represented, in the function of the manometric pressure H in the pipes, by an expression of the form

$$\alpha H + \beta \sqrt[4]{H}$$

α and β being coefficients depending upon the nature and condition of the mains and branches at the time in question. But it is not necessary to know the value of these coefficients to see that every reduction of pressure will tend to reduce the leakage, and that consequently it will generally be advantageous in this case to give in just measure the preference to larger diameters. In this respect there is evidently no absolute rule,* but what we have just said is sufficient to show how important it is for a gas company that the plan of the mains should be studied with the greatest care, not only for the time present, but also looking to the future; for if it is very easy to develop the works themselves in proportion to requirements, nothing is more difficult or more expensive than to have to make frequent alterations in the mains; and we shall conclude this paper by showing that, irrespective of all considerations relative to working, and regarded from the single point of view of a good employment of capital, it may be advantageous to give the preference to diameters which at first sight appear exaggerated.

It is a question of laying a main-pipe 3500 mètres (about 2¼ miles) in length, with a contemplated maximum supply for the first year of 1500 cubic mètres (53,000 cubic feet) per hour. The progressive growth of the consumption is valued for the future at 4 per cent. per annum on the average, and the particular conditions of the case fix at 70 millimètres (nearly 3 inches) the highest limit of loss of pressure admissible upon the course of the projected pipe.

What will be the most advantageous Diameter in regard to the Capital Invested?—The supply of 1500 cubic mètres per hour at a distance of 3500 mètres will entail the following loss of pressure with pipes of the diameters given:—

Diameter of Pipe.		Loss of Pressure.	
Mètres.	Inches.	Millimètres.	Inches.
0.400 . . .	15.7 . . .	64.5 . . .	2.58
0.450 . . .	17.7 . . .	36.0 . . .	1.44
0.500 . . .	19.7 . . .	21.0 . . .	0.84
0.600 . . .	23.6 . . .	8.5 . . .	0.34
0.700 . . .	27.5 . . .	4.0 . . .	0.15

The loss of pressure to the extent of 70 millimètres in 3500 mètres—i.e., 20 mm. per kilomètre—corresponds to the following rates of delivery:—

Delivery per Hour.		Diameter of Pipe.	
Cubic Mètres.	Cubic Feet.	Mètres.	Inches.
1550 . . .	55,000 . . .	0.400 . . .	15.7
2100 . . .	74,000 . . .	0.450 . . .	17.7
2700 . . .	95,000 . . .	0.500 . . .	19.7
4300 . . .	153,000 . . .	0.600 . . .	23.6

The anticipated augmentation being 4 per cent. per annum, the number of years at the expiration of which each of these consumptions will be attained, will be found by solving the following equations:—

1500 (1.04) x = 1550; whence x = 0 years.	
1500 (1.04) x = 2100 " x = 8 "	
1500 (1.04) x = 2700 " x = 14 "	
1500 (1.04) x = 4300 " x = 26 "	
1500 (1.04) x = 6300 " x = 36 "	

To compare the respective advantages of each of the possible diameters, having regard to the placing of capital, the following method must be adopted:—

- Determine the excess of expenditure, E , resulting from the adoption of the large diameter, D_1 , in place of the small diameter, D .
- The diameter D_0 becoming insufficient at the expiration of n years, we look for the dimension of the second pipe which would have to be laid at the end of n years, in order to obtain the comparison with the diameter D_1 , as a power of distribution.

Let p equal the cost of the second pipe to be laid in n years, by solving the equation—

$$E(1+t)^n = p$$

we shall find the rate of interest (t) at which the capital is placed by giving the preference to such or such diameter.

Starting with the figures given above for the capacities and prices of the pipes, we shall see that—

If for a pipe of 0.450 metre diameter we substitute one of 0.500, the capital will be placed at 20 per cent. per annum.
0.600, " " " 10 "
0.700, " " " 7 "

If for a pipe of 0.500 metre diameter we substitute one of 0.600, the capital will be placed at 7 per cent. per annum.
0.700, " " " 7¼ "

If for a pipe of 0.600 metre diameter we substitute one of 0.700, the capital will be placed at 6 per cent. per annum.

The particular financial conditions of the undertaking being known, it

* As by increasing the diameter the surface of the leakage from the pipe is increased in the same proportion, while that of the branch s and other connexions remains invariable, and while, on the other hand, the reduction of pressure due to the adoption of the larger diameter only affects the portion of that pressure which represents the loss of pressure in the pipe under consideration, it is impossible to express, by a general formula, the influence of the diameter upon the leakage; it may, however, be easily ascertained in each particular case. The value of the loss of pressure is, as we know, represented by the equation

$$h = 0.85 \frac{Q_2 L}{D^5}$$

h being the loss of pressure in millimètres of water; Q , the quantity of gas flowing from the pipe in cubic mètres per hour; L , the length of the pipe in mètres; D , the diameter of the pipe in centimètres.

will be easy to ascertain to which of these combinations preference should be given, keeping in view, moreover, the unquestionable advantage—impossible to be demonstrated by figures—which the concern will derive from the adoption of the largest possible diameters.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

In several quarters the reports of the last few days have hardly been so good, owing to the great uncertainty of the political future in regard to the state of things in the East of Europe. The complications there, and the risk of war being declared at any moment, have had a distinct and unmistakable tendency to restrict the operations of foreign buyers of pig and other iron, inasmuch as any outbreak of hostilities would naturally cause an immediate increase of freights, as well as an addition to the rates of insurances. Under these circumstances, in combination with the effect of a very weak market for Scotch pig iron, local pig has been rather quiet, and there has been no further effort to secure increased prices, either for foundry or forge brands. At the same time it should be understood that there has been no recession of quotations, which would, in all probability, become firmer again should the Eastern Question be amicably shelved for the present. In finished iron there is only a very quiet trade doing, the results of the recent quarterly meetings in other districts having been eminently unsatisfactory to shipping and other buyers, who are, therefore, either entirely withholding or minimizing their orders. Some of the largest forge concerns, too, are very poorly engaged, and complain that their order-books are by no means well filled. At the foundries, as I have stated on two or three recent occasions, there is a better business, most of the leading concerns being fairly well employed.

The coal trade is very dull, every possible combination of circumstances having a tendency to keep it so. At the Shireoaks Colliery the men have accepted a reduction of 4d. per ton, a step which may lead to the reduction becoming general, inasmuch as the managing director of the Shireoaks Company is a prominent member of the Coalowners Association. It is evident that some such measure will presently be enunciated, seeing that hardly any of the pits are being worked more than three days weekly; and at many, considerable numbers of the men are now being discharged, owing to the absence of profitable orders.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Trade in this district still shows no improvement, and all descriptions of coal are exceedingly dull. Of coal for gas-making purposes a fair amount has been shipped, and tolerably good prices have been obtained, but for home consumption there is very little demand beyond what is required for contracts, and prices are without material change. House fire classes of coal move off only very slowly, owing to the exceptional mildness of the weather, and stocks are now again accumulating at many of the pits. Whilst others are not working up to their full production. Common classes of round coal are plentiful in the market, as not only is the demand for manufacturing purposes restricted by the present depression in trade, but the low price at which slack is now being offered has induced some of the ironmasters to substitute this class of fuel for forge coal. The better classes of burgy meet with a fair demand, but common sorts of engine fuel are still a drug in the market. The average pit prices in the Wigan district may be given about as under:—Arley, 11s.; Pemberton four-feet, 9s.; Wigan four-feet, 7s. 6d. to 8s.; forge coal, 7s.; burgy, 5s. 6d.; and ordinary slack, 3s. to 4s. per ton.

The coke trade is without material change, either as regards prices or demand, and the greater portion of the ovens in this district are still out.

An effort is being made to again form a coal merchants association for the Manchester district, and I understand that a committee have been appointed to carry out the preliminary arrangements.

In the iron trade there has been a weaker tone during the past week, and the local makers of pig iron are being completely undersold by north country brands, which are being pushed in this market at very low prices. There is, however, no material change in the quotations for Lancashire pig iron, but sellers are scarcely so stiff as they were. The finished iron trade continues steady, local bars delivered into the Manchester district being still quoted at £6 15s. to £6 17s. 6d., and in some cases £7 per ton. Founders, engineers, and machinists, however, are very quiet.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The weather was a great deal more favourable to the rapid shipment of gas coals from the Tyne last week, and steamers were loaded and sent out pretty rapidly. But from the great quantity of coal which had been despatched during the previous fortnight to London and the South of England, the demand at the shipping-places was not very pressing. Rather below an average shipment was effected, and the supply of steamers and sailing vessels was considerably in excess of the demand; coasting freights, therefore, kept easy. The most notable feature in connexion with the coal trade of this district is the reduction of work at most of the second-class collieries producing manufacturing and an inferior gas coal. Many of these pits were wrought last year at a considerable loss to the proprietors, and the second-class coal trade of the North of England may be described as in a sort of crisis; that is, determined efforts are being made to produce less of this class of fuel. Some pits, but not many, are likely to be closed altogether. The price of gas coal is unchanged. It is not likely to alter very materially, for the reason stated last week, that the best collieries in the trade have entered upon considerable contracts, and, therefore, have not much coal to put into the open market. Rates are about 9s. 6d., best gas coals, and from 6s. 6d. up to 7s. 6d. for second and medium sorts. The house coal trade is extremely quiet. Prices seem to keep lower this winter than for some seasons previously. There was a little misunderstanding between employers and employed in the Durham coal trade last week, in some instances, about prices; but it is not likely to extend very far.

The steam coal trade is unchanged. Scarcely any of the collieries in this trade are working up to full time, and some have scarcely worked more than three or four days in the last fortnight. The steam coal owners, however, state that they hope, when they get the "Bill Fair-Play" method of working into full operation, that a much better business will be done. At present the trade is in transition as regards the new method.

The coasting freight market is quiet. The shippers have the command of the market. The supply of tonnage exceeds the demand, and freights have a tendency to become weaker, though they are tolerably low at present. To the Mediterranean, however, there is an improved business outwards, and very high rates indeed are being paid to steamers to take out coals to Constantinople and Odessa for the fleets.

The iron and chemical trades of the Tyne and Wear are in a dull and lifeless state at present. The same may be said of most other kinds of manufacturing trade. The uncertainty which has surrounded the Eastern Question so long, as stated last week, has stopped all speculative trade, and only half the ordinary fleet of steamers which trade from the Tyne to the Continent with goods are upon the stations, and they load very badly.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

When I spoke of the Corporation Gas Supply at Hamilton in my last communication, I ought to have said that the cost of production, which was mentioned as 1s. 1½d. per 1000 cubic feet, meant the cost for coals only. At the same time, I may refer to the fact that the committee of gas managers, who undertook to make a complete investigation into Mr. Young's patent process for enriching gas from the gas tar, as practised at the Hamilton Gas-Works, have never reported upon the results of their inquiries. I presume they have been so much occupied with the pressing duties of their own respective establishments during the depth of winter, as to be able to find but little time for any additional work. The report will doubtless come by-and-by. In the meantime, it is rumoured that Dr. Wallace has received instructions from the Glasgow Corporation Gas Committee to institute some inquiries into the subject on their behalf.

At the last meeting of the Chemical Section of the Philosophical Society of Glasgow, Mr. J. J. Coleman, F.C.S., read a paper on "The Chemical Constitution of Illuminating Gases." He referred to the opinion of most chemists that the illuminating power of coal gas was chiefly owing to the group of compounds called olefines; and he also alluded to the recent paper of M. Berthelot, who ascribed a great portion of the illuminating power of Paris gas to the presence of benzene as one of its constituents. He remarked that the alcohol radicles sometimes formed an important ingredient, and that they would fail of being detected by bromine, which was generally used in coal gas analysis. By cold and pressure, however, they could be condensed, and afterwards estimated. An interesting discussion followed, the speakers being the president (Professor Ferguson, M.A.); Mr. R. R. Tatlock, F.R.S.E.; Mr. E. M. Dixon, B.Sc.; and Mr. E. C. C. Stanford, F.C.S. A hope was expressed that Mr. Coleman would continue his interesting investigations, and bring forward the results in a subsequent paper.

The usual monthly meeting of the Forfar Gas Commissioners was held on the evening of Monday, the 15th inst., when authority was given to a committee to consider, in view of a probable rise in price of the better quality of gas coal, whether purchases should be made at the present quotations.

An alarming fire occurred at the Aberdeen Gas-Works early on the morning of Sunday, the 14th inst. It originated in the purifying-house, in which there were twelve purifiers, of which eight were erected not long ago, and the other four were about to be replaced by new ones. By the combined exertions of the fire brigade and the men employed at the works, the fire was confined to the purifying-house. During the course of the day it was ascertained that two of the old purifiers were unfit for further use; but gas-making was resumed, and most of the other purifiers set in operation. Within three hours after the fire, workmen were actively employed, as speedily as they could be obtained, in effecting the necessary repairs, so as to keep up a sufficient supply of gas in the city. The strength of the walls, and their height above the adjoining roofs seemed to prevent the flames from spreading. The fact that the wind was blowing from the south was also very favourable, as the chemical works of the Messrs. Miller would have been in great danger if it had been in another direction. It is believed that the damage will amount to about £2000. The Town Council are their own insurers.

Mr. Stewart, manager of the Greenock Corporation Gas-Works, reported as follows to the monthly meeting of the Police Board, held last week:—"The quantity of gas made during the month of December was 24,288,600 cubic feet, as against 21,999,600 cubic feet same month last year, or 2,289,000 cubic feet more this month. Coals carbonized last month, 2,400 tons, as against 2140 tons in December, 1875, showing an excess of 260 tons used last month, due to extra quantity of gas made. We received during month 1995 tons of coal, as compared with 1367 tons received in December, 1875. Our stock of coals at the end of December this year was 3000 tons, and we had about the same quantity in stock at end of December, 1875. The gas paid during month at Inchgreen, in all departments, amounted to £585 2s. 7d., as against £621 4s. 8d. in same month last year; and in town the amount paid was £319 13s. 7d., as compared with £335 4s. 6d. in December, 1875, showing a total reduction in both places of £51 13s. for the month. Our sales of sulphates during month amounted to 10 tons, as against same quantity sold previous December; and we sold 20,500 gallons of tar, as compared with 15,000 gallons sold in December, 1875. We also sold last month 2271 gallons of naphtha, as against 3294 gallons in previous December, and our stock of naphtha and sulphates is about the same as at this time last year; but coke and boiled tar are considerably in excess." It was also reported that, during 1876, there had been manufactured 84,949,400 cubic feet of gas, or 6,150,000 feet more than in 1875. There were 650 tons more coal used; but the wages paid were about £157 less than in 1875. At the same meeting the Provost mentioned that it had been agreed to give to the Charitable Society 100 tons of coke free, for the benefit of the poor, and as much more as might be required at 2s. 6d. per ton.

The gas supplied to the city of Glasgow during the week ending the 13th of January had a maximum range from 26·14 candles to 28·63 candles. At Partick and Dalmarnock stations the gas was one day below 25 candles. The Editor of the *Dundee Advertiser* has now "gone in" decidedly for gas at 6s. per 1000 cubic feet. His leading article on the subject is one of very great interest.

The question of Dry versus Wet Meters, to which I referred last week, is still unsettled. At least five letters have appeared on the subject in *The Scotsman* since I despatched my last weekly report.

It has been resolved by the Town Council of Burntisland to proceed with the Dour water scheme with all due haste. At a meeting of that body, held last Wednesday night, a letter from the Dunfermline authorities was read, offering to give a supply of their Devon or Glensherrup water at the rate of 4d. per 1000 gallons, with a discount of 20 per cent. if the quantity should exceed 150,000 gallons per diem; but it was said that the Dour scheme would yield a regular supply of 350,000 gallons per day, at less than half of the Dunfermline offer. A contract has now been entered into for the construction of the necessary works, the total cost of which, including land, is estimated at about £20,000.

The inspector of the Aberdeen Water-Works has just drawn up his report for the quarter ending Dec. 31, 1876, showing that the consumption for 24 hours, as measured for the purpose, was 3,788,800 gallons from the low service reservoir, and 134,160 from the high service reservoir—or a total of 3,922,960 gallons. The smallest consumption from the low service reservoir was from eight to nine p.m., from twelve to one a.m., from two to three a.m., from four to five a.m., and from six to seven a.m., in each of which hours the consumption was 118,400 gallons; and the largest was from nine to ten a.m., and from eleven a.m. to twelve noon, when the consumption in each was 207,200 gallons. During the quarter, the river at the intake at Invercarnie was "very clear" on 35 days, "clear" on 19 days, and "brown" on 37 days. On the 14th of November and the 2nd of December the intake sluices were shut, and no water was taken from the river on account of its muddy state. Five important repairs were executed during the quarter, one of which—the repair of the drain under the aqueduct—necessitated the water being cut off for eleven hours. There were also twenty minor repairs, and on four different occasions the water was

cut off—for a space of about 37 hours in all—in order to allow of an inspection of the aqueduct. The water survey (private supply) discovered 89 water-cisterns, 56 water-closets, and 82 water-taps leaky, but these had since been repaired; 35 burst pipes were also discovered.

Taking the population of Greenock at 68,000, they have recently been getting a supply of 54 gallons of water per head per day. More than one-third of the total consumption is given by meter to the sugar refineries and other public works.

It would seem as if the Perth Water Commissioners had fully resolved on opposing the water bill now being promoted in Parliament by a committee of the citizens. The services of Mr. Hawksley and Mr. Leslie, Edinburgh, have been secured to report upon the plans, &c., prepared by Mr. Bateman, and Mr. Young, C.E., Perth, the engineers for the bill.

Ever having prevailed for a time in a portion of Galashiels, the subject was brought under the notice of the Board of Supervision by their medical officer, and the local authority have had an analysis made by Mr. J. Falconer King of some of the wells. Mr. King says: "As the result of my analyses of these waters, I have come to the conclusion that Nos. 1 and 2 are so impure as to be quite unfit for use, and that No. 3 is so much so as to lead me to say that it should at least be regarded with great suspicion." The first and second samples contained an excessive amount of dissolved saline matter, and the latter of these—certainly the worst of the three—had in it an excessive amount of albumenoid ammonia and chlorine, and was also impregnated with nitric acid.

The "difficulty" between the Forfar Police Commissioners and the Board of Supervision, on the question of the water supply of that town, still continues. Professor Tidy, of the London Hospital, has been engaged by the former to examine the water of the public wells.

Pig iron has come down in price somewhat considerably, business being done on Friday afternoon at 56s. 9d. one month open.

There is nothing of special importance to mention regarding the coal trade.

WIDNES GAS SUPPLY.—At the monthly meeting of the local board, on the 9th inst., it was reported that the make of gas during the year 1876 was 7,893,000 cubic feet, as against 6,915,000 cubic feet in 1875, being an increase of 14·1 per cent. The receipts for the year were £1589 17s. 9d.

HULL GAS SUPPLY.—Mr. James Baynes reports that the gas sent into the district of Sculcoates and Myton during December by the British Gas Company averaged a little over 16 candles illuminating power; sulphuretted hydrogen and free ammonia were at no time present to the ordinary tests. The results for the month are:—

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16·70	15·40	16·12
Grains of sulphur per 100 feet	31·50	28·00	29·80
Mean barometer and temperature in experiment-room:—Bar., 29·65; temp., 54°.			

LIVERPOOL WATER SUPPLY.—The *Liverpool Mercury* states that at a meeting of a sub-committee of the Water Committee on Tuesday last, it was decided to recommend that Messrs. Mather and Platt be authorized to proceed with the sinking of a new bore-hole at Bootle, together with the erection of pumping machinery, permanent buildings, &c. The estimated cost of these new works is £15,500.

NEW COMPANIES REGISTERED.—A company called the Tenby Gas Consumers Company has been established for the manufacture of gas and gas products at Tenby, South Wales. It was registered on the 2nd inst., with a capital of £10,000 in £100 shares. The Waste Water Meter Company has been formed to purchase and work the letters patent dated 14th March, 1873, No. 937, for improvements in apparatus for measuring the flow of water in pipes; No. 4264, dated 29th December, 1873, and also No. 50, dated 5th January, relating to similar inventions, belonging to Mr. George Frederick Deacon, of Liverpool. The company was registered on the 3rd inst., with a capital of £10,000 in £10 shares.

SALE OF GAS AND WATER SHARES.—At Brighton, on the 15th inst., there were disposed of, by auction, 625 A 7 per cent. shares of £20 each, in the Brighton and Hove Gas Company, in pursuance of the company's Act, 1866, and of the Brighton and Hove Gas Order, 1875, and of a resolution of the directors to raise a further share capital of £25,000 for the purpose of the undertaking. There was a very large attendance, and the lots were quickly disposed of. They were sold in lots of two shares each, and the average price was £52 10s. per lot. At Nottingham, on Friday last, there were disposed of, by auction, corporation gas annuities at £77 7s. 6d., £77 2s. 6d., £77 17s. 6d., and £76 15s.; and Nottingham Water-Works Company's shares, £50 paid, at £70 2s. 6d. £19 5s. water-works shares sold at £5 premium.

GAS AFFAIRS AT BISHOP AUCKLAND.—At a meeting of the Local Board of Bishop Auckland, on Tuesday last, it was resolved—"That in the judgment of this board it is expedient to oppose the passing of a bill for dissolving and re-incorporating the Bishop Auckland Gas Company, Limited, and granting powers for supplying with gas the parishes of St. Andrew Auckland and St. Helen Auckland and certain neighbouring places in the county of Durham, intended to be introduced in Parliament during the ensuing session; and that the costs and expenses attending such opposition be charged upon and paid out of the general district rates of the said district." The chairman opened the proceedings of the meeting by reading an account of the negotiations which had taken place between the board and the gas company with reference to the proposed purchase of the gas-works.

BRIGHTON CORPORATION WATER-WORKS.—At a meeting of the Brighton Town Council on Wednesday last, the General Purposes Committee reported that the time had arrived—five years having elapsed since the purchase of the water-works—when the corporation were required by Act of Parliament to make arrangements for the gradual repayment of the moneys borrowed on the water-works account. The total amount of the debt at the present time was £399,500, the greater portion of which bore interest at 4½ per cent., and was repayable on or before July 31, 1942. Accompanying the report was a tabulated statement showing the number and amount of the annual payments. Alderman Hallett, who moved the confirmation of the committee's proceedings, said the water-works would never cost the ratepayers a penny. The profits would meet the annual payments, besides yielding a revenue, which would reduce the other rates. Alderman H. Martin did not believe it would be always so, as he thought the time would shortly arrive when the mode of charging for the water would be changed from paying according to the assessment to paying for what was actually consumed, and then the revenue would be very materially lessened. The proceedings were confirmed.

WET AND DRY GAS-METERS.—In his "Trade Notes from Scotland," our correspondent last week referred to a correspondence which had recently appeared in *The Scotsman*, on the relative merits of wet and dry gas-meters, and he quoted from a letter signed "Jumper," who asked for "a steady light" to be thrown upon the annoyance of jumping lights. We extract from the same journal one among the numerous replies to the inquiry. The writer says: "Your correspondent, 'Jumper,' wishes to know why meters causing jumping lights must needs be used. He doubt-

less refers to the wet meter, which is wrongly credited with being the cause of the nuisance complained of. The complaint would never be heard of if the pipes used for conveying the gas to the burners were large enough and properly laid. When the pipes are improperly laid, even the dry meter is not in all cases a cure. I use five wet meters to measure the gas I consume, and the reason may recommend itself to 'Jumper.' It is, that the wet meter, as at present made, cannot, from the nature of its construction, be made to measure against the consumer more than 2 per cent., and, as an offset to this, it may register in his favour 3 per cent.—anything going wrong with float and valve, or if neglected by the gas company, its further action is not against the consumer. Far otherwise is it with the dry meter; for it is liable to limitless error in recording the gas consumed. I noticed your remarks upon this subject in November last, and I agreed with the writer in thinking the wholesale adoption of the dry meter in new houses a grievance, and that their use anywhere is but a makeshift to hide too small and badly-laid gas-pipes; and that were gas consumers but aware, and could appreciate the principle of their action, the nature of the material used in their construction, and their liability to error as a measurer after a longer or shorter period of working, an effectual stop to their use would be, I believe, an immediate result. That part of the meter—the measuring chamber—upon which their accuracy is dependent, is largely composed of leather, soft and flexible when new, from the oiling they are subjected to at the hands of the maker, but which gets stiff and hard as the leather of any smith's bellows from age, more especially and all the sooner when exposed to all states of impurity found in the gas made over the United Kingdom. The comparatively pure gas is as great an enemy to the leather as the more impure in drying up the oil, thereby contracting and lessening the capacity of the chambers, so that at every revolution or complete action of the meter the index will show a greater quantity of gas than has been consumed. No greater harm to the consumer can befall a dry meter than having it standing disused when the family are, say, at their summer quarters, or in new unoccupied houses. The valves, upon which also depends its accuracy as a measurer, get leaky from the oil hardening, and from the dirt deposited by the gas getting upon their faces. The case of the dry meter, thin tinned iron plate, is very perishable, and very much so with some qualities of gas; and when there is a rusted hole or two in the case, the meter may be flung aside as not worth repairing, and the material not worth a sixpence to any one. On the other hand, the bulk of the wet meters are made of the most durable metals—the measure itself of block tin, which, unlike the leather chamber of the dry meter, is not liable to contract and lessen the quantity of gas registered against the consumer. For these reasons I prefer the wet meter, and when troubled with jumping lights I require the landlord to make provision for drawing off the water lodged in the pipes. I do not mean to assert that all dry meters are inaccurate, but I have no security for their accuracy, as I, and all consumers, have in a stamped wet meter."

POLLUTION OF RIVERS.—The half-yearly meeting of the Association for Preserving the Rivers and Lochs of Scotland from Pollution was held in the Freemasons Hall, Edinburgh, on Friday, the 12th of January—the Duke of Buccleuch in the chair. The secretary (Mr. Macintosh) read the report, which stated that the council felt so strongly the defective nature of the provisions of the Act of Parliament passed last session for preventing the pollution of rivers and streams in Scotland, that they recommended that a deputation of the association should be appointed to wait upon the Lord Advocate for Scotland, in order to point out to his lordship the imperfections of the Act, in the hope that he would be induced to introduce, and carry through Parliament, a measure better suited for effecting the objects desired. The chairman, in moving the adoption of the report, said he regretted that he did not introduce a bill 20 or 25 years ago. There were many things which polluted the rivers which were preventable—for instance, the use of rivers as a deposit for rubbish, cinders, refuse, and putrid matter. Then there was the sewage, which, he believed, might, to a very great extent, be made innocuous. There was one thing not done yet. No inspectors had been appointed under the Act, which was very important. He did not know, however, that the appointing of inspectors alone would do very much, unless the inspectors had something more to do than to be sent down when asked for. His opinion was that the inspector should be bound of himself, when he saw matters wrong, to institute proceedings, because they knew perfectly well that what was everybody's business was nobody's business. He thought an inspector would be of little use unless he was not to be debarred, but enjoined, to visit at once all towns and villages, and especially drains and other places leading off sewage, to see whether or not they were really nuisances to the public, and that he should be called upon when necessary to take steps at once to apply to the person or persons who were, perhaps ignorantly, creating a nuisance, to abate that nuisance. Mr. David Milne Home, of Wedderburn, in seconding the motion, said they were all aware that, in counties, steps had been taken by a great many riparian proprietors with success, and one was also glad to see that the magistrates in burghs were taking similar steps with reference to rivers passing through their towns. They could not shut their eyes to the great attempts being made in the west of Scotland, not only by the magistrates of Glasgow, but by the other towns, in order to prevent the pollution of the river Clyde and its tributaries. In the Water of Leith, the chief source of pollution was the paper-works, of which there were eight or nine, throwing into it their refuse. There was one paper-work which cast little or no refuse into the stream, and knowing that on that river such remedy was adopted it would be more easy to enforce it in regard to the other works. The report was adopted, and Mr. David Smith, W.S., moved the next resolution, authorizing the council to form a deputation to wait upon the Lord Advocate, and perhaps also the Home Secretary, with the view of suggesting the propriety of amending in some respects the Act which was passed last session. Sir J. R. Gibson-Maitland seconded the resolution, which was unanimously agreed to. Major James Colquhoun said they should take care that at least equal powers were guaranteed to the public to proceed under the new Act as were ensured to them at common law. Sir Robert Christison said that the Rivers Pollution Commission had come to the determination that the local authority were not the proper authority to take charge of the rivers, but that there should be a special one to have charge of the whole river basin: and he hoped the council would keep this idea of the commission in view when they approached the Lord Advocate. Colonel Drummond Hay said he thought that authority to prevent river pollution could not be put into better hands than Fishery Boards of the districts. After some remarks from Major Colquhoun and the chairman, the office-bearers were elected, and finally a vote of thanks was given to the chairman.

GAS EXPLOSIONS.—The past week has brought us reports of several explosions of gas, some of them attended with very serious consequences. On Wednesday an explosion took place at Manor House, Sandown, the residence of Dr. Meeres. The family were at dinner, and it is supposed that from the main (in the street opposite the residence, where some new houses are in course of erection), which had been broken and repaired, gas had escaped, and finding its way into a sewer passing beneath a portion of the injured premises, had got into the dining-room, and exploded on coming into contact with the fire. The jambs of the fire-place were torn away, the outer walls surrounding the room were rent in various places, with

an occasional brick completely forced out, the skirting boards torn from the walls, the ceiling of the rooms split all round its connexion with the walls, the large window looking into High Street shattered to atoms, the pictures torn from the walls, and the furniture with the dining-table and all that was upon it, thrown into ruin. Miss Meeres unfortunately had her leg broken above the ankle by the fall of a table, her brother sustained a superficial injury on the forehead, and another person was much shaken and hurt.—On Thursday an explosion of gas involving the demolition of a workshop, and serious injury to one person, occurred at the works of Messrs. Hoskins and Sewell, iron bedstead manufacturers, Heath Mill Lane, Birmingham. The premises form a quadrangle, an open space or yard in the centre, and then extend back from Heath Mill Lane into Floodgate Street, a large range of workshops fronting the latter thoroughfare. To the right of the yard, and between this building and the foundry, was situated the painting shop—a large one-storey structure, about 40 feet long and 20 feet wide, lighted from the roof. Here the process of painting the bedsteads was carried on, and on one side of the room were three stoves constructed of brickwork, with iron doors, and resembling large cupboards. The articles, after passing through the painter's hands, were placed in the stoves to dry, and the necessary heat was generated through a row of gas-jets running under each compartment. After all the operatives had left the works a man named Lawrence entered the painting shop with a light, for the purpose of putting out the gas of one of the stoves, the other two not having been lighted. Almost simultaneously with the opening of the door of the stove an explosion, terrific in its force, occurred. Lawrence was hurled into the centre of the shop, the immense roof was lifted bodily up, and fell in with a crash; all the stoves were demolished, and a large quantity of paint becoming ignited, the woodwork was soon ablaze. Lawrence, although badly burnt, was not maimed, and he managed to crawl from among the debris, and to reach the road, when the neighbours and others, who were alarmed by the loud report of the explosion, went to his aid, and put out the flames from his clothing. He was shockingly burnt about the body, arms, face, and legs, and was removed to the Queen's Hospital. The cause of the explosion is believed to be the extinction of the gas underneath the stove—perhaps being blown out by a strong current of air—and the escaped gas thus accumulating in the compartment became ignited by the light which Lawrence carried. The damage is stated to be covered by insurance.—On Friday morning an explosion occurred at the Black Lion Hotel, Snighill, Sheffield, by which some damage was done and one of the inmates slightly injured. The explosion was caused by a woman striking a match in a small triangular room at the back of the bar, which had become filled with gas owing to the chandelier having slipped down to the bottom of the slide. As soon as she struck the match the explosion took place, and was sufficiently violent to knock her down and smash not only the door of the small room, but another door on the opposite side of the entrance passage.—An explosion took place on Thursday night at Albury Park, near Guildford, the seat of the Duke of Northumberland. It appears that workmen were engaged in laying on to the mansion a new kind of gas. All the pipes were laid, when, on the workmen testing their soundness, an explosion occurred. All the front windows of the mansion were blown out. The workmen were hurled with great force in various directions, one poor fellow being sent through a window into the park below. Some valuable paintings have been injured beyond redemption, as have some rare and costly statuary. A man named Stapleton, the head carpenter of the house, was seriously injured, and now lies in a precarious state. The Duke and Duchess of Northumberland were away from the house when the explosion occurred.—On Wednesday evening an explosion of gas took place at the headquarters of the 1st Surrey Rifle Volunteers in Flodden Road, Camberwell. It appears that Miss Kethro, daughter of the sergeant-major, entered the library for the purpose of lighting it up, when upon igniting a match a terrific explosion occurred, completely shattering the door and windows, portions of the framework being blown into the gardens opposite. The unfortunate girl, was seriously injured, her face and arms being considerably burnt. The explosion was severely felt in the armoury, where it cut the gas-pipes, and caused a hole in the roof to be greatly enlarged. It also broke the windows of the canteen, carrying the frame some 15 feet away. The explosion did some damage also in a bedroom close by. The escape of gas was traced to a chandelier in another room.—A loud explosion, followed by a crash of glass, occurred at 393, Strand, London, occupied by Mr. George Wilson, a dentist, causing the window-frames to be blown out.—On the 13th inst., a man named James M'Beth, a gas-fitter, 20, Green Street, Calton, and in the employment of the Glasgow Corporation, while putting in a meter in a new house in Well Street, on Saturday, applied a light to a pipe, in which a quantity of gas had evidently accumulated, for an explosion at once took place, and he was thrown from the ladder on which he was standing to the floor. He was severely burned about the face and hands.—On the same evening, great excitement was caused in Tralee by an explosion of gas in the County Kerry Club, Denny Street. There had been a leakage in an old concealed pipe, and Messrs. Gray, gas-fitters, and the secretary and manager of the club, with some of the members, were making an examination, when one of the gentlemen incautiously brought a lighted candle in contact with the pipe on the main landing. A terrific report followed. The staircase was blown to pieces, and all present were flung right and left. Providentially no one was seriously injured, except young Mr. Gray, who had his leg broken, but he is progressing favourably under the care of Dr. Falvey. The damage to the club is covered by insurance.—The coroner's inquiry into the circumstances attending the death of a servant girl at Arundel, caused by an explosion of gas at her master's house, has been held. The only evidence bearing on the main point—the escape of gas—was that of Mr. Hale, one of the collectors of the Arundel Gas Company. He stated that having inspected the house, he could find no leak in any part of the pipes; but there was a manifest escape from the gaselier in the dining-room (where the explosion occurred), owing to an insufficient supply of water to the receptacle. These reservoirs, he said, required to be frequently filled, especially when, as in this case, they appeared to be small ones. The jury returned a verdict of "Accidental death."

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

4230.—JACQUET, F. A., "Improvements in gas-heating apparatus." Dec. 24, 1873.

4294.—CLARK, A. M., "Improvements in the manufacture of gas and fuel." Dec. 31, 1873.

70.—CLARK, A. M., "Improved apparatus for regulating the pressure and friction of fluids." Jan. 6, 1874.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

3741.—WALKER, S., and HOLT, E., "Improvements in steam pumping-engines." Dec. 24, 1869.

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WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 30, 1877.

Circular to Gas Companies.

THE "silly season" is fast passing away, and hence it may be that the columns of *The Times* have ceased to be occupied by further correspondence on the "Commission" system. It was Thackeray, we rather think, who first gave the name of "silly" "season" to the interval between the prorogation and reassembling of Parliament, during which, as the columns of newspapers must be filled, letters on various subjects have to take the place of speeches in Parliament. The name is not particularly appropriate, for average newspaper correspondence is not more silly

than average parliamentary talk. To return, however. The "Commission" discussion has come to an end, and we are glad of it. Some Scottish friends of ours, for whom we have a great respect, threaten to reopen it in a more virulent form; but, perhaps, second thoughts will induce them to keep silence. We have endeavoured to extract a moral from the story told, so far as it concerns a class whom we may justly call our clients. Let managers and others concerned in the conduct of gas undertakings be adequately paid, and then the temptation to accept bribes will cease. We hope that both Companies and Corporations will take our advice to heart, and that we shall hear fewer complaints of the insufficient remuneration of their superior *employés*. If this advice be acted upon, the "Commission" system will be effectually squelched, with all its immoral tendencies. We may dismiss the unsavoury subject now, with the fervent hope that we shall never have to return to it.

The letter of Mr. Woodall, of Leeds, published in our last issue, came too late to be noticed simultaneously with the publication. The writer is unnecessarily sensitive. He stands too high in the estimation of his fellow-managers to suppose that any one will, for a moment, imagine that he is responsible for the state of things with which he has to contend. They were all inherited, and our complaint has only been, that the Corporation have not attempted with sufficient alacrity and enterprise to remedy faulty conditions of which they possessed an accurate knowledge. We may assume that they will presently, in conjunction with the erection of additional works, proceed with the alterations of the mains, which would seem to be even more imperatively required. And then will come the control over services and internal fittings, which we have always contended that Gas Companies and Gas-supplying Corporations should exercise. Mr. Woodall mentions some facts which we should hardly think can be paralleled in any town in the kingdom, and they go to show that gas suppliers should have legal powers to supervise, and even prescribe, the internal fittings. Nineteenth—we might say ninety-nine hundredths of the complaints brought against Gas Companies have their origin in causes beyond the control of the Company—such as small connexions and rusty burners.

In their desire to remedy the alleged grievances, the Gas Committee of the Corporation are, we think, about to make a great mistake. They propose to raise the illuminating power of the gas to eighteen candles. Now, it is clear that while the condition of things described by Mr. Woodall remains, the raising of the illuminating power two or three candles will only result in a waste of money. With a proper distributing plant, no increased power would be necessary, and it might possibly be reduced with advantage. As a matter of general experience, we think we may safely say, that from fourteen to fifteen candle gas gives the greatest satisfaction.

Some correspondence in a Leeds paper informs us that, in accordance with the provisions of the Leeds Gas Act, the gas is now only tested at the works. In the days of the Companies, the Corporation had a testing-station in the town, and we should have thought that this would have been continued. The Corporation and their Gas Manager have, however, a very difficult problem to solve, and we can only wish them "a happy issue out of all their afflictions."

Perhaps, for once, our "Circular" might be more appropriately addressed to Corporations than to Gas Companies, for the next topic we have to allude to is the gas affairs of the Corporation of Wigan. The most intense dissatisfaction is manifested in that borough, and we report, in another column, the proceedings at a meeting called to give emphatic expression to that dissatisfaction. It is the old, old story. Gas bills increase in amount, and the public mind can only find one explanation. A singular misconception as regards the use of the exhauster is obviously the source of the suspicion that Gas Companies have the power of forcing atmospheric air into their mains, which air, as the reverend chairman of the meeting put it, acts as much on the meter as the pure unvitiated gas. We confess to being greatly puzzled by these complaints from Wigan. The official testings represent the gas as being fully up to, and, generally, considerably above, the statutory requirements. It is with no particular pleasure that we note that some of the consumers regret the extinction of the Company, who would seem to have given perfect satisfaction. The Corporation have not been very successful in the management of the undertaking, and now affairs seem coming to a crisis. We shall wait, with some curiosity, to see what explanation of the alleged extraordinary increase in the gas bills is offered; and here, at once, we recommend the Corporation to exercise all the control they have power to do over the internal fittings of their customers, for, no doubt, defects in these lead to an exaggerated consumption, which the consumer never discovers until his gas bill is sent in. All the cases of

complaint, however, cannot be explained on the hypothesis of defective fittings; but we cannot believe that the collectors exercise their imagination in settling what the amount of a gas bill ought to be.

The undertaking of the Warrington Gas Company may now be said to be sold to the Corporation, for, somewhat to our surprise, after all that has transpired, the poll of the town resulted in a majority of 588 in support of the Town Council and the purchase. That the result is a *bonâ fide* expression of opinion on the part of the ratepayers may be confidently inferred from the large number who voted, and who must, upon an ordinary estimate, have been a vast majority of those who could possibly have votes. It is a great triumph for the Town Council, considering all the abuse that has been bestowed upon them, and all the opposition that has been raised; and since we consider the terms of purchase fair, if not liberal, we do not commiserate the Gas Company. No doubt the trenchant letters of Mr. Spice, contributed to the columns of the *Warrington Examiner*, greatly contributed to set the public mind right as to the present value of the undertaking and its promising future. We may part from the Gas Company with the sincere expression of a hope, that the Corporation may be as successful in their management. Unlike cases before referred to, the Corporation of Warrington will take over an undertaking perfect in all its parts, and they have simply to maintain the efficiency, and extend as may be required. We may be excused here for pointing out to the Corporation that the duty they will presently assume will be that of supplying gas to their constituents at the lowest possible cost, and that they have no moral right to tax the consumers of gas in order that rates may be reduced, or public improvements made, with gas profits.

At a meeting of the Town Council of Salford last Wednesday, the Chairman of the Gas Committee said he hoped shortly to be in a position to move a resolution lowering the price of gas. The extent of the contemplated reduction he did not announce, but it will probably be threepence per 1000 feet. This, as gas affairs stand in Salford, will be very satisfactory. We mentioned, some weeks ago, that the Gas Committee had reported to the Council that the expenditure of £160,000 was necessary for alterations in, and extensions of, the gas-works. The report, we are glad to see, was adopted by a large majority in the Council. The proposed works are urgently needed to place the undertaking in a proper position, present and future. Mr. G. Livesey's advice was secured by the Council, and that, with the experience of Mr. Hunter, the manager of the works, is a sufficient guarantee that not a single pound will be expended unnecessarily.

The Ilkeston Gas Company have made application to the Board of Trade for a Provisional Order; but the Local Board, being desirous of acquiring the undertaking, resolved to oppose the Company. Last week they went to what we must regard as the unnecessary expense of polling the parish on the question; the result being a large majority in favour of the opposition resolved upon by the Local Board. What grounds of opposition the Board can offer, it is out of our power to guess. If they like to make terms for the purchase of the undertaking, we dare say they may succeed; but they must establish much against the Company before they will persuade the Board of Trade to refuse the Order prayed for.

The Town Council of Louth seem disposed to compose their differences with the Gas Company, and offer to abstain from parliamentary opposition, if the Company will make some concessions. The Bill promoted is to re-incorporate the Company—a very old one—and to give power to capitalize some expended profits, and also a small sum of money advanced by shareholders. It, of course, incorporates the General Act of 1847; but the Town Council desire that a clause shall be transferred from an old Act of theirs, which enacted that after paying a ten per cent., or, as we must now say, a maximum dividend, the surplus profit of the Company should be applied to the reduction of the price paid for public lights, or, in other words, to the reduction of rates. This Act, we may assume, was passed before the general measure of 1847, and, we may take it, confers no power to form a reserve or other fund. The Company will probably contend for power to form a reserve, and we do not see how their right to it can be contested. When that fund is formed, the question of the application of surplus profits can be easily settled, and we do not know that a better plan could be arranged than to apply them in the way the Council wish. Some other small concessions are asked for, which the Company can have no reason for refusing.

A motion of a very amusing character was brought forward at a meeting of the Town Council of Dublin last Tuesday. It will be remembered, that in the session of 1873 the Corporation of Dublin promoted a Bill to effect the purchase of the undertaking of the Alliance Gas Company. To support their case,

they engaged a number of engineers and other scientific witnesses, some of whom visited Dublin, and all of whom gave evidence. The Bill of the Corporation, as we all know, was rejected, and one consequence has been that the gentlemen engaged by the Corporation have never been paid their legitimate charges. If our memory serves us, two have brought actions and gained verdicts; but whether or not they have been paid their charges and law expenses is not known to us. It looks as though some others were now pressing for payment; at all events, at the meeting mentioned above, Mr. Byrne proposed a modest motion, to the effect that, since the Corporation had no power to pay their own debts, the Gas Company should be asked to pay them, on the ground that the latter alone profited by the evidence given. We may be excused for doubting whether the evidence given in favour of the Corporation was of the smallest value to the Company, and we could not recommend the latter to entertain for a moment Mr. Byrne's proposition, if it should ever come before them. The Alliance Company have recently "made a present"—to use the phrase of the chairman of a Metropolitan Gas Company—to the citizens of Dublin of £8000 a year. Surely the rich citizens who profit by this might help the members of the Town Council in discharging what is called a "debt of honour," but which may be found to be something more serious, if the creditors push their claims. If our memory serves us, a Mr. Byrne was brought over from Dublin as junior counsel for the Corporation. Has he ever been paid his fees and expenses?

We receive, at the last moment, the report of the Directors of the Chartered Gas Company for the past half year, which we reprint in another column. It will be seen that, notwithstanding heavy payments for commutations of annuities, which have been made out of current profits, the finances of the Company are in a highly satisfactory state. It seems clear that the Directors will have no occasion to regret the reduction of threepence per 1000 cubic feet of gas from the commencement of the present year. We shall have occasion to refer again to the matter when we publish the accounts.

Water and Sanitary Notes.

WATER affairs at Richmond (Surrey) naturally attract a good deal of attention, even beyond the limits of the district. The case is, indeed, peculiar, and, according to our recollection, unprecedented. We do not remember to have heard of a case in which the whole supply of a considerable town was cut off. Of course, as we said last week, we do not blame the Southwark and Vauxhall Company for acting as they have done; but, nevertheless, we think the step they took unwise. For our own part, we should have been disposed to try competition. It is true that, on inquiry, which we made in Richmond last week, we got more than hints that a species of terrorism had been exercised over the tradespeople, to persuade them to support the Vestry. We did not hear a single complaint of the quality of the Company's water. The grievance alleged was, that the rates had been suddenly doubled, for no reason that the consumer could appreciate. Now, if the Company had reverted to their original rates, we cannot help thinking that they could have held their own against the Vestry. The inhabitants of Richmond hardly know, perhaps, to what they have committed themselves. Our first inquiry, "How are you off for water?" was addressed to a woman at the door of a small house. The reply was, "We have no water!" To a further question, "How do you get what you want?" the answer was, "We beg it from Mr. — and Mr. —, who have pumps." Now, it is not unimportant to know that the Public Health Act may give the Vestry power to shut up these wells as soon as their water undertaking is fully installed. They will only require the certificate of a *doctinaire* Officer of Health and chemist that the water is unfit for domestic use, and forthwith a chain must be put on the pump-handle, or the well be filled up. The inhabitants will be compelled to take water of the Vestry, in the absence of a competing supply. Proceedings of this kind are going on all over the country; wherever the water supply is in the hands of a local authority, there is a war against private wells. No proof is ever offered that the water ever did any harm; but a chemist certifies that it is unfit for use, and forthwith a well is ordered to be closed. Provincial newspapers have, during the past week, afforded us several examples of these proceedings.

In our walk about Richmond it seemed to us that the work of connecting the houses with the mains of the Vestry was proceeding very slowly. The matter is peculiarly urgent, and we thought we noticed that the British workman was displaying his usual characteristics, and was particularly lazy. The men used their pickaxes in a way that suggested they were afraid of

inflicting pain on the roadway, and when they had made a trench they sat composedly in it, apparently expecting that the coils of leaden services would connect themselves. Plumbers appeared conspicuous by their absence; and the general impression we obtained by our walk through the town was, that a supply from stand-pipes and private wells would be required in Richmond for a considerable time to come.

More important than all, however, is the question whether, when they have connected all the services, the Vestry will be able to maintain an efficient supply without going to further large expenses. We have, more than once, expressed a strong belief that they will not; and it is evident, from the terms of the resolution passed at the meeting, reported in another column, that many in the town entertain a like opinion. It is a most serious matter for the ratepayers of Richmond, for in one way or another they must be taxed for their water.

Yesterday, a metropolitan deputation was to wait on the Home Secretary, to request him to take into consideration the Water Supply of the Metropolis. The hour at which we are compelled to go to press prevents us from giving any report of the proceedings, so we quote from an anticipatory notice in the columns of a contemporary. The deputation were to complain, first, of the quality of the water, which it is correctly said is condemned by the Rivers Pollution Commission—or, as we should say, by Dr. Frankland, for the "Commission" was a farce—and also by the Royal Commission of 1866, which, we think, is not quite a true statement. Further, the deputation were to complain of excessive water-rates, and we shall not deny that on this score some grievances do exist. But it must be accepted as a fact, that the domestic water supply in the Metropolis is exceptionally cheap. We have the best reasons to know of a house rated at £36 per annum, and the water-rate is £1 16s.—that is, five per cent. per annum on rateable value. What would it be if the water undertakings were in the hands of the Metropolitan Board, as recommended by the deputation to Mr. Cross? We venture to think that the Board could not possibly supply water at a lower rate. A differential rate for warehouses, under close inspection, seems to us to be desirable, and the adoption of this would go a long way to quiet agitation. We shall refer again to this matter, when we see what the deputation said and Mr. Cross promised.

The resolution of the Liverpool Town Council to attempt the extension of their well system has brought upon them a deputation from manufacturers who object to a supply of hard water. Nevertheless, all the preliminaries seem to be arranged for the sinking of a new well at Bootle. In the course of one, two, or it may be three years hence, we may learn the true results of the experiment. In the meantime, the demands of Liverpool and the neighbourhood will about equal the possibilities of supply; and, if the experiment should fail, a serious embarrassment will arise. It would be several years before any one of the gravitation schemes proposed could be made available; and thus a water famine in Liverpool is within the range of possibility. We have always expressed an opinion that the extension of the well system would prove a failure; we are confirmed in this belief by the statement of the manufacturers who have sunk wells in Liverpool and obtained brackish water. The new red sandstone is a very permeable stratum, and, no doubt, excessive pumping from it in the neighbourhood of Liverpool would soon attract water from the Mersey.

Of many things which lie before us for notice, we have now only space to mention one. The sewage farm of the Local Board of Crewe has before been alluded to in these columns. It has been a disastrous failure throughout. Last year a rate of 1s. 2d. in the pound was required to make up the loss on the current expenses. The entire loss to the ratepayers since the farm was instituted is truly said to be "something enormous." The Board have now decided to lease the farm, which may, or may not, bring down the rates. We should very much like to know who selected the site of, and laid out, this farm.

PRICE OF WATER AT HUDDERSFIELD.—At the last meeting of the Town Council of Huddersfield it was resolved that—"From and after the 1st of March next the charge for water taken for trade purposes by meter be reduced to 6d. per 1000 gallons within the borough."

PRICE OF GAS AT WINCHESTER.—The *Hampshire Independent* says: "The 'ministry' at our gas-works have taken a reductive measure in an announcement that on and after April 1st they will reduce the present price 8d. per 1000 cubic feet, making it then 4s. 6d. We hope this will be seductive enough to warrant the corporation in reverting to the use of gas again for the public lamps."

WIDNES GAS SUPPLY.—We are informed, on competent authority, that the figures quoted in the last JOURNAL (page 133) as to the make of gas in 1876 were wrong. By an error in copying, the returns for the month of December were inserted for the returns of the whole year. The corrected statement is as follows:—Make of gas for the year 1876, 62,622,000 cubic feet, as against 55,619,000 cubic feet in 1875, being an increase of 12·5 per cent.

THE GASLIGHT AND COKE COMPANY.

Report of the Directors to be submitted to the Proprietors at the Half-Yearly Ordinary General Meeting to be held on Feb. 9, 1877.

The accounts herewith submitted of the working of the company during the half year ending on the 31st of December last exhibit an improvement in almost all their details. The principal items in which the reverse is perceptible are those having reference to general wear and tear, and to the sale of coke. The increase in the amount expended on the first is chiefly due to the fact that the works at Beckton, which have been in operation since 1869, are now beginning to require the ordinary repair and renewal; the decrease in the last is attributable to the unexampled mildness of the winter months covered by the period to which this report has reference. The latter cause, coupled with general dullness of trade in London, has also operated to prevent the increase in the company's rental for gaslight proceeding at the normal rate; but the sustained improvement in manufacture, which was noticed in the last report, and a further reduction of the unaccounted-for gas, have materially tended to alleviate its effect.

After providing for payment of interest on the debenture and other preference capitals, the directors are enabled to declare dividends at their respective parliamentary maximum rates on the unguaranteed stocks, and a dividend at "the standard rate" of 10 per cent. on the ordinary stock of the company, and to carry forward an undivided balance of £43,426. The restrictions of The Gaslight and Coke Company Act, 1876, have prevented the directors from placing any portion of this surplus to the credit of the reserve-fund, the Act requiring such a step to be taken only in connexion with a reduction in the price of gas. To this important object, however, the directors have been assisted by the condition of the coal market; and they have the pleasure to state that, from the favourable nature of their existing coal contracts, they felt justified, in the month of October last, in announcing that, from the first day of this year, their charge for gas would be reduced to 3s. 6d. per 1000 cubic feet.

It will probably be found that this reduction in price will induce a larger consumption of gas throughout the company's districts; and to provide for such a contingency, as well as for the ordinary increase of trade, the directors are actively employed in adding to the producing and storing plant at their principal stations. They are also now engaged in the digest of a scheme for the improvement of their distributing power by the connexion of all stations by means of trunk mains of the largest size, and they are of opinion that a liberal, though cautious, expenditure on such objects will be found to be conducive alike to an efficient supply to consumers and to the interests of proprietors.

As intimated in their last report, the directors have permitted the commutation of pensions by all the retiring officers of the various amalgamated companies who chose to avail themselves of that privilege, the scale of commutation being that laid down by Parliament, and a very serious annual burden on the funds of the company will thus be removed.

The directors have also completed the other arrangement which they foreshadowed in their last report, and have established the fund therein alluded to for the guarantee of the fidelity of their own officers, which they believed will be beneficial to all parties concerned.

During the half year, but one subject for uneasiness has presented itself. The high standard of purity in the company's gas, required by the Gas Referees, acting in pursuance of the City of London Gas Act, 1868, and of the Company's Act of last session, has necessitated a return to the employment of lime as a purifying agent. The mode of purification thus adopted has enabled the directors to comply with uniform success with the requirements of those officials, but it has also unfortunately entailed upon them a difficulty which past experience had led the directors to apprehend. In spite of every precaution taken by their officers, or suggested by the Gas Referees themselves, in dealing with the removal of the foul lime from the purifiers, the company have been threatened with legal proceedings by vestries and other public bodies, and individuals, in various parts of the districts contiguous to their manufacturing stations, to compel the abatement of the annoyance resulting from its use, for which the directors are in no sense responsible. To free themselves, therefore, from the dilemma in which they are thus placed, the directors have, after much consideration, determined upon the presentation of a Bill to Parliament in the ensuing session, for affording them relief, and they are not without strong reasons for hoping that their application will meet with public support. Should the Bill pass into an Act, and the company be permitted to revert to the means of purification recently employed, all cause of public complaint will be removed.

All descriptions of the company's debenture, preference, unguaranteed, and ordinary stocks and shares, are now quoted in the official list of the Stock Exchange.

RICHARD HOWE BROWNE, Governor.

Horseferry Road, Westminster, S.W., Jan. 26, 1877.

MARGATE WATER-WORKS COMPANY.—The annual meeting was held on the 22nd inst.—Mr. W. W. Pickering in the chair. The report of the directors stated that the company's affairs were in a very prosperous condition, and a dividend of 5 per cent. for the half year was recommended and adopted by the shareholders. The outgoing directors and auditor were re-elected, and reference was made to the loss sustained in the death of Mr. W. Barker, who had been connected with the company since their commencement. The question of the water supply for the Cliftonville district was introduced, and it was stated by the directors that a fine supply of water had been found at the new pumping-station in the Dane, it being confidently anticipated that the new spring would be amply sufficient to meet the requirements when the pumping apparatus was in working order.

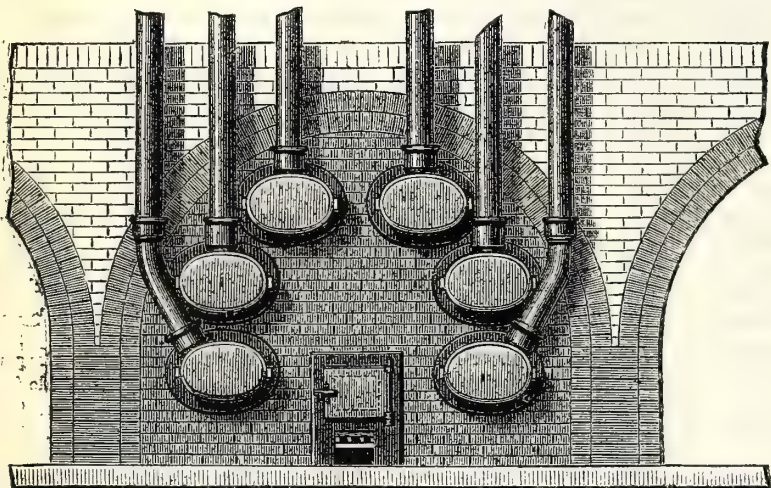
Correspondence.

OECHELHÄUSER'S SYSTEM OF RETORT-SETTINGS.

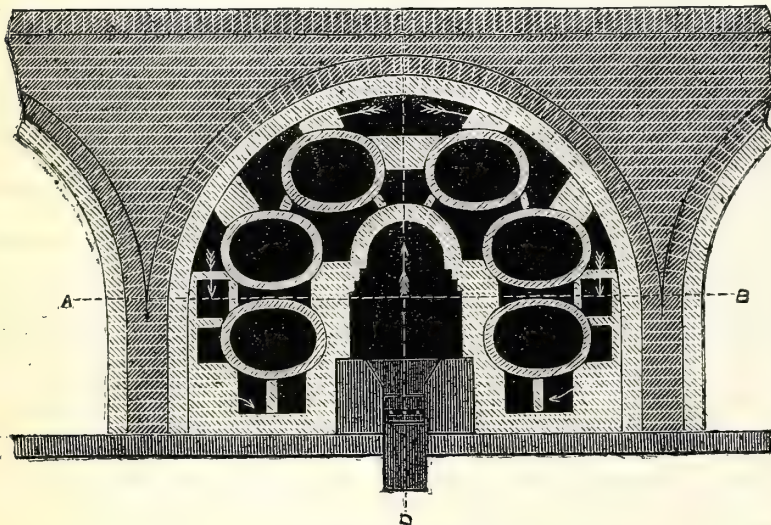
SIR,—Your esteemed JOURNAL has brought to us this year some very interesting articles about retort-settings and their construction. I beg you to allow me to send you a sketch of retort-setting which is nearly exclusively used on the Continent, and the construction of which is the invention of one of the most important men in gas-making—namely, Mr. W. Oechelhäuser, Privy Councillor, and chief director of the German Continental Gas Company at Dessau.

This retort-oven, as shown by the diagram, is a setting of six, and was first introduced between 12 and 15 years ago into the gas-works of the company before mentioned.

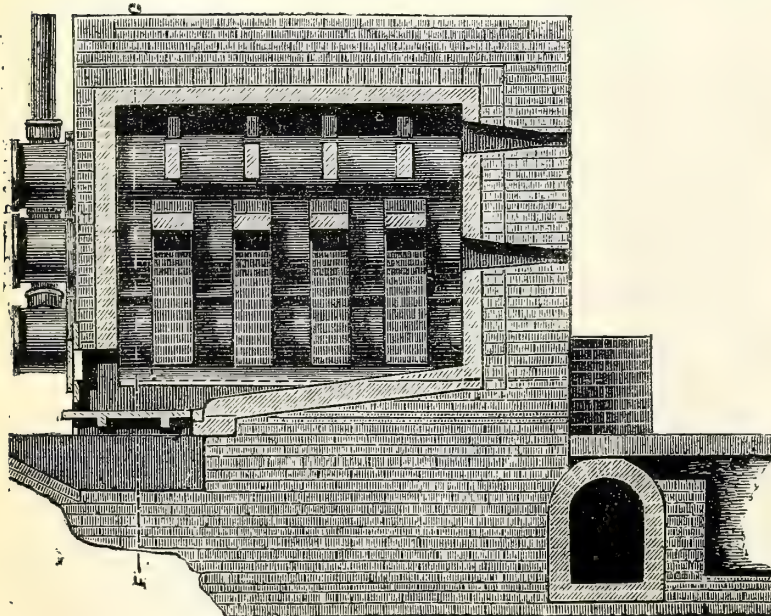
It is a well-known fact that in the larger works in France, as well as in Germany, the temperature in the retorts is higher than in England, by which naturally results a larger supply of gas per retort per day. No doubt the German Continental Gas Company had reached, in this respect, the maximum, as may be shown by their annual reports read at the general meetings of the company, and published in different journals.



FRONT ELEVATION.



SECTION THROUGH F, G.



SECTION THROUGH E, D.

In the setting of six retorts according to the enclosed design, the retorts are $8\frac{1}{2}$ feet long and $14\frac{1}{2}$ by $20\frac{1}{2}$ inches in diameter, and produce from 50,000 to 60,000 cubic feet of gas in 24 hours.

In order to demonstrate more clearly to my brother managers the superiority and excellence of these retort-settings, please allow me to give some figures of management, the true criterion of a good retort-oven. They are charged, in regular working, every four hours, with a quantity of from 1800 lbs. to 1900 lbs. of coals, which is adequate to a daily quantity of 108 cwt. to 114 cwt. of coals for the production of gas.

To obtain such results, the temperature must be raised to nearly a white heat. The quantity of fuel necessary for the extraction of gas from the above-mentioned quantity of coal daily is between 16 cwt. and 17 cwt.; or, to give here, too, some average numbers obtained by us—for every 100 lbs. of coal for gas-making, 18 lbs. to 20 lbs. of fuel are required for firing.

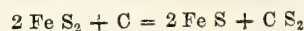
The durability of these retort-ovens, although worked at such a white heat, is no less than with others at a lower temperature, supposing the materials, retorts, bricks, &c., are of the best kind. According to the annual general report of the German Continental Gas Company, 1875, one new retort only was used for every $4\frac{1}{2}$ million cubic feet of gas produced; or, what is the same, every retort produced $4\frac{1}{2}$ million cubic feet of gas before it was changed for a new one. According to the same annual report of the company, every retort had produced daily—that is, in 24 hours—8314 cubic feet of gas in their gas-works at Warsaw. It must be remarked here that no cannel is employed.

The opinion until now generally accepted by several engineers, that at such a high temperature the gas became bad, or lost its illuminating power, is not confirmed by practice; but it is only necessary that the latter time of distillation—that is, the time in which the light oxide gases are principally produced—must be abridged, and the following charge must be begun.

Besides many other improvements and proficiency in gas-making on the Continent, we owe to this celebrated investigator, Mr. Oechelhäuser, the most perfect consumption of tar in retort-ovens, instead of our usual coal firing. The burning of the tar is so complete that not the smallest particle of smoke escapes from the chimney. Generally it may be taken for granted that every 100 lbs. of tar used as firing material is equal to 170 lbs. of coal. Whether the one or the other of the above methods of firing is to be used, must be shown by a simple calculation upon the prices and the sale, as well of coals as of tar.

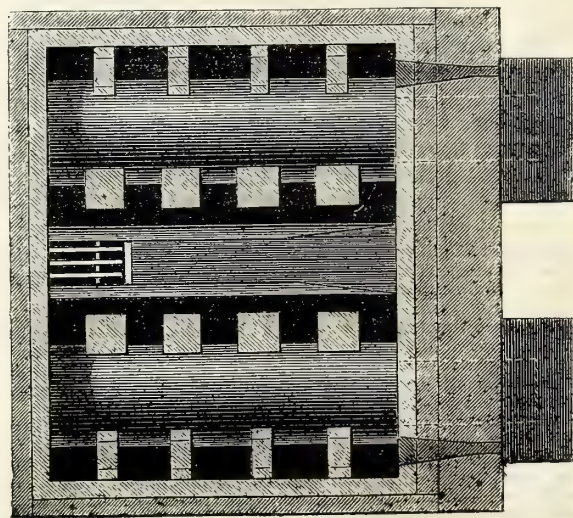
In the same manner, Mr. Oechelhäuser has been the first who practically introduced into Germany the generator-furnaces from France, which he improved in a very practical manner, so that all gas-works of his company, according to this system, will be fitted up with them in the following year.

By-and-by I will take the liberty of sending you a sketch of this system also, and will only add here that the above fire-beds, as shown by the following sketch, instead of six retorts, will contain eight of them. They will require, for firing, about 30 per cent. of coal less than those of the earlier and usual method, and labour itself will be considerably reduced, because the generator is to be replenished with coal only every five or six hours. Further, it has been said hitherto, and, strange to say, very often, by renowned chemists, that a high temperature in retorts causes, or favours, the formation of the so noxious compositions of sulphur, more especially sulphuret of carbon. Other chemists, especially Dr. Odling, thought that the production of sulphuret of carbon takes place during the latter part of the distillation of coal, because then the pyrites enclosed in coals melts, and through the already formed cokes becomes decomposed, according to the formula—



(See paper read by Dr. Odling before the British Association of Gas Managers, June 10, 1872.)

This last opinion seems to be right according to experiments made on the Continent; as I have said, that the latter time of carbonizing with us is abridged, and the temperature is kept very high, so that the distillation is finished in the shortest time.



SECTION THROUGH A, B.

It is a fact that both in Germany and in France gas is generally purified almost exclusively by oxide of iron, even when English coals are carbonized, and notwithstanding there is less, and very often much less, sulphur in gas, than in England, where they commonly work at lower temperature, and the purification is brought about more by hydrate of lime. This circumstance can be explained only as I have said already, by the temperature of the retorts in the former countries being very high. The time of distillation is thereby shortened, and the formation of the composition of sulphur, and chiefly sulphuret of carbon, is prevented.

One of the most celebrated gas engineers of the gas-works in Paris wrote to me, not long ago, about this matter, and on the sulphur which is contained in Paris gas—where gas is purified in the very same manner—by oxide of iron, and that to inquire after sulphur there would be "*chercher la petite bête*," because in several investigations it was found to be 33 milligrammes per cubic mètre = 0.03 gramme, which is not worth speaking of. No more sulphur was found in gas at Breslau; per cubic mètre = 40 milligrammes = 0.04 gramme (*Journal für Gasbeleuchtung*, No. 1, 1876). At Berlin, where the investigations for sulphur regularly take place by Dr. Tilfrunk, they never found more than 0.23 gramme per cubic mètre; that is, less by half than the Gas Referees in London permit.

I should be very glad if some of my brother managers would try the retort-setting before mentioned, according to the system of Oechelhäuser, and prove for themselves the practicability of the same; further, I leave it to chemists to examine and to sanction by science what practice has shown to us to be good and profitable.

CONRAD VOSS, Engineer.

Krakau in Galicia, Dec. 31, 1876.

THE EXPLOSION OF A GAS-METER.

SIR,—As the explosion referred to in the JOURNAL of the 2nd inst. has excited considerable interest among a number your readers, may I be allowed to inquire if "S. E." can reply to the following queries?

1. Can any one attest that the gas from the jet referred to continued to burn steadily, or grew fainter and fainter until the explosion occurred?
2. Is it possible that, from repair of mains or service-pipes, or any other cause, the gas may have been turned off from the street that day, previous to the lighting of said jet?
3. What distance may the shop be from the gas-works?
4. Is it possible that oxygen gas may have been made or used in the neighbourhood of the shop on that day?

R. F.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1877.

During last week the Examiners continued their sittings, and found the Standing Orders had been complied with in respect of the following unopposed petitions for bills:—Carshalton Gas; Limerick Gas; Waterford Gas; Southend Gas; North Cheshire Water; Dundee Gas; Warrington Corporation Gas; Blackburn Borough Gas, Water, and Extension; Ashton-under-Lyne Gas; United General Gas Company (Limerick); Newcastle and Gateshead Water; Dukinfield and Denton Local Board of Health; Alliance and Dublin Consumers Gas (Bray Supply); Newcastle-under-Lyme Borough Extension and Improvement; Wakefield Improvement; Falmouth Water; Hanley Corporation Gas; Longton Corporation; Leeds Improvement; Sunningdale District Water; Crystal Palace District Gas; London Corporation (Various Powers); North Dock Ward (Dublin) Gas; Kent Water; Tudhoe and Sunderland Bridge Gas; The Gaslight and Coke Company; West Surrey Water.

The only opposed petition before the Examiners last week was that for the East Worcestershire Water Bill; but the Standing Orders were declared to have been complied with.

A memorial complaining of non-compliance with the Standing Orders in respect of the petition for the Dublin Improvement Acts Amendment Bill was presented from John M'Evoy.

GAS EXPLOSION AT STAINES.—Last Wednesday afternoon a man named Charles Timlick, aged 34, was killed on the spot by an explosion of gas at the West London District Schools, between Ashford and Staines. He was employed at the gas-works on the premises, and was at the time engaged alone in doing something to one of the purifiers, when a loud explosion was heard, and the man was discovered dead, with the top of the purifier on one of his legs. It is supposed the accident was caused by deceased striking a light and omitting to shut back the gas by closing the valve. The deceased was a married man, with a family.

SUFFOCATION BY GAS.—A fatal accident occurred on Wednesday last at Ashenhurst Works, Blackley, belonging to Messrs. Cowlishaw, Nicol, and Co., manufacturers of embroidery, furniture trimmings, &c. The firm make the gas used on their own premises, and employed a man named James Smethurst as gas-maker. Shortly after ten o'clock on Wednesday morning, Smethurst was seen in the gas-house cleaning one of the three cylinders, and putting fresh lime for purifying purposes into it. Two hours later a man named Jackson visited the house, and found Smethurst lying dead upon the floor, having evidently been suffocated by gas. It was his duty to shut it off so as to prevent it escaping through the cylinder while the latter was being cleaned; but when Jackson entered the house the gas was issuing from the cylinder. There was a slight bruise under the deceased's left eye; and it is believed that this was produced by the unfortunate man falling when he first became unconscious. —*Manchester Examiner*.

CONNAN'S QUAY GAS AND WATER COMPANY, LIMITED.—This company have just been formed. The capital is to be £15,000, in 1500 shares of £10 each. In their prospectus the directors state that the water supply of Connan's Quay at present is obtained from wells, pumps, &c., and only in small quantities. The Local Government Board have called upon the inhabitants to obtain a proper supply. The statutory powers of the company render available to the locality the plentiful supply from the Broad Oak Brook, the quality of which is proved to be suitable both for domestic and manufacturing purposes, and the quantity is unlimited. Arrangements have been made to collect it in reservoirs, and the whole of the water will be distributed by gravitation throughout the district. The company have purchased land for the purpose of erecting gas-works, and contracts have been entered into for the construction of the same; also for the necessary ironwork for water-works, and it has been decided to commence operations forthwith.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

FRIDAY, JAN. 26.

(Before Vice-Chancellor Sir James Bacon.)

THE ATTORNEY-GENERAL v. TOMLINE.

The ATTORNEY-GENERAL (Sir John Holker), Mr. HEMMING, Q.C., and Mr. RIGBY appeared for the War Department; Mr. KAY, Q.C., and Mr. PHEAR for Colonel Tomline.

This was a suit by the War Department against Colonel Tomline to assert the right of the Crown to a small piece of land, situated in the middle of a field belonging to Colonel Tomline, about a mile and a half from Fort Languard, and from which the water supply of the Fort has been derived since the time of Charles I. The plot in question is a rood in extent; is known as Garrison Spring, is unenclosed and uncultivated, and is a dell or hollow with a boggy bottom. The Fort till recently has been supplied by a 1½-inch pipe from a spring-head at the north of the plot. The War Department have made a fresh spring-head in a more southern part of the plot connected with the old spring by a pipe; they have also laid down a pipe which drew water from a source to the eastward, which is situated on land admitted to belong to Colonel Tomline, and from their new water-head have laid down a 4-inch pipe to the Fort instead of the old 1½-inch pipe. Colonel Tomline has cut both the eastward pipe and the 4-inch pipe that leaves the new water-head. By this information and bill the Secretary of State for War asked that Colonel Tomline might be restrained from interfering. Each party claimed the ownership of Garrison Spring under a possessory title. Colonel Tomline admitted the right of the Crown to an easement, but denied that there was any right to increase that easement, either by drawing the water from fresh sources or by using a larger duct.

His LORDSHIP, in delivering judgment, held on the evidence that the Crown was entitled to the fee simple in Garrison Spring; that it, therefore, had a right to make its new water-head; it had also, as an easement over land belonging to Colonel Tomline, a right to take the water to the Fort, and by increasing the size of the pipe it had not increased the servitude; but it had no right to tap the new water supply on Colonel Tomline's land. The Crown had, therefore, asked for more relief than it was entitled to. An injunction would be granted except as to the pipe to the east, but as too much had been claimed no costs would be given.

QUEEN'S BENCH DIVISION.

(Before Justice LINDEY and a Special Jury.)

CORRIE v. MAYO.

This was a new trial, ordered by the Court of Appeal in December last (see report in JOURNAL, vol. xxviii., p. 915), and it occupied the whole of the week before last. The subpoenaed report is taken from *The Times* of Saturday, Jan. 20. It was an action by the plaintiff, who had been tenant of a house belonging to the defendant at West Clandon, near Guildford, for breach of a covenant in the lease, to supply him with a sufficient quantity of water. On the first trial the jury found a verdict for the defendant, but the case was carried to the Court above, and ultimately to the Court of Appeal, whence it was remitted for a new trial, on the ground that the verdict was against the weight of evidence.

The SOLICITOR-GENERAL, Mr. C. BOWEN, and Mr. KILDAR ROBINSON appeared for the plaintiff; Mr. DAY, Q.C., and Mr. PITT LEWIS for the defendant.

It appeared that the plaintiff, in November, 1873, agreed to take the house from the defendant, on lease, and moved into the house about that time. The lease itself was not executed until the 20th of December, and the covenant, for the breach of which this action is brought, was contained in that lease. The plaintiff having already suffered from the insufficiency in amount of water supplied, means were at once taken on the part of the defendant to obviate that inconvenience. There were at that time two wells on the premises—one, a deep well, from which the water supply was drawn; and the other a shallow well, which, at the time of the plaintiff's entry, was not connected for the purpose of supplying the house. In order to increase the supply from the deep well, on the 28th of December boring was commenced, which was to be carried into the chalk to a considerable depth, and which it was expected would increase the quantity of water that could be drawn from that well. While these operations were being carried on, the shallow well was connected with the house supply, and the plaintiff borrowed from his neighbours in order to make up any deficiency in the amount necessary for household purposes. This boring was completed on Feb. 28, 1874. The boring was carried through various clay strata, and after reaching the chalk at 60 feet below the bottom of the well, was carried on for 15 feet into the chalk. Before and during this time, and subsequently, some of the plaintiff's family and establishment, which amounted to some 20 persons in all, suffered in several cases from sore throats of a very similar type and a very persistent character. His wife, three of his daughters, and two female servants, were affected in this way, while another daughter and two other servants seem to have been in ill-health in other ways. Mr. Corrie and the male servants did not appear to have been affected with those symptoms, from whatever cause they arose; but in April, 1874, the plaintiff's medical man, Dr. Steadman, being unable to account for the persistency of the sore throats in those whom they attacked, suggested the possibility of their being caused by bad water, and took certain samples of the drinking water then in use by the plaintiff's family, which he forwarded to Mr. Ogston, the analyst. Mr. Ogston reported that the water was of a doubtful character, but might improve. This account of the water was communicated to the defendant, but nothing further passed on that subject. There was some correspondence at and after this date, which relates to some of the items claimed as damages, but do not touch on the real issue in this cause—namely, whether the water supplied by the deep well was pure and fit for domestic purposes. Nothing further appears to have passed on that subject until April, 1875, when a complaint as to the character of the water was made, and samples again taken, some of which were forwarded to Mr. Ogston, and others to the defendant, which he immediately despatched to Dr. Corfield to be analyzed. Both analysts again reported unfavourably of the water, although Mr. Ogston found it somewhat better than the sample sent him in the preceding year. It should be remarked as to these analyses, whereas the evidence was that the butler had drawn some samples in the month of April, and Mr. Ogston's report bears that date, it appeared that Dr. Corfield did not receive and analyze these until the 23rd of June; and it was contended by the defendant that such an interval of time between the time of taking the samples and subjecting them to analysis would render untrustworthy the results of that analysis. On learning the state of the water the defendant, however, suggested as a mode of rendering certain the supply of pure water direct from the chalk, that the well should be relined to render any filtration of surface sewage, &c., impossible, if such a possibility then existed. The plaintiff at this time had put the matter into the hands of his solicitors, and about a week elapsed before the defendant obtained permission to commence the work. However, in the beginning of August the process of relining and casing the well was commenced and carried out. The

plaintiff's family, however, had at this time left the house, and the plaintiff finding, as he thought, no improvement in the circumstances, commenced the action against the defendant for breach of covenant on Sept. 30, 1875. At the last trial the lease was surrendered, and the plaintiff had now given up possession, so that the claim was for damages for the breach of covenant and expenses in and about the house, and arising from the circumstances. The points really in issue were whether the water supplied to Tanfield House was bad in quality owing to the insufficient means of supply, and whether it was of a character to have caused the illness which occurred among the members of the plaintiff's family and household, and which, according to his account, necessitated his giving up the house. The case, therefore, turned, first on the way the well was bored in the first instance and the strata through which it passed. The well-sinker, who bored the well, was called concerning this by the defendant, and said that the boring passed first through about 50 feet of various clay strata, then through sand and clay, ultimately reaching the chalk at a depth of 60 feet from the bottom of the well, and the boring was continued into the chalk for a depth of 15 feet. The question arising out of this was, how the organic matter discovered by Mr. Ogston and Dr. Corfield's analyses should have found its way into the water. The suggestion on the part of the plaintiff was that surface sewage found its way into the well by filtration from above, and so forcing its way, produced the impurities in the water which had the injurious effect on the health of the family as described. As to this, Mr. Milne, a civil engineer and a geologist of considerable attainments, gave it as his opinion that filtration was impossible through strata of clay to the depth described, and adduced reasons in support of his opinion. However, to avert this, if it were possible, the casing of the well was completed on the part of the defendant, and it appeared that if that casing were good and sound it must finally preclude any possibility of surface filtration into the deep well. A second point in issue, therefore, was, whether this work had been executed in such a manner as to ensure immunity from that danger. On this point there was a considerable conflict of evidence, the plaintiff's witnesses saying that the cement of the lining was of an inferior character, and had never been allowed to get hard, and that the work was, in short, so executed that it would not exclude water from the well. On the other hand, for the defendant, the bricklayer who cased the well said that it was made thoroughly sound and water-tight, and every precaution taken; and several witnesses who had seen the well pumped dry since the casing pronounced it to show no signs of leakage. One of these witnesses had, in the course of the week, while the action was proceeding, made holes in the side of the well, and pronounced the casing to be sound and water-tight, and of a considerable thickness. At one time, no doubt, some water had found its way into the bottom of the well while the pipe was closed, as the plaintiff alleged, through defects in the concrete at the bottom; but for the defendant it was said this was occasioned by the loosening of the stand-pipe in consequence of violence used by the plaintiff's servants in putting in and taking out the plugs. Another point at issue between the parties was whether the symptoms developed by those of the plaintiff's household who suffered from ill-health while at Clandon were such as would be occasioned by drinking impure water. On this point Dr. Steadman, of Guildford, who attended the plaintiff's family, expressed his opinion that the type of illness, from its similarity in the several cases, and from its general character, was a probable result of the drinking of impure water, and in this he was supported by Mr. Thornton, surgeon to the London Hospital for Diseases of the Throat, and to some extent by Dr. Corfield. On the other hand, Professor Wanklyn, Dr. Stevenson, lecturer at Guy's Hospital; Dr. Sills, of Guildford; Mr. Haynes Walton, surgeon of St. Mary's Hospital, and Dr. Morell Mackenzie expressed their opinions that impure water would never produce the symptoms detailed by Mrs. Corrie, her daughters, and Dr. Steadman. It was incidentally suggested by these witnesses that the wall paper of the dining-room, being loaded with arsenic, might produce such symptoms, but they were disinclined to attribute them to either one or the other cause. Another point which presented considerable difficulty, was the reconciling of the various analyses made of the water at different times. The analyses made before the casing of the well presented unfavourable features in every case; but for the defendant it was contended that it was not clear that all these came direct from the deep well, or without admixture with water from the shallow well in the pipes through which it came. The analyses, however, presented also a great divergence of opinion even after the casing of the well; Dr. Corfield and Mr. Ogston still reporting unfavourably of the water, while Professor Wanklyn, the late Dr. Letheby (whose evidence was read), and Dr. Stevenson pronounced it very good. It became, therefore, a question for the jury what conclusion they would arrive at from these analyses taken in connexion with the rest of the evidence.

After very forcible speeches by Mr. DAY, Q.C., and the SOLICITOR-GENERAL, on behalf of their respective clients,

The learned JUDGE summed up the case with great care, telling the jury that the questions they had to answer for the determination of this action would be the following:—Had a reasonable time elapsed for the defendant to do the work under the covenant to secure a sufficient supply of water to the house before the action was brought; and if the answer of the jury to this should be in the affirmative, the following question would arise:—Did the defendant within a reasonable time do the necessary work to secure a sufficient supply of water—first in quantity, second in quality.

The jury found a verdict for the plaintiff for £100.

ASTON PETTY SESSIONS.—FRIDAY, JAN. 26.

(Before Messrs. SMALLWOOD and RYLAND.)

THE CORPORATION OF BIRMINGHAM AND THEIR GAS STOKERS.

William Smith and William Matthews, gas stokers, lately employed at the Salfley Gas-Works, each summoned the Corporation of Birmingham for the sum of £3 10s., which they claimed in lieu of a fortnight's notice.

It was stated by Mr. PHILLIPS, who appeared for the complainants, that at six o'clock on the morning of the 16th inst., his clients presented themselves at the works for their usual employment, when they were informed that they would be required to use a scoop which was much heavier than the one they had been accustomed to. The men consulted among themselves on the matter, and they decided to object to use the heavy scoop. The superintendent of the works persuaded them to make an attempt to work with the scoops, but, after trying for 10 minutes, they declined to continue any longer, and left the works, the manager telling them that he would not further employ them.

Three stokers were called, and they stated that the objectionable scoops were above a hundredweight heavier than those they had formerly used.

Mr. HERBERT, for the corporation, denied that the scoops were more than 30 pounds in excess of the weight of the old ones. The men did not give the new scoop a fair trial. He urged that if the corporation were to be at the mercy of men who were allowed to say that they would not perform work which they disliked, no employer would be able to get his work done fairly and properly.

The manager and two foremen stated that the complainants could have used the scoops without any inconvenience; and the magistrates elicited

that no notice of the intention of the authorities to change the scoops was given to the men.

An order was made for the payment of the amount claimed, one of the magistrates remarking that the corporation might have avoided these proceedings by giving the men notice to leave when they declined to use the scoops.

LIVERPOOL COUNTY COURT.—TUESDAY, JAN. 23.

(Before Mr. P. THOMPSON, Judge.)

RATHBONE v. THE LIVERPOOL UNITED GAS COMPANY.

This was an action by the plaintiff to recover the sum of £50 for damage done to his carriage through the alleged negligence of the servants of the defendants.

The evidence showed that on the night of the 24th of August last the plaintiff's landau was driven by his coachman to the Edgehill Railway Station, for the purpose of meeting the 11.20 train. After leaving the station, the coachman proceeded home to Greenbank Cottage, a son of Mr. Rathbone sitting on the box next to the coachman, and two gentlemen being inside the carriage. Near to the Croxteth Road entrance to Sefton Park some excavations were being made by the defendants, in order to lay down new gas-pipes, and some of the pipes were lying on the opposite side of the road so that they might be ready for use. The excavations were lighted, but there was no light placed on the gas-pipes. The coachman drove safely past the first light, but after he had got a short distance the carriage came in contact with a pipe which was projecting about 2½ feet into the roadway. The result was that one of the wheels was broken, and the carriage was otherwise injured, the harness having to be cut in order to release the horses.

For the defence it was contended that there was contributory negligence, and, therefore, that the defendants were not liable. The coachman, it was alleged, drove the carriage too fast, and did not take the precaution which he ought to have taken when he knew that the road was obstructed.

His Honour thought that the accident arose entirely from the negligence of the defendants, in not having lights placed near to the pipes, or some one to give warning that they were there. The company were, therefore, liable for the damage.

A verdict was then entered for the plaintiff for £50.

SHEFFIELD COUNTY COURT.—WEDNESDAY, JAN. 24.

(Before Mr. THOS. ELLISON, Judge.)

SHEFFIELD UNITED GASLIGHT COMPANY v. HYMAN HYAM.

In this case the Gas Company sued Mr. Hyman Hyam for £16 13s. 2d., alleged to be due for gas and fittings supplied. The defence was that the defendant had filed a petition for liquidation on Nov. 9, 1874, and that he was consequently freed from the debt. It was admitted that the amount had been owing, but that the result of the liquidation proceedings freed him from it. On the other hand, the result of a later meeting of defendant's creditors, held in London, at which a composition of 9s. in the pound was agreed to, was relied upon. After some argument the matter was adjourned until the 31st of January, in order that some additional information might be obtained as to under what particular section of the Bankruptcy Act the proceedings had been registered.

COURT OF SESSION, EDINBURGH.—TUESDAY, JAN. 23.

(Before Lord CURRIE HILL.)

EDINGTON AND SONS v. THE DUNDEE WATER COMMISSIONERS.

This is an action at the instance of Thomas Edington and Sons, engineers and ironfounders, Glasgow, and D. Y. Stewart and Co., engineers and ironfounders, Glasgow, against the Dundee Water Commissioners for payment of £22,733 3s. 4d., and between £1800 and £1900 in name of interest. They aver that the sum in question is the balance due to them under certain contracts for the construction of the works necessary for bringing in a water supply from Lintrathen to Dundee, and also for supplying the piping for the purpose; and they further claim £2500 as damages, on the ground of alterations which entailed delay in the completion of the works, and caused loss to pursuers. Defenders maintain that pursuers are not entitled to claim any sums for alterations and additions, except as authorized in writing by the commissioners or their engineer. It is also alleged in defence that some of the pipes were defective, and in the course of the works several of them burst. There were other mishaps which are attributed to the negligence of the pursuers, who, it is said, abandoned the contract before it was completed. In respect of loss and damage, the defenders say they have counter claims which compensate and extinguish any claim competent to the pursuers. Parties were to-day ordered to revise the record.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

THE ALLEGED NUISANCE AT THE FULHAM GAS-WORKS.

At the Meeting of the Chelsea Vestry, on Tuesday, the 23rd inst.—Mr. KINGSBURY in the chair,

The following letter, addressed by the Gas Referees to the solicitors of the board (Messrs. Lee and Pemberton), was read:—

"Gentlemen,—We have given careful consideration to the statement in reference to the nuisance occasioned to the parish of Chelsea by The Gaslight and Coke Company's works at Fulham, which accompanied your letter to us of Nov. 11, 1876.

"We have also paid several visits to the works in question, and have watched the process of discharging the lime purifiers and conveying away the refuse lime. The arrangement in use for the last-named operation, by which the refuse lime is kept constantly under cover, from the time when it is lifted out of the purifier till the loading of the barge in which it is removed has been completed, seems to be good, and to be carefully carried out. We believe that no nuisance is caused during the operation.

"The process used for emptying the purifying-box has been recently improved by the introduction of a plan which Mr. Evans, formerly the engineer, and now a director of the gas company, states that he employed successfully before the discovery of the use of oxide of iron as a purifying agent, to prevent nuisance arising from the refuse lime. Before the lid of the purifier is raised, air is drawn downwards through the vessel, and thence expelled through a large brick trough filled with oxide of iron. By this means both the 'foul' gas which filled the purifier is rendered innocuous before it is allowed to escape, and also the sulphuretted hydrogen which the lime gives out, especially when in a moist condition on its first exposure to the air, is arrested.

"Our observations, however, at Fulham and at other works lead us to believe that the principal source of the nuisance which is liable to arise from purification by lime is not a gaseous effluvia, but the refuse lime itself, which exists when in a dry condition as an exceedingly fine dust. Where, as at Fulham, the purifiers are not enclosed, but stand in the open air, and their contents are exposed to the wind while being

trodden upon by the workmen, and shovelled into bags, this dust arises, and is carried away so abundantly that the clothes of a person standing at some distance to leeward are thickly powdered by it, and acquire a more persistent smell than would be caused by exposure to gaseous effluvia. It is to this dust, carried, as it easily may be, to distances of a mile or more from the works, that the nuisance complained of in Chelsea is probably due.

"The remedy seems obvious—namely, either to enclose the purifiers so as to shelter them altogether from the wind, or to lay the dust by watering each layer of lime, sufficiently to damp it through, before it is stirred by the workmen. This latter process, as being more immediately applicable, we have recommended to the superintendent of the works, advising also that he should employ the down draught of air suggested by Mr. Evans, not only previous to the raising of the lid, but also throughout the operation of emptying the purifier. We have also recommended that the labour of emptying should, as far as possible, be so systematized, that the workman should deal successively with the different sections of each layer, keeping covered over the remaining sections; this plan has the further advantage of concentrating the down draught of air upon that area on which the lime is being disturbed.

"Our recommendations have been adopted by the company, and the mode of working just described has been in use for the last two or three weeks. During this time we have thrice visited the works, and we believe that if this mode of working is carefully adhered to, no further nuisance will be occasioned.

"It must, however, be borne in mind that purification by lime is not the only operation in the manufacture of gas which gives rise to unpleasant smells. On the occasion of our last visit to the works, on the 10th inst., the superintendent stated that some complaints had been made to him recently; but he also mentioned that he had recently emptied a large scrubber (a vessel through which the gas passes before it enters the purifiers) charged with the coke, which had become clogged with the tar and other impurities removed from the crude gas.

"We would say, in conclusion, that, although it is undoubtedly easier to conduct the less complete purification of gas by means of oxide of iron, without occasioning nuisance, than so to conduct the more complete purification by means of lime, we believe the latter to be practicable, if proper arrangements are made, and sufficient vigilance is exercised.

"It is not our province, neither are we in a position, to give to the company such engineering or chemical advice as they need to discharge properly their responsibility in this matter; but we can see far enough into the question to make us believe, what the vestry of Chelsea express as their hope, that 'some method might be found of obviating the nuisance without sacrificing the purity of the gas.'

(Signed) "A. VERNON HARCOURT, } Two of the Gas Referees."
WILLIAM POLE, }

The SURVEYOR (Mr. G. Stayton) said at twelve o'clock that morning at the wharf the nuisance was as bad as ever.

Mr. G. W. RICHARDS remarked that it could hardly be the dust which caused the nuisance, as, for a long time there was a vapour noticed coming before the wind.

Mr. LAWRENCE said it was a well-known fact that there was a smell observed in rooms where dust could not penetrate.

Mr. CROSS observed that the smell from the gas was very bad that morning at seven o'clock.

The letter was referred to the Gas Analyst (Dr. Barclay) for report.

CAMBERWELL VESTRY.—At the meeting of the vestry, on Wednesday last—Mr. Turner in the chair—the clerk reported that, with reference to the sum of £600 advanced to him by the vestry to pay costs incurred in opposition to the gas bills last session, he had paid Messrs. Simson and Co., the parliamentary agents, their accounts, amounting in the aggregate to the sum of £561 2s., for counsel's fees, &c., and had paid the balance of £38 18s. into the London Joint Stock Bank. Some complaints were made respecting alleged increases in consumers' bills, notwithstanding a reduction in the price of gas per 1000 feet, and the chairman stated that as he was charged by the Surrey Consumers Company £9 8s. for 21 days consumption of gas, he had the meter changed, and the result was that his next account was £7 17s. 3d. for 75 days consumption of gas. He considered this so unsatisfactory that he should not pay the amount. As the company's price had been reduced, so the charges to himself had gone up. A letter was read from the clerk to the Lewisham Board, asking the vestry to co-operate with that board in opposing the Crystal Palace District Gas Company's Bill, to be introduced into the next session of Parliament, which sought to relieve them from any restraint as to the quantity of sulphur in their gas other than sulphuretted hydrogen, which letter was submitted to the vestry for their consideration. The communication was referred to a committee.

RICHMOND WATER SUPPLY.

A Public Meeting of the Ratepayers of Richmond was held on Friday evening last, in the Freemasons' Hall, at the Greyhound Hotel, "to discuss the position of affairs, and the policy of the Richmond Select Vestry and the Southwark and Vauxhall Water Company." The meeting was called for eight o'clock, but long before the commencement of business the hall was crowded in every part, and great excitement prevailed; indeed, the whole proceedings from first to last were of a very tumultuous character. Yells, hisses, groans, and cheers prevented anything being done for a long time, and it was fully three quarters of an hour before the first formal resolution could be moved.

Mr. Lockwood was called to the chair at the outset, and, after a few remarks, he proceeded to read a letter from the water company's engineer, but the interruption was so great that he found it impossible to do so. The meeting was determined not to hear him, although appealed to by Mr. Gascoyne, a member of the select vestry, and assured that the chairman was not a shareholder in the company, and that the meeting had not been called at their instigation. As it became evident that Mr. Lockwood would not be listened to, that gentleman at length vacated the chair, and left the hall.

After a considerable time further had been wasted, a resolution was come to, on the motion of Mr. GASCOYNE, seconded by Mr. DRUCE, that Mr. F. G. B. Trevor, a churchwarden, and a member of the select vestry, be requested to preside.

Mr. TREVOR, in taking the chair, said he only consented to do so on the understanding that some attempt would be made to preserve order. He appealed to those present to listen to whatever remarks were offered by speakers on both sides of the question, and then to express their opinions, for or against the resolutions to be submitted, according to their judgment. As a member of the select vestry he feared nothing, and only asked the meeting, before condemning them or any one else, to hear what they had to say in their own behalf.

Mr. DRUCE then came forward to propose—"That this meeting, while duly sympathizing with the vestry in their efforts to provide an ample supply of pure water, as promised in their circular of Dec. 28, considers that the time has now arrived when they should make an immediate arrangement for an adequate supply of water from some reliable source,

the sources of supply at present relied upon having proved absolutely insufficient, and having occasioned much inconvenience and distress." He said he was a ratepayer and nothing more, and he had, in common with others, suffered inconvenience from the discontinuance of the supply of water by the company. On hearing that the present meeting had been called, he stated that if it was to be an "indignation meeting" against the vestry he would not be present; but he was assured it was not so intended, and therefore he consented to come. And if any one thought the motion he had made was expressive of a want of confidence in the vestry, he could only say he took a different view of the case. He believed the ratepayers sympathized with the vestry, who had been placed in a most difficult position by the action of the company. He had taken some trouble to ascertain the facts of the case, and he believed them to be this: For a period of 16 years the company had supplied Richmond with water, and then they took advantage of a technical legal right to do a great moral wrong. And if any one could be found bold enough to uphold such conduct, he could only say he should be sorry for that man. Of course a trading company would not willingly submit to have a rival concern come in and take away their business all at once. But did the vestry wish to take away the business of the company all at once? What were the facts? Up to 1870—i.e., ten years from the commencement of their operations—no fault, at least no material fault, was found with the supply of water by the Southwark and Vauxhall Company. But in the year 1870 the first step as taken to obtain a better supply of water for Richmond, and what was that first step? It was an overture made to the company to go to Parliament and obtain powers to supply the place with water. They refused to do it, and the local authority then very properly said: "Will you sell us your pipes and tackle?" Not a bit of it; they treated the vestry with defiance, and this was the tone they took from the beginning. The vestry then went to a great expense in obtaining a Local Government Board Inquiry, of which the company had notice, but would not in the first instance attend. The inquiry was re-opened in November, 1874, and continued until the month of April, 1875, and throughout this second inquiry the company were present, and were heard. Could any one say they had not had fair play? They had had more than fair play, they had had forbearance shown to them. The Local Government Board gave the vestry power to raise £28,000, but the company then introduced a bill into Parliament, and brought an action in the Court of Chancery to restrain the vestry from proceeding with their application. The motion stood over until the result of the company's bill was known. What was that result? The bill they themselves brought in was withdrawn by themselves. But when was it withdrawn? Not until they had put the vestry to the utmost expense possible, short of taking them before a select committee. Then came on the trial of the action in Chancery, and the company were there ignominiously beaten, and their bill dismissed with costs. (A voice: "They put us to £2000 expenses.") That was on the 23rd of March, 1876; but for six months afterwards the company did not move in the matter. Had they sent out a circular to the ratepayers intimating that, in consequence of the proceedings of the vestry, they would decline after a certain period to supply the town with water, except under a new contract, he would have exonerated them from blame. That would have been the right course to take. But they let things go on, and he (Mr. Druce), in blissful ignorance of their intentions, paid his water-rate like a —, and then one day he found the water to his house entirely cut off. Under the circumstances of the case, he thought the vestry were right to look upon the company as enemies, and to treat them at arm's length. He was not prepared himself, in the absence of all the facts as to what transpired between the vestry and the company, to say that the former had acted in every way as he could wish. It struck him, as an outsider—but here he spoke under authority—that it would have been more politic on the part of the vestry rather to have held out the olive branch; they might have tried, even if not successful, to have adopted some conciliatory policy. Still, he could hardly blame the vestry for not having done it, remembering how the company had treated them from the beginning. Some one in the meeting seemed to think that the vestry should have applied for an injunction to restrain the company from discontinuing the supply to the town. But the vestry were advised on this point; they took counsel's opinion upon it, and he (Mr. Druce), as a Chancery lawyer, having looked into the matter, entirely agreed in the opinion given to them, that if they had applied to the Court of Chancery they must have been beaten ultimately. It was, however, one of those cases in which "a risky action" might have been tried, in which advantage is taken of the technicalities of the law to obtain delay, but they were too honest and outspoken John Bulls for that; they could not "come the Artful Dodger" enough. The vestry were asked to pay compensation. For what? For the company continuing to do a wrong. He never heard that being paid to commit a wrong made the wrong a right. At the same time he would have suggested to the vestry, on that occasion, to go to the company and tell them that although it was certain they had done wrong in supplying the parish, for the past 16 years, with water, there was no one to find fault with them if they continued for a little longer to do that which was evidently beyond their power. In fact, the only persons who could have taken exception to their proceedings were the Conservators of the Thames, who might have objected to the company drawing more water from the river than they required to supply their own proper district. And assuming the company had agreed to do this technically legal wrong, the vestry might have offered to indemnify them against any claims made upon them by the conservators. The company knew they were not acting rightly, or they would not have come to Richmond "like a thief in the night" to break off the connexions between their mains and the service-pipes of the consumers. He would sum up their conduct by saying it was scandalous, vexatious, and spiteful. It was scandalous to deprive a town of 20,000 inhabitants of their water supply at a month's notice. And it was purely vexatious and spiteful on their parts, because if they had continued the supply until the vestry were ready to take it up, they would have derived a benefit to their own shareholders, of which by their action they had deprived them. It had been stated that the capital of the company in Richmond was £60,000, but he did not believe it. The capital of the old Richmond Company was between £7000 and £8000; but he would assume that the Southwark Company gave £16,000 for the undertaking, and that by the extension of the town further capital had been required, and it was now £20,000—or he would go further and double that amount—say it was £40,000. The income they received from the supply of water to the town was £7000 a year. Was not that a good return on an investment of £40,000? All he could say was that if he were a shareholder of the company, which he was happy to say he was not, he would make it "extremely hot" for the directors at the next general meeting of proprietors. Under all the circumstances, he should ask the present meeting to pass unanimously the resolution he had proposed.

Mr. MUNRO hoped the words at the end of the motion, "and distress", would be omitted.

Mr. DRUCE objected to the suggestion, and said the vestry ought to be made acquainted with the exact state of affairs, and he was sure they would not take this resolution as a vote of want of confidence. He had suggested to them, through Mr. Gascoyne, that they should lay before the ratepayers a report of what they were doing. He had heard it stated that

the only sources of supply at their command were two, one at the bottom of the cemetery—(Interruption.) He did not say that the water came from the cemetery, but it came from close to the cemetery, at the lower end of the lane—(Renewed interruption.)

The CHAIRMAN said he thought there was a misapprehension in reference to Mr. Druce's statement. Mr. Druce did not mean to say that the water drawn from that part came from the cemetery; he simply stated, as a matter of fact, that the water came from outside one portion of the cemetery, underneath the freeboard—he did not say that the water percolated from the cemetery.

Mr. DRUCE said, so far as his observation went, the water appeared to come from Richmond Park. It was the stream he had always noticed as supplying two large ponds, where a dairyman of the town kept a very large herd of cows—(Laughter, hisses, and cheers.)

Mr. DRUCE said the meeting seemed to think he was "chaffing" them—but he was not. He did not mean "the cow with the iron tail." He mentioned the fact of the number of living cows being kept near the pond, as proving to those who knew anything of agriculture that there must be a good supply of wholesome water in the neighbourhood, for cows could not thrive without it. The other source of the vestry's supply was near the "Star and Garter," which he was told was the surplus water after the supply to the White Lodge. There were, he believed, three other supplies down the town; but the question he would put to the vestry was, "Are these sufficient in the present crisis?" (No, no.) They were insufficient, and the want of others had, as stated in the resolution, occasioned inconvenience and distress. No doubt all this could be remedied, and would be remedied by the vestry, which had already done so much; but it was time that the inhabitants of the town were made acquainted with the fact of what they had to depend upon in permanence. As to the "distress" from the present state of things, he knew but little of it himself, but the medical men, who were accustomed to visit among the poor, assured him of its existence; therefore he thought the word should not be left out of the motion.

Dr. ANDERSON seconded the motion. He disclaimed any feeling of hostility to the vestry, and declared that he merely came forward to offer, as a medical man, a few remarks in support specially of the latter part of the resolution. There could be no doubt of the fact in the mind of any one who went through the town, that a certain amount of inconvenience and distress did prevail. The medical men of the town had that day signed a document, which was to the following effect:—

As unfavourable statements have been current respecting the health of Richmond, we, the undersigned, practising in this town, beg to report that for some time past the mortality has been very low, that there is no epidemic prevailing, and we subjoin a list of the total number of cases of zymotic diseases under our own care at the present time. Notwithstanding the healthy state of the town, we are fully alive to the necessity of obtaining an ample and pure supply of water with as little loss of time as possible, and we strongly recommend that an immediate analysis of the water supply to the inhabitants from all the sources in use should be obtained and published, and that the analysis should be repeated from time to time.

(Signed)	FREDERICK CHAPMAN,	WM. ANDERSON, M.D.
	A. K. MAYBURY, M.D.	J. FERGUSON, Surgeon, &c.
	N. ARCHER WARWICK, M.D.	FREDERICK J. WADD, M.B.
	THOMAS DUNCAN, M.D.	WILLIAM YATES, Surgeon, &c.
	W. A. F. BATEMAN.	

The list showed one case of small-pox, but none, it would be seen, of typhoid fever, scarlet fever, measles, or diphtheria. In the present crisis something ought to be done. He would merely add that there was inconvenience and distress, and that if the present state of things continued, there was probability of future disease, and, perhaps, great danger in the town. No doubt, also, many people would leave the town if this state of things continued.

Dr. SELLE said his course for many years in the vestry had always been to secure the greatest happiness for the greatest number, and he could assure the meeting that he and his brother vestrymen were now earnestly engaged in securing for the people of Richmond a pure and abundant supply of water. In talking of analyses, Dr. Anderson had quite forgotten to refer to the analysis of the water supplied by the Southwark and Vauxhall Company. He asserted that there was more water in the town that day than there had been the day before, and they were obtaining more and more every day. When they got to the proper depth with their artesian well—they had it on the authority of one of the most eminent engineers—there would be 300,000 gallons of water per day at their disposal. (Cheers and dissent.) He did not like the last part of the resolution, and was of opinion the word "distress" should be left out, and "inconvenience" should be substituted. (Interruption.) He had himself been round with the water-carts in the lower parts of the town, to assist in giving water to those who needed it, and he had himself pumped water into the carts. Hitherto the vestry had been beaten in their operations by the weather, and two of their men had been laid up with rheumatic fever. Notwithstanding everything, he proposed that the word "distress" should be left out of the resolution.

A person in the body of the hall called upon Dr. Selle to produce the analysis of Dr. Rowland, the medical officer of health, showing the quality of the water now being supplied to the town.

Dr. SELLE said he had not brought it with him; it could be seen next day. He moved as an amendment to omit the words "and distress."

Mr. MUNRO seconded the amendment.

Dr. ANDERSON said he was personally responsible for the word "distress," and he ventured to say that, instead of being too strong, it was not strong enough. He had been himself a witness of that distress. He did not want to exaggerate it, and create a panic, because he believed the town at the present moment was very healthy; still, it must be remembered that diseases of this kind and order were very insidious, and took some time to develop themselves. But they even now existed.

Mr. GASCOYNE: From this water?

Dr. ANDERSON: Yes. One word more and I have done. Dr. Selle has spoken of the analyses by Dr. Rowland. I am not an analytical chemist like him, and I wish to speak with all respect of him; but I and my friends have a rough-and-ready method of testing water. This method we have applied to the water at present furnished, and we find it is slightly impure. ("Hear, hear," and interruption.)

Mr. GASCOYNE: I am surprised at such a statement from Dr. Anderson. (Interruption.) Dr. Anderson's partner told me that nothing could be discovered out of twelve or sixteen tests of the water. (Renewed interruption.)

Dr. ANDERSON: I deny it, and I will produce my partner to contradict it. (Cheers and hisses.)

Mr. GASCOYNE: I trust the meeting will not pass the resolution in its present form. I know my poor neighbours as well as most people, and I am sure they would be ready to suffer inconvenience in support of the vestry. For gentlemen like Mr. Anderson to come forward in this way—I am ashamed of him. (Hisses, cheers, and prolonged interruption.) I move that the resolution be withdrawn altogether. (Laughter, and "You cannot deny facts.") The former part of the resolution does not do harm, but the latter part will hamper the committee so that they cannot act. (Hear, hear.) Do the gentlemen mean that we are to go back to the old works? ("Hear, hear," and interruption.)

Mr. DRUCE: I beg to say I did not mean it.

Mr. GASCOYNE then moved, and Dr. SELLE seconded, as an amendment, to omit from the resolution the whole of the latter portion, leaving it to stand thus—"That this meeting fully sympathizes with the vestry in the efforts made by the Water Committee to furnish an ample supply of pure water, as promised in their circular of the 28th of December."

After a scene of confusion which lasted some minutes, the CHAIRMAN proceeded to put the question, and, on a show of hands, he declared both amendments to be negatived.

The original motion was put and carried by a large majority.

Captain M'DONALD then moved—"That, apart from the legal rights of the question, the action of the Southwark and Vauxhall Company, in cutting off the supply of water from the town of Richmond—being unnecessary as far as their pecuniary interests were concerned—was a vindictive measure, prompted by animosity towards the Richmond Vestry, they having undertaken to find us a better supply, and was unworthy of any body of Christian men placed in a responsible and public position, and dealing in such a commodity as the supply of water to a town; further, that such arbitrary action urgently calls for the intervention of Parliament to prevent the like occurrence in some other locality." Water companies, he maintained, were not established for their own gain; parliamentary powers were granted to them to meet the necessities of the public. In the present case, let the legal merits of the question be what they might, the company had, by the course pursued by them, deprived the inhabitants of the town of the supply of the prime necessity of life. He would not go into the merits of the question as to whether the vestry had acted right in every particular. It was very easy to find fault with a public body, and they should bear in mind that in the composition of the Richmond Vestry there were many able men who worked hard for the interests of the ratepayers—(Laughter and cheers.) He believed they were doing their utmost to supply pure water to the town at a moderate cost, and it was only on the 9th of the present month that the Water Committee were thanked for their action in the matter. That vote of thanks was, perhaps, a little premature, but still he believed that that body had devoted all their energies to meet the emergency. They were not the persons who had cut off the water from the town, and all the resolutions passed that day would not benefit the inhabitants on the morrow. Practically speaking, they were in the hands of the vestry for good or evil. That body were doing all they could in the matter, and therefore he would say, be generous—don't pass any resolution which might embarrass those who are acting for the common good. They could not obtain anything by finding fault with those who at the present time were their purveyors of water. (A Voice: Don't offend the company, we may want them again.) Let them turn from the vestry to those who were the cause of all their misfortunes. In the Registrar-General's return, published this month, it was shown that many of the London water companies supplied water unfit for domestic use, and, figuring amongst the worst, they found the Southwark and Vauxhall Company. Should they not thank any body of men who were taking them out of the power of such people. It was all a question of money. If the company could have extracted £2000 or so out of the pockets of the ratepayers for so-called compensation, they would still have the water. He therefore asked them to condemn *in toto* the arbitrary, unjust, and unchristian action of the company, which might have been productive of the most mischievous results, not only to Richmond, but to the hamlets, if they had been visited with sickness, fire, or pestilence.

Mr. MUNRO seconded the motion, which was put and carried almost unanimously.

A vote of thanks having been given to the chairman, the meeting, which had been very tumultuous throughout, broke up about ten o'clock.

CORPORATION GAS AFFAIRS AT WIGAN.

On Monday, Jan. 22, a Meeting of Gas Consumers, convened by circular, was held at the Royal Hotel, Wigan, to consider what steps should be taken with a view to reduce the excessive price charged by the corporation for gas in the borough. The chair was occupied by the Rev. P. HAINS, and upwards of sixty tradesmen were present. We copy the report of the proceedings from the *Wigan Observer*.

The CHAIRMAN having introduced the business, called upon Mr. Edwardson, a member of the corporation, by whom the meeting had been convened.

Mr. EDWARDSON said those present would be aware that in the previous week he took the trouble to go round the market-place to ascertain the amounts of the last quarter's bills, and the corresponding quarter's of last year. The result of that inquiry revealed to him the fact that in many cases the increase in price was 100 per cent., in some 50 per cent., and in others 15 per cent., and even lower, but the average increase was something over 15 per cent. That seemed to him a very great increase. Whether the Gas Committee were justified in making those charges he was not prepared to say definitely, but he was inclined to believe they were not. He understood the authorities said that the extra pressure put upon the mains was the cause of the increase; but if that were the case, he wanted to know why the increase was not the same proportionately in all cases. He thought the Gas Committee or the gas manager should be called upon for a reply. It was estimated that each burner burned about 3½ or 4 feet of gas in an hour, but if they examined their gas bills they would find they were charged for consuming gas at the rate of 9 feet per hour. He was not a practical man, and therefore could not say much on the subject, but he knew there was a difference between £5 and £10. It was rumoured there was an air-injector machine in use at the works, for the purpose of forcing air into the gasometers, and from there into the mains and service-pipes. Those were questions which they ought to put before the Gas Committee, to ask them how they could explain them to the satisfaction of the gas consumers, and, of course, the ratepayers. That was all he had to say at present on the question, and he thought they had good ground for asking them to explain the cause of the large increase. He was not prepared with a resolution, but probably he would be before the close of the meeting.

Mr. J. FAIRHURST said his last quarter's bill was £3 10s. over the corresponding quarter of last year.

Mr. M'CLURE said that Messrs. Evan and M'Clure's gas bill for the last quarter was £19 7s. 11d. as against £11 11s. 3d. in the corresponding quarter of last year. He might tell them this increase in the gas bills was not confined to Wigan, for at Earlestown, where his firm had also a place of business, their gas bill was exactly double what it used to be.

Mr. T. R. PART said it was the same at Hindley.

The CHAIRMAN said there were times when it was best for them to confine themselves to their own businesses, and in this case they would be attending to their own interests if they were to confine themselves to Wigan.

Mr. M'CLURE said he would bow to the chairman's decision, but he might mention that in the town of Dundee, in Scotland, the gas was double the price of gas in Wigan, but the gas bills were considerably smaller for the amount of time the gas was burned. The gas there was, he believed, made more pure, and it was in the long run cheaper, though it was double the price per 1000 of the Wigan gas.

Mr. GRE said when he got his bill he was so astonished at the price—5s. per cent. in advance of the corresponding quarter—that he sent it back to

the gas manager with a note, requesting him to inspect his pipes and meter, as evidently a mistake had been made in some way or other. They, however, had never deigned to reply to his note.

The CHAIRMAN: When did you send it?

Mr. GEE: A fortnight or so ago.

Mr. RIDER said for his shop in the market-place the bill for the 1875 quarter was £1 19s. 2d., and for the last quarter £4 19s. 9d.

Mr. S. PART: Mine is less than the corresponding quarter in last year.

Mr. BEST: Mine is £4 more than the corresponding quarter in last year.

Mr. S. TAYLOR said his bill had increased 37½ per cent. notwithstanding that he had burned less gas than in the previous quarter.

The CHAIRMAN (examining Mr. S. Part's bill): But if you will examine it you will find there are 12 days short in one of the quarters, and that may make a difference.

Mr. A. BIRKETT said his bill had increased between 40 and 50 per cent. His bill was £5 2s. 4d. against £3 14s. 4½d. What puzzled him was the want of uniformity in the gas charges. For instance, he had 36 burners, and a neighbour of his who had only seven burners had an account sent which was about the same as his (Mr. Birkett's) 1875 bill.

Mr. EDWARDSON: Thirty-six jets, £5 2s. 4d. I have 25 in my shop, and my bill is £8. I have actually fewer burners than I had last year, and yet my bill has increased 75 per cent.

Mr. S. TAYLOR: I have 20 burners for £8 10s.

The CHAIRMAN said it appeared strange that there is such a unanimous feeling throughout the town. A good many families in private houses had particularly enjoined upon him to give expression to their feelings on the subject. The gas bills had been so enormously large that he had heard of no other feeling in the town but one of surprise almost bordering on indignation because they thought something like imposition or fraud had been practised upon them. He had heard that frequently in the town that day.

Mr. J. FARRINGTON, Wigan Lane, said in the 1875 quarter his father's bill was £1 9s. 6d., and at that time he wondered whether the price of gas had been raised, so much higher was it over the corresponding quarter in 1874; but they might imagine his surprise when last quarter he discovered it was £2 4s. 5½d. He could not account for the increase.

Mr. SMALLMAN said he had not to pay for the gas he consumed, so that he did not know anything about the charges; but, notwithstanding he had five burners in his room, he knew that when he wanted to read he had to light a couple of candles.

The CHAIRMAN said his experience with the Gas Committee hitherto, with the exception of the last few months, had always been a happy and pleasant one—that was to say, he had had very little to do with them, and the bills he had had to pay had been exclusively confined to his schools. The gas bill for his house at Thornhill he had had no reason to complain of; but as regarded the vitiation and depreciation of the gas, he was far from satisfied. Since the works had changed hands, it appeared to him there had been a twofold failure. First, the gas had been greatly vitiated. What kind of air passed through the pipes, it was not for him to say; but he believed there was something else than ordinary gas. Besides that, the bills had enormously increased. What Mr. Smallman said about the gas, although they laughed at it, was a fact. He was sure that had St. George's Church been lighted with candles last Sunday night, it would have afforded the members of his congregation a better light than the one they had. So bad was the light that it was hardly possible for them to read an ordinary book with it. In addition to that, the gas supplied them was of the most vitiated description. That being so, he had of necessity to illuminate the church materially as well as spiritually; with the material light that came out of his pocket in the same way as the other light came from his mind or head. He would now say a few words with regard to the school. During the summer months, from April to June, they had no gas in the schools, but recently a bill came in for £1 16s. He went to the gas-works to ask them when the gas was used, and told them they had had neither concerts nor meetings, and that in fact he could not discover the gas had even been lighted once. After some investigation, however, he found out that it had been lighted on one occasion, and that gas to the value of about 2s. had been consumed. He went to the gas manager on the subject, and told him it was an imposition; and, to tell them the truth, the gas manager spoke very candidly, and said he was afraid some of the collectors did not read the meter registers—that they charged the public not according to what they consumed, but according to what they ought to have consumed. After this he extended his investigations, and found that one of his parishioners had had a dispute with the gas company, and that she would not pay her bill. The consequence was her gas was cut off, and she had to resort to paraffin lamps, which she found to be a very agreeable change; but the next quarter she received the ordinary bill, only a little in excess of the corresponding quarter, and at the end of the second quarter she received another bill, again in excess of the corresponding quarter in the previous year. She now complained at the gas-works, and thus it was six months before the authorities discovered there was no connexion between his parishioner's gas-pipes and the main. Now, from that instance they might gather many others. Since then he (the chairman) had had a most extraordinary quarter's bill. They had 15 or 16 burners, and ordinarily the gas for the year amounted to £7 or £8—never more than £3 per quarter—but this last quarter a bill had been sent in for £8, equal to 200 per cent. of an increase for the whole amount of an ordinary year's bill. Since then the school had been painted, and a great deal of extra gas had been used, and on an examination of the meter from Sunday to Sunday, he found they had only burned 3s. worth of gas, but when the account came in he knew he would be charged something like 9s. Counting the hours and weeks during which the gas was lighted, it ought not to have amounted to more than £1 19s., but instead of that he got a bill for £8. He did not intend to pay it; and as the summer was coming on, they might cut the gas off if they pleased. Some one might ask him why he did not intend to pay. Because he was certain the amount of gas represented had not been consumed. If a certain amount of air was put into the pipes, they had no right to be compelled to pay for that vitiated air. They contracted to pay for gas, and not for vitiated air. They had entered into a contract that the authorities should supply them with a good article, and that they (the public) should pay for it; but if they were supplied with a bad article, he did not think the public should adhere to their part of the contract. He did not know the truth of it, but he was told there was a particular way of forcing air into the pipes, and that the air went through the pipes and affected the meter precisely in the same way as gas would. Then they were paying for what was not gas at all. They had to pay for that which depreciated the gas and likewise increased their bills. He would ask them whether that was fair. When an account was disputed, the gas people were ready to tell them the remedy was in their own hands, and without showing who were in the wrong—for they were their own lawyers—they cut off the connected pipes from their houses and their shops, and, in doing that, they broke the contract they had entered into. If a gas consumer said he did not owe a certain bill, the onus should be with the authorities to show that he was entitled to pay it. Until that was done they had no right to cut off the gas. Supposing they allowed an account to go beyond the period mentioned in the Statute of Limita-

tion—and that was precisely the case with regard to himself—and the persons said they did not owe the money, the gas people would, without any ado, cut off the gas from their premises until the account was paid. In his case he was the only person they could intimidate, therefore they cut off his gas, thinking it would make him pay his bill. It was a most unfair proceeding. Supposing the infirmary and the workhouse authorities, did not pay their gas bills, the gas people might intimidate Mr. Fairbank or Mr. Smallman in the same way into paying the bills, rather than sacrifice the health and comfort of their patients. That was an aspect of the question that affected him, and one which, at any time, might affect any of them. Some of the facts he had mentioned were admitted by the gas authorities themselves. They admitted that the collectors might have put down what they imagined the consumers had used. If that were the case, he did not think the public were called upon to pay their bills. To show how things were conducted in the gas office, he might state that the very bill he paid two or three weeks ago had again been sent in to him, although he had the receipt in his pocket. A gentleman told him he received a blank form in a stamped envelope. That was the way the gas people did their business. He presumed this was the first time there had been a meeting in Wigan on the subject. They had been connected with the old company for many years, and they had regularly paid their bills, because they believed they were due; but now things had undergone a very considerable change, and they felt the gas authorities were not giving them the article they contracted for, and that they were charging them an exorbitant price for what was supplied them.

Mr. S. TAYLOR said a bill amounting to about £5 had been received for gas for the Scarsbrick Baptist School, many of the lights of which had not been used during the last quarter. They had had lighted two burners in one class-room for an hour four nights a week, and another burner one hour one night in the week. As he had said, the bill for those lights was £5, but for the chapel, which had 45 lights burning every Sunday, the bill only amounted to £15 for the same quarter. There was surely some explanation required there.

Mr. BIRKETT said that last summer a bill was sent to the managers of St. Catharine's Schools for £19. As that was about the time Mr. Higham left the parish, the school for two months out of the quarter was rarely used, in consequence of there being very few meetings held. Altogether no more than eight or nine jets were in use during the whole quarter, and that only on one or two occasions. Ultimately it turned out that there was a leakage between the ceiling and the rafters. It seemed that preparatory to the congregational tea party a man had been sent from the gas-works to make things right for that occasion. He perceived gas was leaking between the ceiling and the rafters, and said he would come again and rectify it. He, however, never came, and the result was that the managers of St. Catharine's Schools settled the bill by paying one-half.

The CHAIRMAN said he had lately read the Gas Works Clauses Act, and no company had any right to cut off the gas without giving 24 hours notice of their intention to do so; but in his case he received no notice, and as he was the party to whom the bill was sent, he apprehended notice should have been sent to him before the gas was cut off.

Mr. BELLIS proposed that a committee of five gentlemen be appointed to consult some eminent practical gas engineer upon the question, and to take such other steps as might be necessary to promote the object of the meeting.

Mr. J. FAIRHURST seconded the motion, which was carried unanimously, and the committee was at once nominated.

Mr. GEE said the next question was, what should they do? Should they allow the discount to lapse, and not pay the bills until some action was taken by the Gas Committee? Whatever they did, they should resolve to act in a body, or their meeting would be useless.

The CHAIRMAN said that of course remained for the meeting to decide. It was a serious and important question that Mr. Gee had put.

Mr. M'CLURE suggested their paying the bills, but under protest.

The CHAIRMAN: That would give you freedom for any further action.

Mr. BELL: I am afraid, however, a protest would not be of much use.

The CHAIRMAN: It is the feeling of the meeting to combine not to pay the bills until some satisfactory solution is given.

Mr. TAYLOR: You must remember that unless the bills are paid the gas will be cut off.

Mr. WALKER: But the Gas Committee cannot afford to cut them all off. They will never put in mine again if they once cut it off.

The CHAIRMAN: As regards myself, I will not pay my school bill. I will stand by myself in that respect.

Mr. WALKER: I propose that we refuse to pay until they make some deduction.

Mr. FORT suggested that the committee appointed should wait upon the Gas Committee.

The CHAIRMAN said that as they were animated with one feeling, it was a question whether they could be beaten. The chance of success was in united action—if there was any difference of opinion they could not succeed. Their meeting that night was a representative as well as an influential one, and many large consumers were present. As he had previously said, the gas people had no right to cut off any one's gas without giving at least 24 hours notice, but in many instances, and among the poor, it was cut off without any notice whatever being given. Such practices, however, were totally illegal. Recently the gas authorities at Southampton and Blackburn had been proceeded against for cutting off the gas, and both of them lost the day; the Court ordered them to pay the damage, and, as compensation, 5s. for every day the gas had been cut off.

Mr. EDWARDSON said the committee would, with the least possible delay, obtain the opinion of some eminent gas engineer, and advise their friends what to do in the matter.

Mr. BELLIS suggested that they should get up an indignation meeting to be held in the public hall, and doubtless many small consumers would come forward and tell them how their bills had also been enormously increased. He did not think the dissatisfaction simply rested with the tradesmen. A gentleman in the room had told him that one cotton-spinner's quarter's bill was £100 in excess of the corresponding quarter in last year.

Mr. HURST said he had seen some working people that day who had told him their gas bills were double what they used to be.

Mr. J. FAIRHURST said he had been told by a cottager in Frog Lane that the increase among the working people in that neighbourhood was equal to 60 per cent., and that if a public meeting was held he would make it his duty to make a house-to-house visitation for the purpose of ascertaining the exact amounts.

Mr. WALKER said they should wait till they had consulted some gas engineer before they called a public meeting.

Mr. HOWE suggested that the thing should be deferred until they saw what explanation was given at the next quarterly meeting of the Town Council, which would be held on the first Wednesday in February.

Mr. GEE proposed that a public meeting be called, but that the arrangements be kept in the hands of the committee.

Mr. BIRKETT seconded the motion, which was carried unanimously.

A vote of thanks to the Rev. P. Hains for presiding terminated the proceedings.

PARA GAS COMPANY, LIMITED.

The Ordinary General Meeting of Shareholders was held at the Offices of the Company, Mildmay Chambers, 82, Bishopsgate Street, London, on Thursday, the 25th inst.—JAMES BRICKWELL, Esq., in the chair.

The SECRETARY (Mr. T. S. Borradaile) having read the notice of meeting, the following report and statement of accounts were submitted:—

The directors beg to submit the usual statement of accounts and balance-sheet for the half year ending Sept. 30, 1876, on examination of which it will be seen that the profits added to the balance brought forward from the accounts of the 31st of March last aggregate £5475 4s. 3d.; of this amount the interim dividend has absorbed £1668 14s., and, after making provision for bad debts, the amount now available for division amongst the proprietors is £4612 9s. 2d. This will admit of a declaration of dividend of 4½ per cent. per annum, carrying forward a fair balance; but the directors recommend to the shareholders that the dividend to be declared should not exceed the rate of 4 per cent. per annum (which, with that paid in March, will make 3 per cent. for the year), such dividend being payable at such date as may be decided upon by the shareholders at the ordinary general meeting, to be held on Thursday, the 25th inst.

The improvement shown in the present accounts is chiefly owing to lower prices paid for coal and freights, the reduction of the debenture interest, and the strictest care in the supervision of the expenditure.

The letters received from the engineer and manager (Mr. Louis Penny) continue to be satisfactory, and the works are maintained in efficient condition.

In accordance with the powers vested in them, and after careful consideration, your directors declared an interim dividend at the rate of 2 per cent. per annum on the paid-up capital in June last.

As it is found that the half-yearly meetings of the company are but very poorly attended, that certain expenses consequent upon them can be avoided, and that half-yearly accounts are not so satisfactory to shareholders as the former annual statements, the directors propose to recommend the discontinuance of the half-yearly meetings.

Two of your directors—namely, Captain J. Walrond Clarke, and Mr. George Whitfield retire by rotation, but are eligible for re-election, and offer themselves accordingly.

Mr. Philip Crellin, the auditor of the company, likewise retires from office, but being eligible also offers himself for re-election.

Dr. General Balance-Sheet, for the Half Year ending Sept. 30, 1876. Cr.

Authorized capital	£175,000 0 0	Works, including extensions, furniture, &c.	£142,754 10 2
Less not taken up	8,130 0 0	Gas-fitting capital on March 31, 1876	£11,039 8 9
	£166,870 0 0	Extensions to date	93 16 8
Debiture loan	5,000 0 0	Value of stock in Pará	4,066 11 8
Fire insurance-fund	717 5 7		£15,199 17 1
Bills payable	859 2 2	Less gas-fittings sold, &c.	170 2 10
Sundry creditors in London	742 13 6	Lighter capital	1,732 14 11
Ditto in Pará	483 15 8	Stores	1,933 15 5
Gas-fitting rental reserve-fund to March 31, 1876	£299 7 5	Coals	3,673 13 8
Add reserve for the current half year, less expended in repairs	100 4 2	Sundry debtors in Pará	11,057 0 4
	399 11 7	Mauá and Co. (in suspense)	112 14 9
Profit and loss account	4,612 9 2	Cash at Pará bankers	167 0 8
		Ditto Glyn and Co.	405 6 0
		Petty cash (London)	4 11 5
		Ditto (Pará)	0 8 1
		Bills of exchange, in hand	2,813 8 0
	£179,684 17 8		£179,684 17 8

Revenue Account.

Coals & wood for carbonizing	£3,578 6 11	Public lamps, &c.	£5,736 17 2
Wages, including lamp-lighting, purification, and carbonizing	2,070 10 2	Private lights	3,560 7 9
Salaries	720 5 8	Public establishments	258 5 9
Sundry charges	63 11 6	Illuminations	104 7 10
Retorts	277 2 7	Fitting-rental	152 11 5
Repairs	207 3 10	Meter-rental	204 8 5
Office expenses, stationery, printing, &c.	123 9 7	Lighter revenue	193 10 0
Law charges	17 4 5	Coke	1,242 8 3
Gas-fitting revenue and expenditure	400 15 4	Tar	111 9 0
Interest and discount	23 15 10	Exchange	27 6 4
Debiture interest	150 0 0	Rent and taxes	137 9 2
Directors fees	300 0 0	Transfer fees, &c.	3 5 0
Profit & loss account (profit)	3,800 0 3		
	£11,732 6 1		£11,732 6 1

Profit and Loss Account.

Interim dividend declared	£1,668 14 0	Balance brought forward from March 31, 1876	£2,675 4 0
Bad debts to this date	£126 15 0	Revenue account (profit)	3,800 0 3
Less recovered during the half year	45 8 8		
	81 6 4		
Moiety of amount due by Messrs. Mauá and Co., considered loss	112 14 9		
Balance carried forward	4,612 9 2		
	£6,475 4 3		£6,475 4 3

The CHAIRMAN: Gentlemen, before asking your sanction to the report, I should like to make a few remarks in reference to our operations. The directors consider that there should be no secrets between them and the proprietors; and this being our annual meeting, I shall be glad of the opportunity to inform you how it is we are in a somewhat better position than when we met you here a twelvemonth ago. I cannot do better than begin at the beginning, and that will take us to the works themselves. And here I will speak first of some of the advantages we had obtained. Take coals for instance. The coals and wood carbonized in the corresponding half of 1875 cost £4226; last half year they cost £3578, effecting a saving of £648. The canal that we used in the previous year cost us something like 90s. per ton; common coal and wood were also very dear. In the year 1876 we effected a considerable saving in the price of both coal and canal, the cost of wood remaining about the same. In 1875 the coal carbonized in the half year was about 1600 tons; last half year it amounted to about 1850 tons. The saving in the cost of coal last half year was nearly equal to one-half per cent. on our dividend. The next item in which we have effected a saving is that of salaries, amounting to £154; and I may here state that we find our new manager fully equal to the anticipations we had formed of him. The item of wages is very similar in amount to that shown in the previous year's accounts; if any change, there is a slight diminution. Coming now to the balance-sheet, I cannot do better than refer you, in the first place, to the amount we have had to pay annually for borrowed money. You will recollect that we borrowed £10,000 at 10 per cent. That amount has been paid off, and the sum of £5000, at 6 per cent., has been issued in its place. We have in this way effected a saving of £700 per year, a not inconsiderable amount, considering the position in which we are placed. There is due in Pará the sum of £11,057. This is a very large sum, and it is in excess of the former year, when it stood at £9579; and perhaps it may not be out of place to make a remark as to how the amount has so much increased, because in the fact of always having so much money overdue lies one of the difficulties we have had to encounter. I trust, however, that the

course adopted by the board, and the rigid instructions they have given to their manager, will have the desired effect of reducing this item. At the time our accounts were made up the Government owed us something like £7000, in addition to the current account. We are not in any doubt as to the security of the amount; we believe it to be as good an asset as we possess, but there is a difficulty as to when we shall come into possession of it. I am happy to state, however, that since this report was put into your hands we have received £2000, so that the £7000 is now reduced to £5000. There is, however, the current account to be added to this, so that the amount still due to us by the Government is about £7000. We believe that the promises that have been so repeatedly made to us, more particularly those lately received, will be fulfilled better in the future than on former occasions. We therefore hope on, because we feel that, as to its ultimate payment, the money is secure. The next matter I have to refer to is one which was before you on a former occasion, and which, I regret to say, remains in the same position. It is the amount of loss sustained by the failure of Messrs. Mauá, the bankers. Our account with them was £225 9s. 6d., and, looking at the condition of their estate, we have felt ourselves under the necessity of writing off a moiety of that amount in our present balance-sheet, the remaining £112 odd we have reason to believe we shall receive. And this brings me to make a remark upon the revenue account; and with reference to our receipts, I am pleased to tell you that, though the progress is slow, we are gradually increasing the amount. It is to be regretted that, although some improvement has taken place at Pará, the trade of that city is still anything but what we could wish to see it. In the public lighting there is a small advance—the increase for the half year being £72 3s. 4d., which, I think, has chiefly arisen from the energetic conduct of our manager there—in other words, we have not suffered during the past year from the severe fines to which we were exposed in former times. This I consider is very satisfactory. The next point I touch upon is even more satisfactory, and that is the condition of our private lighting. We have had an increase in this department, amounting to £304 11s. 11d., and as twelve months ago we were looking rather to a decrease than an increase, I think this is a very pleasing feature in our accounts. The fact is, we do not hear so much now, as we did then, of the use of kerosene. In the "Public establishments" there is also a slight increase—between £40 and £50; and the receipts from "Illuminations" have certainly not retrograded. The next item is "Meter-rents," and when I tell you that we have received an extra £20 on this account, you will see at once that we have now more consumers or larger meters in use, the fact being that we have both. The last item is that of "Coke sales," and I am equally glad to tell you that coke, which, not only in this country, but almost everywhere, is a drug in the market, has been sold better in Pará than before, we having realized an extra £100 by its sale in the last half year. Our manager, in his last despatch, wrote in good spirits on this subject, and said his coke was going off pretty freely. He has been able to enter into two or three favourable contracts with the owners of steam-vessels for the supply of coke, and for which he gets good prices. They take a fair quantity, and this keeps down his stock, so that he is enabled to get a better market for the remainder than he would otherwise obtain. Taking all these little local matters into consideration, I think we may regard this part of our report as satisfactory. I will now refer to our position with regard to dividends. Six months ago, you will recollect, the board paid an interim dividend at the rate of 2 per cent. per annum. That absorbed £618 14s. Having provided for this, and also for bad debts, the sum we have in hand this day is £4612 9s. 2d., which is equal to a dividend at the rate of 4½ per cent. Such a dividend would absorb the sum of £171 15s., leaving us with a balance of nearly £550. But we strongly recommend you not to divide the whole of the amount, but that you should be content with a dividend on this occasion at the rate of 4 per cent.—i.e., 2 per cent. for the half year. This will absorb £3337 8s., leaving a respectable balance to be carried forward to the next account. There are one or two other matters in the report to which I might allude, more particularly that which refers to the holding of half-yearly meetings, and I am glad to see one or two gentlemen present who have expressed themselves strongly on this point in past times. The experience of the directors is that they cannot render such detailed accounts of the operations of the company at the semi-annual meeting as they could desire, and, therefore, they have inserted a clause in the report, embodying their recommendation that those meetings should be abandoned. At the same time, if it is the wish of the proprietors generally that they should be continued, the board will be only too happy to carry that wish into effect. I now move—"That the report and accounts of the directors, as presented to the meeting, be approved, adopted, and entered on the minutes."

Mr. WILSON seconded the motion, which was put and carried unanimously.

The CHAIRMAN moved—"That the interim dividend paid to the shareholders at the rate of 2 per cent. per annum, for the half year ending the 31st of March last, be and is hereby confirmed, and that a half-yearly dividend to the 30th of September last, at the rate of 4 per cent. per annum, free of income-tax, be declared, payable to the shareholders on and after the 1st of March next."

The motion was duly seconded and carried.

On the motion of the CHAIRMAN, seconded by Mr. H. P. STEPHENSON, the retiring directors—Captain J. W. Clarke and Mr. George Whitfield—were unanimously re-elected; and, on the motion of the CHAIRMAN, seconded by Mr. GEORGE, the auditor—Mr. Philip Crellin—was also re-elected.

The CHAIRMAN then moved, and Mr. TATHAM seconded, a motion to the effect that the half-yearly meetings lately held be discontinued for the future.

Mr. WHITE said he presumed, from what had been stated by the chairman, that the holding of half-yearly meetings was not provided for in the Articles of Association.

The CHAIRMAN said it was not, and apart from the question of the increased work which the holding of the meetings occasioned, the directors felt it was more satisfactory to present to the shareholders the results of their operations for a whole instead of a half year when they met them.

Mr. STEPHENSON asked what the proposition of the board involved. It might be, and probably was, desirable to omit the meetings in the summer months, when many shareholders were away from town, and there was a difficulty in obtaining a quorum, but if the passing of the resolution carried with it the omission to make up stocks and circulate the accounts half-yearly, and the non-payment of the interim dividend, he thought it would be detrimental to the interests of the shareholders.

The SECRETARY, being appealed to, said that before the arrangement was made for holding half-yearly meetings, the accounts were received from Pará half yearly, and the books in the London office were made up half yearly; and a statement of the affairs of the company submitted to the directors, so as to enable them, as required by the Articles of Association, to declare an interim dividend; but the accounts were never circulated amongst the shareholders until the close of the financial year, when the annual report was presented, and the interim dividend approved.

Mr. WILSON urged upon the board the importance of having the stocks taken, and the accounts made up half yearly. In the present prosperous condition of affairs his remarks could not be considered inimical to the

directors. With regard to the half-yearly meetings, which he had always advocated, he was prepared to abandon his position, if the shareholders generally thought the meetings undesirable; but he reminded them that a retrograde condition of affairs might arise, in which it would be desirable that the board and the shareholders should have such an opportunity of consulting together as was thus afforded. As to the accounts, he admitted that, as far as they went, they were perfectly clear; but he conceived that they did not go far enough. In his opinion every gas company should present their accounts in a form similar to that adopted by the metropolitan companies, which showed exactly the quantity of coals received, carbonized, and in stock, the quantity of gas produced, and the returns for secondary products. The shareholders were thus placed in a condition to judge accurately of the position of the undertaking. He was pleased to see, from the report just presented, that the private lighting at Pará was extending. The basis of the company's success was the development of the private consumption of gas. No doubt the advance in the cost of kerosene had limited the competition of that means of artificial lighting with gas, and he would like to know whether any experiments had been made in Pará to show the value of kerosene in comparison with gas. He observed that coke had advanced a little in price, but did not think it was as yet what it should be, because nothing but cheap coal could compete with it in Pará. Mr. Penny seemed to be taking the right course in making contracts for the disposal of his coke, so as to keep down the stock. With reference to the purification of gas, he remarked that it involved a very considerable expenditure. He would like to ask the directors whether they had made any inquiries respecting Mr. Livesey's ammonia process of purification. At Pará the ammoniacal liquor was useless in a commercial point of view, because it did not pay to import sulphuric acid. It might, therefore, be well worth inquiry whether the process to which he had alluded could be adopted.

The CHAIRMAN said, with reference to the half-yearly meetings, the board had no very strong views, and would not attempt to force the recommendation he had read, upon the meeting, against the general wish of the shareholders. He was glad to hear the judicious remarks made by Mr. Wilson, and so far as the board could adopt his suggestions, they would be glad to do so. But it must not be forgotten, that greater difficulties existed in reference to an undertaking carried on in Pará than in one much nearer to London.

After some further conversation the resolution for abolishing the half-yearly meetings was put and carried, it being understood that the half-yearly stock taking and making up of accounts (copies to be furnished to the shareholders), with the payment of interim dividends, should be continued as heretofore.

On the motion of Mr. GEORGE, a cordial vote of thanks was given to the chairman and directors for their services.

The CHAIRMAN acknowledged the vote for himself and colleagues.

On the motion of Mr. WILSON, the thanks of the meeting were given to the secretary and the other officers of the company.

The SECRETARY acknowledged the vote.

The CHAIRMAN said he omitted to refer to one remark made by Mr. Wilson—viz., the purification of the gas by an improved process. He was aware that experiments had been made, by the talented engineer of the South Metropolitan Company, of purifying gas by the use of ammonia; but he had not heard that any practical results had yet been obtained upon a scale sufficiently large to justify the general adoption of the plan. At the Beckton and Bow works, of which he (the chairman) was a director, it had been, or was about to be, tried; and he could only assure the honourable proprietor that the directors were fully alive to the importance of that or any other process that promised to be effective and economical. The proceedings then terminated.

SALFORD CORPORATION GAS-WORKS.

A Special Meeting of the Salford Corporation was held on Wednesday last—the MAYOR (Alderman Walmsley) presiding—to consider the report of the Gas Committee (published in the JOURNAL of the 9th inst., p. 54) on the proposed alterations and extensions of the gas-works.

Mr. SHARP, chairman of the committee, proposed the adoption of the report. He said that it contemplated the carrying out of one complete scheme, at a cost of £160,000—£30,000 of which would be applied in making good deficiencies, and £130,000 in carrying out extensions. To divide the scheme into separate parts, and to carry them out separately, would be the most extravagant course that could be adopted; for, in that case, £30,000 would be spent in providing apparatus which would, perhaps, be useless when the larger scheme was completed. The money which it was proposed to expend in supplying deficiencies would not enable the committee to manufacture more gas. The whole scheme had been considered with the view to its being executed in the most economical manner, and the land had also been laid out with that view. The money spent would, he believed, realize a good per centage.

Alderman JENKINS seconded the motion.

In answer to Alderman Brown, Mr. SHARP said he hoped that at the next council meeting, or the next but one, he should be in a position to move a resolution lowering the price of gas.

Mr. MIDDLEHURST supported the motion.

Alderman LEE said he thought it would have been well if the Gas Committee had taken the council into their confidence years ago. They would not then have been placed in the dilemma they were now in, for he believed they were insolvent, and that it would be many years before the districts received anything towards their improvement accounts from the profits arising from these works. He believed the committee had lost a large sum of money on coal contracts; he hoped to have been able to say how much that loss had been, but he had not got the information; and he believed—though he had not much foundation for what he said—that their plant had been reduced so much in value as partly to account for the position in which they now found themselves. He was of opinion that for the present they should only proceed with so much of the work as was necessary to increase their purifying and cleansing power, and thus make the gas something like what it ought to be. It seemed to him there was great need for that, and also for a reduction in the price at present charged to consumers. The price of gas in the outside districts was 4s. 8d. per 1000 cubic feet. He considered that the gas ought to be made and sold at 3s. 6d. per 1000 cubic feet, and that a margin of profit should be secured at that price, because coal was cheaper now than it had been for 20 years past, and if gas could be made at a profit five or six years ago, when the price charged was only 3s. 6d. per 1000 cubic feet, he saw no reason why they could not do the same thing now. He did not wish to be obstructive to the committee; but, as a member of the council, and having public duties to perform, he was bound to express his opinions relative to anything that he thought was under unsatisfactory management.

Mr. SINCLAIR protested against the last remark.

Mr. Alderman LEE said it was not his object to injure the reputation of the committee. They now numbered among their members some of the best men in the council, therefore he had some hope; but he must say that in times past there had been considerable neglect.

In answer to a question, the TOWN CLERK stated that if the council passed the resolution they would commit themselves to only the principle

of the report. All the contracts must of necessity come before the council for confirmation.

Mr. SINCLAIR defended the action of the present committee, who were appointed about a year and a half ago, and urged that they should not be blamed for the errors of their predecessors.

After some further discussion, the council divided, six members voting against and twenty-seven in favour of the resolution, which was therefore carried.

EXPLOSION AT THE DEWSBURY CORPORATION GAS-WORKS.

On Friday morning last (says the *Dewsbury Reporter*) an explosion of an exceedingly disastrous character took place at the old gas-works, Bradford Road, Dewsbury, which works were purchased not long ago by the Corporation from the Dewsbury and Batley Gas Company. It was intended, as the large new works in Savile Town were finished, that those in Bradford Road should be discontinued, and it is fortunate that the producing power at the new works is so great as to almost render the town independent, even now, of the old ones, for the late catastrophe has undoubtedly materially interfered with the production of gas at that establishment. The works, which are situated at the junction of Mill Road and Bradford Road, consist of two medium-sized telescopic gasholders or gasometers, a retort-house of considerable size, besides the usual apparatus for purifying and registering the gas.

The noise of the explosion was heard all over the town, and over a very considerable portion of it the shock of the explosion, like that of an earthquake, was distinctly felt. Great numbers of people at once made for the scene, amongst them our reporter, who was one of the earliest. He found on nearing the place that outside there were little effects of the explosion to be seen, with the exception that numerous windows of adjacent houses, and other buildings, were broken, evidently by the concussion of the air. In one house the lower part of the window sash had been entirely blown in. On entering the yard an awful scene presented itself. From the top of one of the gasholders, the one at the south end of the yard, a large flame of gas was issuing, and smaller jets of flame were issuing from along the rivet holes. The cause of this evidently was that the concussion had so shaken the fabric as to render it leaky at the joints, and the gas had become ignited. The yard of the works was strewn with fragments of slate and rafters from the engine-house, purifying-shed, and the building where the materials used for purification are stored. Some damage had been done to the retort-house by several stone flags of the roofs having been carried away, but it was not damaged to any serious extent.

The effects of the disaster were more plainly perceived on nearing the engine-house. Here we must pause to mention that it had been found necessary to muster the *employés*, 23 in number, and call the roll, to ascertain if all were safe. This was done by one of the foremen, when it was found that John Smith, a yard labourer, residing in Springfield Gardens, was missing. It was, therefore, decided to search for him, as it was believed possible that he might be under the ruins of the engine-house, which building had, with the exception of one wall, been entirely blown down. An immediate search was made, and the poor man was discovered quite dead shortly after eight o'clock. His head was smashed, and his feet were very much bruised. Death appeared to have been instantaneous. Smith leaves a widow, but we understand he has no children. An extemporized stretcher was got, and the remains of the unfortunate man were conveyed to one of the outbuildings, and subsequently removed to his late residence. This brings us to the immediate scene of the explosion—the purifiers. These purifiers consist in the main of large iron boxes of enormous size and weight, and they were seriously displaced; and it was here that the full effect of the explosion had shown itself. The shed adjoining, containing the materials used for the purification of the gas, was considerably damaged, the roof being almost blown off; the slates were nearly all displaced, and the rafters were broken, many of them into pieces a yard or so in length. The iron casing of the scrubber was cracked, and it was noticed that the tar inside had become ignited. Besides all this damage, the explosion had forced down the wall separating the old yard from the one where the lime, iron pipes, &c., are stored. The roofs of several houses near were damaged, and the inmates were greatly alarmed. How the explosion was caused could not at the time of writing be ascertained, and probably may never be known with certainty; but some light is sure to be thrown on the affair at the inquest upon the body of Smith.

COALS AND COAL GAS IN AMERICA.

The New York correspondent of the *Standard*, writing on the 22nd ult., makes the following remarks:—

In September our domestic economists were greatly rejoiced at the breaking up of the monopoly in coal which resulted from a quarrel in the Board of Control, a ring which had managed and manipulated the trade for the mining and railroad companies for several years, gradually putting up the prices until they were extortionate. It was then predicted that the combination would soon rearrange the matter and go on with the monopoly. That prediction has not yet been verified; but two other monopolies have made decided advances since then, both in the direction of our carbon necessities—petroleum and gas.

Before giving the new monopolies, a glance at the coal question may be in place. The sale of 97,250 tons of Pittston coals at the regular monthly auction indicates a slight advance on the November rates, but not an alarming one. The November sales, by averages, were:—

Grate coal	2-64 dols.
Lump	2-67 "
Steamer	2-66 "
Egg	2-60 "
Stove	3-34 "
Chestnut	3-59 "

The sales the day before yesterday gave the following figures:—

Grate	2-82 dols.
Steamer	2-82 "
Egg	2-82 "
Stove	3-44 "
Chestnut	3-59 "

A concert of action between the producers of crude oil and the refiners was begun some months ago, and its effects are now coming to light. Behind this movement as a motive lies the fact that many citizens, especially in large cities, finding gas too expensive, were beginning again to use kerosene lights; and new patents of kerosene heating-stoves were popularizing the use of kerosene as a heating material. The understanding seems to have been between the gas makers and the petroleum miners, and partly against the refiners and wholly against the consumers, whether of gas or oil. But in the progress of the issue the refiners join the miners. The coal miners had had their ring broken, and hence stood aloof; contracts for foreign trade having been made months in advance, that trade was not immediately affected, and indeed has not yet been sensibly so. But the effects came at once to the consumers of the refined oils, especially kerosene for lamp use. The hundred vessels at this port now loading with petroleum and its products, amounting to some 400,000 barrels, were

supplied by contracts ante-dating the effective operation of this "corner," but the retail prices in this city for four weeks have shown the character of the operation mentioned. Retailers used to buy their stock at from 17 to 20 cents, and they sold it at an average of about 20. Then they had to pay—the scale rapidly sliding up during a few weeks, when kerosene stoves and winter weather both prevailed—higher prices—25, 27, 30, 34, 38, and the consumer paid prices correspondingly high, as high as 50 cents a gallon being paid not a week ago. Then it was plain that consumers would cut down their quantity, and prices relaxed a little. Yesterday we were told that the "corner" had been broken up; and to-day we are offered kerosene at 34, which may have cost the retailer more money than he asks; and we are told to hope for yet material reductions in price.

Co-operating with these operators—participants in their crime—we have the gas companies of this city, with no doubt ready followers in all the great cities, but whose plans have not transpired yet. The gas question has a twofold aspect—private or individual, and public or municipal.

The cost of manufacturing gas in this city has been something like a dollar and a half per 1000 cubic feet; but to-day, owing to a cheapening process, known as the naphtha enriching process, and to the decline in the price of coal, the cost of making 1000 feet of gas is not more than one dollar. What the profits of the gas companies—there are five of them in this city—have been (even before the recent late cheapening) may be inferred from the quotations of gas stocks. These quotations for three of the companies are for 100 shares:—

Mutual	100 dols.
Metropolitan	146 "
Manhattan	245 "

The others are not at hand. The Mutual is a new company, established in 1874. One of the companies has been paying dividends exceeding 20 per cent. for several years. The usual price of gas here is 2.50 dols. per 1000 feet. In Chicago it is 1.50; and it is between these figures in Brooklyn, Baltimore, Detroit, and St. Louis. But we are looking at New York prices just now. The crisis in gas was reached not many days ago by the rejection of the bids made by the gas companies for lighting the city for the year 1877. This rejection was the result of a discovery of the fact that there was concert among some of the companies, if not all. The corporation attorney's report on the bids, in which he advises their rejection, says—"The bids would seem to furnish conclusive evidence of collusion among the various companies by which the city is mapped out and divided up among them, and the city thus deprived of competition." There are five companies, and 19,573 lamps. The bids and numbers of lamps included in each are as follows, the price in dollars being that bid for each lamp the year, the companies to light and to put out the lamps daily:—

	Dollars.	Lamps.
New York	36.00	4142
Manhattan	36.00	4116
Metropolitan	32.00	3719
Harlem	37.50	4061
New York Mutual	36.00	3535

To contrast these bids with the prices paid in former years, the following table giving four years will suffice:—

	1873.	1874.	1875.	1876.	1877.
New York	39	33	28.00	23.00	36.00
Manhattan	39	33	28.00	23.00	36.00
Metropolitan	39	33	28.00	34.12½	32.00
Harlem	39	39	38.95	37.95	37.50
New York Mutual	—	35	29.16½	25.75	36.00

In view of the cheapening mentioned, the bids for next year appeared to the municipal authorities to be extortionate, and were consequently rejected, and other offers advertised for. The combination claimed to be discovered was among the three companies that bid 36 dols. for each lamp a year. The two other companies bid less than last year's price, and the local reasons for difference of bids are well known. The appropriation made by the city for next year's light is 700,000 dols.; but the bids of the five companies aggregate the sum of 831,000 dols. In competition with the local gas companies, a company in Boston—the Globe Gaslight Company—offer to affix their patent gasoline attachments to all the street lamps in this city, at a cost of 26.48 dols. a year, attending to all the details as the gas companies usually do. This bid falls within the appropriation, being 518,293 dols., which is some 312,700 dols. less than the aggregate bids of the gas companies. As if preparatory towards entertaining some such plan rather than submit to the imposition of the gas company combination, the city authorities passed a resolution that the Mayor, Comptroller, and Commissioner of Public Works be respectfully requested to consider the propriety of inaugurating a system for the production and supply of gas for public and private purposes, similar to that now in use for furnishing water; that, in order to provide for temporarily lighting the streets, the officers above named be requested to substitute oil or other illuminating material in the lamps of Fifth Avenue, as an experiment, and that the result of the experiment be duly reported as soon as the public interest seems to call for it. This resolution, and the call for bids—to be opened on the 28th inst.—for lighting the city for three months instead of a year, indicate that the City Fathers mean to resist the gas monopoly to the bitter end. It is expected that the gas companies will break down in some graceful way, for nobody believes their pitiful stories of losing money, and nobody is likely to believe them so long as they pay such handsome dividends.

As a matter of history, interesting in connexion with the present gas war, the price of furnishing light to the city paid the five companies by the city since 1858 may be given. The basis and figures are the same as in the tables given above in part:—

Year.	New York.	Manhattan.	Harlem.	Metropolitan.	New York Mutual.
1858	25.78½	25.00	28.80	—	—
1859	25.78½	25.00	28.80	—	—
1860	25.78½	25.00	28.80	—	—
1861	25.72½	25.00	28.80	—	—
1862	25.78½	25.00	28.80	—	—
1863	25.73½	25.00	28.80	—	—
1864	25.78½	25.00	28.80	—	—
1865	45.00½	53.00	50.00	50.00	—
1866	45.00	53.00	50.00	50.00	—
1867	45.00	53.00	50.00	50.00	—
1868	45.00	53.00	50.00	50.00	—
1869	45.00	53.00	50.00	50.00	—
1870	45.00	53.00	53.00	53.00	—
1871	45.00	53.00	53.00	53.00	—
1872	41.04½	41.04½	41.04½	50.00	—
1873	39.00	39.00	39.00	—	—
1874	33.00	33.00	33.00	39.00	35.00
1875	28.00	28.00	38.95	20.00	29.16½
1876	23.00	23.00	37.50	34.12½	25.75

UTILIZATION OF TOWNS WATER.

On Friday, the 12th of January, Mr. A. M. FOWLER, borough engineer of Salford, read a paper at the meeting of the Scientific and Mechanical Society, Mosley Street, on "The Utilization of Towns Water." After some preliminary remarks on the importance of obtaining an abundant supply of good water, he said: The distance to be traversed to obtain a supply of pure, bright spring water (containing, say, from 4½ to 5 degrees of hardness) does not now-a-days seem to be so serious a question as in the past; but when we consider how small a portion of this pure water is actually used for cooking, drinking, and washing, it is desirable to ascertain how such water can be best appropriated for our domestic use, instead of appropriating it for manufacturing and other purposes, when water of an inferior quality would do. Chemical analysis has of recent years been so fully brought to bear for the detection of pollutions in drinking and river waters that we are able, by this means, to speak with some degree of certainty as to the fitness of waters for domestic use, and for the many other purposes for which the various qualities of water may be appropriated.

Knowing the great and increasing demands for water in our manufacturing towns, and the increasing difficulties year by year of obtaining an efficient supply, I deem it desirable that active measures should be taken to meet the increased demands. The manufacturer has never been in so precarious a position as at present. Royal Commissions have been appointed from time to time, and voluminous evidence has been recorded by them with a view, no doubt, of ascertaining the best means for preventing the pollution of our rivers and streams; but nothing has been done to show us practically how to preserve our watercourses in their original state of purity; for, whilst irrigation is recommended as a means to purify foul waters, Government has declined to sanction the acquirement of the large tracts of land necessary for that purpose.

I wish to show how bright spring waters can best be preserved, and, after being used, be utilized with advantage and profit. I propose to have a second source of water supply in all large towns having a population of, say, above 20,000 inhabitants, to be appropriated for all sanitary purposes—i.e., the removal of all excreta and sewage by water carriage, the watering and cleansing of streets, flushing of sewers, for extinguishing of fires, the generation of steam, calico printers, dyers, fellmongers, and all classes of manufacture and trade, and for every other purpose except cooking, drinking, and washing.

The actual consumption for domestic purposes by the inhabitants of cottage houses amounts to about three gallons per head per day, and it may be said that the supply to the inhabitants of other dwellings amounts to five gallons per head. The supply to our large towns averages about 20 gallons per head—the smallest quantity being 15 gallons per head consumed at Norwich, 25 gallons are used at Manchester, whilst the supply to Glasgow reaches 50 gallons per head. It will therefore be seen that the actual quantity consumed for domestic purposes forms a small proportion of the large quantities of water brought into our manufacturing towns.

For the supply of water to closets attached to cottage property where the closets are outside the houses, I propose to utilize the waste water from the houses for the removal of the excreta refuse, by constructing the privy or closet at such a level outside the house that the whole of the slop and waste waters, and the rain from the part of the roof, may be discharged into and passed through a syphon-trapped pan of the closet. By this means the whole of the bright water at present used, as also the complicated machinery for the prevention of waste, will be dispensed with.

This suggestion I have fully realized in practice, and the system can be seen in the town of Longton and in West Market Street, Salford, where closets have been fitted up on this plan, and been in use upwards of two years. It has been said that they would freeze up in winter, and in summer there would not be sufficient water to cleanse them. Time has proved quite the reverse. The waste water passing through the closets is nearly ten times more than the curtailed supply admitted into the mechanical closets as required by some water authorities. I have had water-meters attached to this block of cottages, and also to a block of similar dwellings on the midden system, for a period of 140 days, and the test proves that the water supplied in each case is three gallons per head per 24 hours, thus showing that no extra town's water is used in these outside water-closets.

All local authorities are long will be compelled by the recent Government measures to construct main arterial sewers through their respective districts, and erect works to deal with the sewage in such a manner that the sewage water may be discharged from the inhabitants so as not to be offensive. In the case of Salford, the corporation have already constructed a main trunk sewer through two-thirds of the borough to collect the liquid filth of the town, and have commenced to form works for treating the sewage so that the same may be passed into the river so as not to create a nuisance. On the carrying out of these measures the river Irwell will be entirely free from pollutions from that borough.

About 20 years ago the net cost of obtaining a supply of water was from 2½d. to 3d. per 1000 gallons; but in consequence of the increase in population in our large towns, the demands of the manufacturers, and the high price of wages and materials, the cost of obtaining water must now be taken at double this rate. The cost of conduits alone is now something enormous, when we take into account the great distance water is conveyed for our use. The manufacturers in Manchester fetch their water (so to speak) 14 miles. The principal supply of water for Liverpool is obtained from Rivington, 25 miles distant, for the town of Leeds 20 miles, and Glasgow 40 miles. The works necessary to secure a quantity for all purposes and at all seasons must necessarily be of such a capacity as to admit of storing, say, in the month of March, a six months supply; hence the great cost of works.

These enormous expenses entailed in securing bright waters should not fall upon the manufacturer if it can be shown clearly that a more economical method can be adopted by which this commodity (for the purposes I refer to) can be obtained at less expense.

The supply to millowners is generally measured by meter, and no doubt this plan would be universally adopted but for the likelihood of such a condition curtailing the supply of water for sanitary and domestic use, especially to the poorer classes. The meter system is, however, advocated by many, but it appears to me that such a method of taxing a water supply is similar to the old law of taxing the number of windows to our dwellings. For we all know that light, air, and water are most essential for our health and comfort, and we cannot have too great an abundance of them.

There are about three millions of people in the valley of the Mersey; two millions are supplied with water at a cost of about £4 per head, and they are taxed at the rate of 1s. in the pound on the rental. These enormous expenses would in a great measure be reduced to the manufacturer, and the constant construction of works would be obviated by utilizing the water in our midst. By the principle I propose the cost to the millowners would be at a permanent price of 2½d. or 3d. per 1000 gallons for any quantity required, instead of, as at present, 6d. per 1000 gallons, and in a few years likely to be much higher. In addition to this the supply would be constant and abundant.

G A S - M E T E R S.

By W. J. WARNER, Chief Engineer of the South Shields Gas-Works.

[A Paper read before the Association of Foremen Engineers and Mechanical Draughtsmen of Newcastle.]

The paper which your committee has done me the honour to solicit is a very simple one, and most complimentary to my co-patentee, Mr. Cowan, of Edinburgh, and myself. It is, "A Paper illustrating the Working of our Patent Gas-Meter." Though your committee were thus very considerate in limiting the scope of the paper, yet I am almost tempted to think that they had an impression they were but inserting the key that would bind me to a general treatment of the whole subject. If so, I do not think they are to blame. The subject is one that comes home to you all; it touches the pocket of every housekeeper. It is interesting, too, though but little is known about it, and that of such a vague and general character that but few persons, comparatively, can read the index from which their bills are made out.

To meet, then, what I venture to say is the wish of your committee, I will deal with the whole subject of the measurement of coal gas, and in as simple a manner as I possibly can—arranging the matter under five heads:—

1. Standard measure.
2. Wet and dry meters.
3. The essentials of a meter.
4. The application of these essentials in the consideration of the two descriptions of Meters.
5. The results of testing large numbers of meters.

First, then, standard measure. The unit of this is one cubic foot. Now, as the weight of a cubic foot of water, at a temperature of 62° and the barometer at 30, is known to be 62·321 pounds, this weight of water drawn from a seven-gallon cask, or other vessel holding about 25 quarts, will leave a cubic foot of air in the vessel. If the vessel were connected to the outlet of a gas-meter, and the air drawn through the meter from the open inlet, the meter could be tested by such an arrangement; or if the vessel were connected to the inlet of the meter, a cubic foot would be forced through by the displacement of the air on the refilling of the vessel with water. In the first case the water would be displaced by the air, and in the latter the air by the water. Thus, irrespective of shape or configuration, we get a standard measure from any air-tight vessel; and though of the capacity of 1000 ounces which a cubic foot may be said to be, it will be found to be accurate to a drop of water, or a thousandth part of one of these 1000 ounces. With such precision is no other article sold, though one thousand thousands of these ounces are sold for 3s.

In the manner I have described the "testing gasholders" as they are called, for proving meters, are graduated. This instrument is simply a cylinder rising and falling in a tank of water; the upper end closed and air-tight, the other open to allow of the holder passing freely through the water, above which the pipe of communication with the interior of the holder is carried. To maintain a uniform pressure through the whole range of its action, a cycloid is attached to the shaft of the sheave over which the holder is counterbalanced; thus the holder may be subjected to any pressure below, at, or above the atmosphere, and such pressure will be uniform through the whole range of its action. The pressure prescribed by the Sales of Gas Act for testing meters is to be equal to that of a column of water 5-10ths of an inch high. By attaching self-indicating mechanism to the holder, it could be used as a meter, and would be one of the most simple in construction and action. The size, however, would prevent its use in a single form—the 10-feet one before you would only give about three hours supply to one ordinary burner; therefore the holder would have to be duplicated so as to have another ready for supply on the exhaustion of the first, and mechanism would have to be attached for opening and closing the cocks by the action of the holders, just as in the case of a steam-engine. Thus, you see a meter must necessarily be of a bulky form, of a complex character, and that the power to drive it is very slight.

Before going further, I may say that it is not necessary that the action of the holder should be vertical; its path of motion may be changed, as well as its form. A portion of an annulus may be used and moved from its centre. In this form a gasholder was constructed at The Gaslight Company's works in London early in the history of gas lighting, about 1813, and was called a "revolving gasholder." The shaft which carried the holder was made hollow, and passed through a stuffing-box; from this the pipes to and from the holder were carried. This was the germ of the gas-meter, to which I have now to draw your attention. Two holders were turned round a central shaft which conducted the gas to them, and to which were attached self-acting valves for opening and closing the communication between the supply-pipe and the chambers or measures, and between them and the burners. The first seven working diagrams are illustrative of this, showing the progressive steps in the development of the machine. The first being Clegg's "Revolving Gasholder." The second, two such chambers combined, forming an annular wheel, with a complex valvular arrangement; 3, 4, 5, 6, and 7 show various modifications in the form of the chambers of this wheel, by which the openings into and from them become hydraulic valves, thus dispensing with all mechanical action in valvular arrangement. The stuffing-box, too, was dispensed with by Mr. Malam, a cover was placed over one end of the wheel with an opening around the shaft, on one side of which was placed a bent pipe, through which the gas is conveyed into the hollow cover, thus materially reducing the friction of the machine.

The meter, however, still required further improvement in this respect, as the flow of gas was not sufficiently steady. Mr. Crosley effected this by changing the annulus into a wheel open at its axis, and placing the openings, or "hoods" as they are called, at the two ends of the cylinder; the inlet hoods under the hollow cover, and the outlet hoods open to the case, from which flows the measured gas.

The action of the meter was thus perfected, but the perfection of action was purchased at the cost of measurement. The measures or chambers in the annulus form were unvarying in capacity, but in the open wheel the surface of the water takes the place of the inner cylinder of the annulus, and thus every change of water-line affects the measurement; diagrams 8, 9, and 10 show this very clearly.

I must pass on, however, to the dry meter. Its prime mover—I cannot say its measuring chamber—will be best understood by substituting flexible sides for the metallic cylinder of the gasholder, and dispensing with the water. The duplication of the chambers, connecting-rods and valves, as I have explained in connexion with the gasholder, are all indispensable. Various kinds of these chambers, and various numbers of them, from 2 to 6, have been constructed and used in a more or less flexible form, but the principle is the same in all. The best form, and the one now generally employed, may be fairly represented by a pair of bellows; the valves used are the common slide, or D; but several kinds have been employed, as you will see by the diagrams, and by which you can also see their action.

The third head of my paper is "The Essentials of a Meter." They are—The absorption of a minimum of pressure; a continuous and steady flow of gas; accuracy of measurement under varying conditions; reliability and durability.

Fourthly, we have thus a measure of the comparative advantages of the two descriptions of meters in the application to them of these essentials. The first test applied to the two gives an equally satisfactory answer; in the absorption of pressure in action both are practically perfect; and it is marvellous to see these beautiful little instruments moving by simply blowing into them. In the second test we do not get the same satisfaction. The dry meter is equal to the wet in the delivery of a steady and continuous flow of gas when the instrument leaves the maker's hands, but it does not continue in the same satisfactory condition. The wet meter has but two working surfaces, the bearings of the shaft, on which the wheel revolves, and they are always under water. Not so with the dry meter. Here we find in the most simple instrument between 30 and 40 joints, without reference to the flexible leather forming the chambers, nearly all of which are exposed to the current of gas flowing from the mains, and what may be carried with it. Both leather and valves are affected; the friction, therefore, cannot be constant through each revolution, and thus the flow is interrupted and the lights made unsteady. Though this point is not second to measurement, yet it is with the measurement we are most concerned. The lights, like the pounds, will take care of themselves; it is the pennies of consumption to which we must give close attention.

The same cause here affects the measurement as the lights. The measuring chamber varies with the condition of the oiled leather, of which it is partly constructed. It stiffens, and the chamber is reduced in capacity; it becomes dry and porous, and so permits more or less gas to pass through the instrument without being measured. The valves also are liable to pass gas without being measured, by the deposit which takes place on them from the gas as it passes through the meter. They are also subject to another influence, which has passed almost unnoticed, but upon which I feel I can speak with great confidence to you—the lead and lap of the valve; now the position and condition of the valve must vary considerably in so frail and delicate an instrument.

We have here, then, structural weakness, and liability to error in principle, which cannot be remedied, nor can be found in the wet meter; but it, too, is liable to vary in its measurement, the capacity of the chambers varying with the water-line. There is, however, a great difference between the two instruments in this respect; so great, indeed, is it that (and here I would be understood to speak most advisedly) dry meters should be placed with another class of instruments than absolute measures, and considered as an "inferential meter," amongst which it may take the highest place. With such a variable chamber, and so delicate a valvular arrangement, how can there be absolute measurement?

This I submit to you, gentlemen, with your great and varied mechanical knowledge and experience, as well qualified to form a correct judgment, being free from professional prejudice on this subject. The soundness and the capacity of the so-called measures are dependent upon the condition of the leather; the soundness of the instrument, and the capacity of the measures, are also dependent upon the condition and action of the valves; the variation in the measurement cannot be otherwise, then, than unlimited—the instrument may work correctly for some years, but it may vary to the extent of 2, 3, 5, or 10 per cent. against the consumer, and it may also vary to any extent against the company.

Now place against this tin-box-full-of-complicated-gim-cracks the simple wheel of the wet meter, mechanically as simple literally as a grindstone, as rough in construction as a tin pot, and yet as delicate and as accurate as the finest balance—accurate, however, you must bear in mind, only as long as the water-line is maintained at its level—the least variation in this, as the surface of the water forms one side of the measure, and its accuracy is gone. As the water rises, the measure becomes less in capacity, the indication remaining the same as when the meter was correct, the registration is to the prejudice of the consumer; *vice versa*, by the lowering of the water-line the company is prejudicially affected. Now I do not doubt a remedy for this will at once suggest itself to you, thus perfecting this beautiful instrument. It will take this form: Make an overflow chamber, and allow the surplus to run off; the consumer will then be protected against accident or negligence, and the company can look after itself by supervision and inspection.

Now this was the state of things for a considerable length of time. The "spout" or pipe through which the gas enters the wheel was cut off at the water-line, the surplus water could thus flow down a pipe into a waste water-box, which, if not attended to, would fill and shut off the gas, thus effectually preventing the meter registering fast. To the inlet of the meter a valve was affixed, actuated by a float on the surface of the water, so that upon the water falling to a lower level, the valve closed and shut off the gas. Thus both buyer and seller were protected, the difference between the high and low level being the full extent of the variation in the registration of the meter to which it was liable.

By the Sales of Gas Act, passed about 15 years since, this is limited to 2 per cent. against the consumer, and 3 per cent. against the company—5 per cent.; and this was necessary for the action of the float in the wet meter. Although on this occasion there was a splendid opportunity for the dry meter advocates to bring their article to the front by agreeing to a lower range than 5 per cent., yet it was not taken advantage of, and so we may fairly infer that it was thought the dry meter could not be relied upon to maintain its accuracy, as all other measures are bound to do.

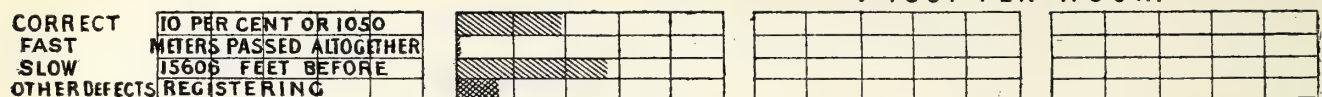
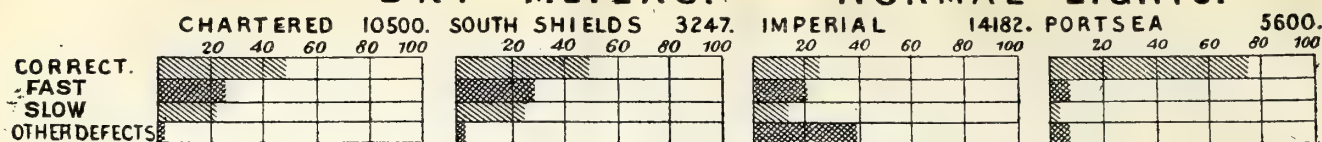
Many commendable attempts have been made to reduce this 5 per cent in the wet meter, and to obtain absolute accuracy. The proportions of the wheel were altered; it was made of less depth and greater diameter. The variable area of each chamber was thus reduced; but against this had to be placed the increased variable capacity of the hoods, which form a part of the chamber, being the passages of ingress and egress of the chamber.

Before proceeding, I would dwell upon the beautiful simplicity and adaptability of these hydraulic valves, which they really are. The simplicity is such that they have been spoken of as not being valves at all, but though only parts of the chambers, yet as they open and close the gas communications as they rise from and enter the water by the revolving of the wheel, the action must be valvular. Their adaptability consists in allowing the wheel to revolve in varying depths of water without their valvular action affecting the freedom or the measurement of the wheel. I know of nothing to equal this in the whole range of mechanics; and it comes simply from making the depths and areas of the hoods equal, and placing them on the opposite sides of the axis. Thus, at the highest water-level, the inlet hood closes sooner than when the water is lower, but as the chamber proper, or measure, is filled before this takes place, it is not affected by the closing of the hood sooner; nor is the wheel impeded, for as the outlet hood on the opposite side rises from the water, it adapts itself to the lessening capacity of the inlet hood, and so through all the changes of water-line.

To return to the attempts made to improve the meter, various arrangements were contrived to maintain the water-line at a uniform level. Supplementary vessels were employed for the purpose of feeding the meter by gravitation, floats and fountains, and by power, reciprocating scoops, and revolving buckets. All these marred, I need not tell you, the beautiful practical simplicity of the meter, and they were all, more or less, failures. Attempts have also been made to restore the annulus form of wheel.

DRY METERS.

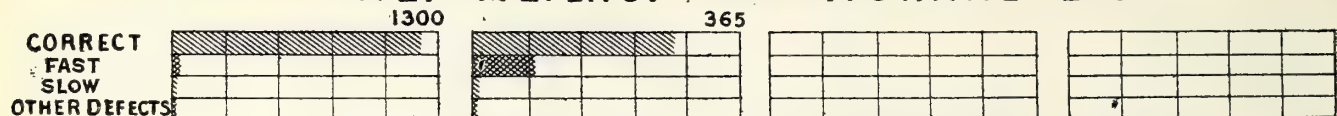
NORMAL LIGHTS.



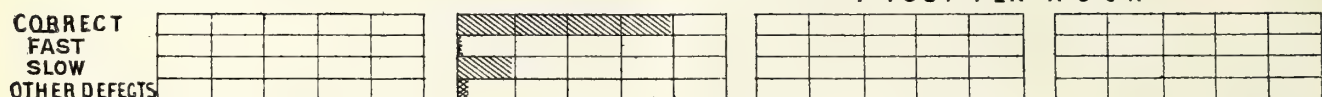
1 FOOT PER HOUR.

WET METERS.

NORMAL LIGHTS.



1 FOOT PER HOUR



RESULTS OF METER-TESTING.

These, too, have proved failures. The invention, however, of Mr. Cowan and myself restores the principle in action, but not in construction; indeed, I should say more than restores it, for the hoods would, as I have shown, cause a variation with the variation of the water-level; but, in our meter, not even this would affect the registration, and the meter remains in action as simple as the ordinary wet meter.

The principle of construction is not at all difficult to understand. A small wheel is made with its hoods and partitions arranged the opposite way to the ordinary wheel, but in every other respect like it. The small wheel is of such a diameter that its periphery is a little above the high-water line when the meter is in action, the small wheel being placed in the centre of the large wheel, and of about half its depth; thus one-half of the large wheel is an annulus, and therefore of unvarying chambers; the other half of the chamber is varying, being unoccupied by the smaller wheel; this small wheel, however, takes its supply from the measured gas in each chamber, and as the varying portion of each chamber is of the same capacity as each chamber of the small wheel, it follows as the small wheel takes its supply from the large one, that a varying volume of gas is removed by the small wheel from the larger, and thus a uniform volume of gas is measured and discharged at each revolution of the wheel. Besides the diagrams and models, a meter is in action showing the principle.

The other two essentials of a meter which I laid down are reliability and durability. Of the latter you can judge for yourselves, as both descriptions of meters are before you, but I will draw your attention to one fact—the metal of which the wheel is constructed is pure tin, and therefore incorrodible, while the dry meter is of tinned iron, and not so. I will advance no opinion upon the comparative reliability of the two descriptions of meters, but I place before you a measure of the same in the diagram on the wall. It is the tabulated results of testing between 30,000 and 40,000 meters by four gas companies: The Gaslight Company, London; the late Imperial Gas Company, London; the Portsea Gas Company; and the South Shields Gas Company. Each figure is divided into 100 parts in length; the four horizontal spaces are for the four classes, into one of which each meter has had to be placed—"Correct, fast, slow, and defective from other causes;" therefore each figure represents the true relative proportions, or per centages, of every 100 meters tested.

Though but a glance will show you the true state of things, we will look at the matter a little closer. The whole of the results, with the exception of those of the South Shields Company, are from a paper read to the British Association of Gas Managers at Leeds, June, 1875, upon the "Systematic Testing of Consumers Meters," and one of the conclusions arrived at is, "that while all meters should be periodically examined, it is imperative that with dry meters there should be a system of testing." "The Imperial Company make it their rule to test once in six years; but I," the author of the paper, Mr. Douglas, says, "soon satisfied myself that a more frequent inspection would be beneficial; I therefore fixed three years;" and he then adds that "as we have a separate tester who can manage about 3000 meters a year, and we have a little over 6000 meters in all, we manage to test every meter once in two years."

I must trouble you with these particulars that you may be in a position to estimate the value of the figures before you. His testing covers a period of 2½ years; 5600 dry meters were tested, representing 30,017 lights: the results are in per centages:—

76.8 correct.	
10.0 fast.	
4.8 slow.	
Stopped. 2.1	} otherwise defective, 8.4
Oscillating. 2.6	
Leaky 3.7	
100.0	

His opinion of these figures I will give you in his own words. They are:—"A result which, from the gas manufacturer's point of view, is satisfactory—a result beyond which, so far as registration is concerned, I do not think we should be eager to go." To you—for it must be borne in mind that the consumer has to bear the expense, as well as the annoyance, of this taking down and testing every two, three, or five years—I do not think it will be quite so satisfactory to find that in less than three years 10 per cent. register against you, though nearly 5 per cent. register in favour of others, or that just upon 25 per cent. of the dry meters fixed cannot be relied upon for 2½ years. Passing on to the Imperial Company's results, you will find a marked difference between the two.

Against the correct 76.8 is found but	26.51 of the Imperial.
" fast 10.0 we have	21.52 Imperial.
The slow 4.8 is increased to	14.27 Imperial.
Otherwise defective 8.4 is increased to	37.77 Imperial.

100.0

100.00

These figures, I need scarcely say, could not be used without some reference to the discrepancy between the two results, as both relate only to dry meters. Mr. Douglas says: "From this return it would seem that the proportion of defective meters was somewhat large; but the nature of the defects for which meters were condemned to be readjusted was trifling, showing the rigidity of the examination." This may have been satisfactory to him, but I scarcely think it will be so to you and consumers.

Now I will attempt to throw a little light upon this subject, though I am in possession of no other facts in reference to those two companies but what I have given you. We will gauge these facts by the diagrams of the Shields testing, taking first the "normal lights," or the testing of meters on the full number of lights for which they were made, as arranged under each company's name:—

	Chartered.	S. Shields.	Imperial.	Portsmouth.
Tested	10,500	3,247	14,182	5,600
Correct	48.77	49.43	26.51	48.03 { 76.8
Fast	25.50	24.54	21.52	10.0
Slow	22.60	21.81	14.20	4.8
Other defects	3.13	4.22	37.77	8.4
	100.00	100.00	100.00	100.0

The Chartered and South Shields, we may say, are the same, 50 per cent. correct of the number tested. Making every allowance for the frequent testing at Portsmouth, and admitting that this has raised the per centage to 76.8, we have to deal with the Imperial only.

Now, no one knowing the nature of the dry meter would be satisfied with the normal test only, but would have each meter tested with a small light; that is to say, one about the size of those used in small passages or sick rooms, such as you see before you, marked one foot per hour. Please note the effect of this test upon the diagram, "South Shields;" the normal lights and the one foot per hour stand thus:—

	Normal Lights	One Foot per Hour.
Correct	49.43	36.18
Fast	24.54	0.95
Slow	21.81	51.61
Other defects	4.22	11.26
	100.00	100.00

We find here, then, a loss of 13.25 on the "correct;" add this to the Imperial correct, 26.51, and it brings up the figures to 39.76.

Now you will notice a considerable increase in the "slow" and "defective" on the one foot per hour. They are higher than the Imperial by 10.90; add this to the corrected Imperial figures, 36.76, and it brings the figures up to 50.66, against the Shields 49.43, and the Chartered 48.77. It may be said, "We can see why you take the difference between the normal and the one foot, but we cannot see why you take the difference between the slow and defective of the Imperial and Shields." It is because I believe the test was a more severe one than the Imperial, and, therefore, throw more meters down in the scale. This effect you will see on the whole of the one foot per hour when compared with the normal lights. Then compare the Imperial with the one foot per hour. In the former you will find 48.03 "fast and correct," but in the latter only 37.13. The Chartered tests on a small light have not been published in the tabulated form, but the same radical defect has been found; for it has been said that 10 per cent., or 1050 meters, allowed in the aggregate 15,606 feet to pass before beginning to register.

I am afraid I shall weary you with these figures, but they really ought to be widely known. Both company and consumer ought seriously to consider whether the use of such an instrument as a dry meter ought not to be prohibited. The evidence of Mr. Johnson, the superintendent of the Chartered Company, is alone sufficient for this purpose. He says, "Out of the 10,500 meters tested, there were 2728, or 25½ per cent., fast. The average per centage of each was 4.44. Then there were 2300, or 22.6 per cent., that were slow, the average per centage of error being 8.21." Bear well in mind that this is not the full extent of the evil. Hear what Mr. Douglas says: "Of the meters fast, only 105 were over 6 per cent. fast; and of those slow, only 101 were over 6 per cent. error," so that there were upwards of 200 consumers in Portsmouth, and about 5000 in one London district alone, between which there was a difference of 12 per cent.; and upon this Mr. Douglas complacently says that "what the company lost by meters not registering sufficiently was made up by nearly the same number registering in their favour." Admitting this, is it not a gross injustice to the consumers to allow such a state of things to continue? But there are worse, much worse cases than this. I have found dry meters registering 10 per cent. fast, and others, and not a few, 10, 20, and 30 per cent. slow and upwards. But what of the wet meters? The diagrams here tell their own tale again. They stand thus in figures:—

Tested.	Chartered. 1800.	South Shields. 365.
Correct	91.40	73.70
Fast	5.39	21.09
Slow	2.71	2.74
Other defects	2.50	2.47
	100.00	100.00
One foot per hour—		
Correct		76.82
Fast		0.54
Slow		16.98
Other defects		5.66
		100.00

The Shields meters, I may say, are very old ones—between 20 and 30 years, I should think. But these, you will see, are infinitely better than the so-called improved dry gas-meter, not as many months old.

But I need not dwell further upon this. A gas-meter is now made that is unvarying and perfectly reliable, the construction of which is well known, and with which we have had 50 years experience—need I say I allude to the wet meter principle, with the improvements of Mr. Cowan and myself?—improvements that leave the meter as simple and durable as of old, but of unvarying capacity under every condition of water-line. The report upon a dozen 5-light meters sent to a large town a short time since has just come to hand from the company. Seven are absolutely correct, and five vary only to the extent of half per cent. under all the changes of water-line, 7 gills of water being drawn off each meter.

There is now, therefore, no reason why gas should not be sold as other articles—by measure, absolutely correct, unvarying, and with a periodical testing of not two, three, five, or six, years, but ten years, and then ten might again be added to this, without the least fear of the interest of either company or consumer being prejudiced as long as the meter continued to work.

The meter has been called “an enigma,” “a puzzle,” “a conjuring box.” I hope you will not henceforth consider it such, but look upon it as it has been beautifully described—as an instrument that may be “set in motion by an impulse less powerful than the breathing of a new-born infant, and discharging the duties assigned to it with the fidelity of a tried servant and the accuracy of a skilful accountant. The meter may truly be described as the offspring of genius well instructed by philosophy.”

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The unsettled condition of Eastern political affairs has, in a great measure, tended to retard the further progress of that incipient improvement in the state of trade to which I have referred on several recent occasions. It was supposed that when the Conference terminated its labours, matters would be on a totally revised basis, and that merchants and other buyers would have some idea as to what they should do. This has not proved to be the case, however, and the consequence is that merchants who deal chiefly with the Levantine and Eastern markets are still holding back orders, lest the outbreak of hostilities should place them in a very disadvantageous position. This reticence, of course, largely affects the hardware industries, and in turn has a depressing influence on the iron trade. Notwithstanding this fact, however, the pig iron producers remain steadily firm in their quotations, and hold out for a slight advance for future deliveries. They are selling fairly good parcels of foundry brands of Derbyshire, Yorkshire, and Lincolnshire pig, but forge qualities do not move off very freely, owing to the quietude of the finished iron departments. At Staveley, Sheepbridge, Claycross, Stanton, Thorncliffe, Milton, and Elsecar, and a few smaller establishments, there is a steady output from the blast furnaces; the balance outside what is used on the premises being sent here or into the Staffordshire and Lancashire markets.

In pipe work there is still a fair amount of business in hand, on account of the Sheffield, Leeds, and other local undertakings, as well as for sundry London companies and provincial local boards. The brass manufacturers and makers of brasswork are well engaged, chiefly on engine brasses, water-works and gas fittings, together with general articles for the use of plumbers.

In the coal and coke trades there is a growing and most severe competition, with a consequent “cutting” of prices, which leaves a minimum of profit. Many of the district collieries remain wholly or partially flooded, and those which are in working order are only producing coal about three days weekly—a fact which indicates both lower prices and a reduction of the men’s wages. Some of the local coalowners are sending consignments into Lancashire with somewhat encouraging success.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is no very material change to notice in the position of either the coal or iron trades of this district. In both branches of industry a general tone of depression continues to prevail, with a weakness in prices indicative of a fall in values before very long, unless a revival in trade, which does not at present seem probable, should give a firmer tone to the market.

Supplies of all classes of coal are abundant, and, what is a most unusual circumstance at this time of the year, stocks are accumulating at many of the pits. Colliery proprietors, who are determined to move off their production, have in many cases to do so at a sacrifice in price, and for sales in bulk considerably less than the list rates is being taken. There has not as yet been anything like the usual winter demand for the house fire classes of coal, and the consequence is that all the better descriptions of round coal are plentiful in the market. Good Arley coal can be bought at the pit mouth at from 10s. 6d. to 11s. per ton; Pemberton four-feet, 8s. 6d. to 9s.; and common coal at from 6s. 6d. to 7s. 6d. per ton, according to quality, the latter class of fuel being very difficult to sell; and for good shipping orders extraordinarily low prices are being accepted. Burgundy and slack, except in the very best sorts, are still a drug in the market, the average selling price for ordinary burgundy being 5s. 6d. per ton at the pit, and for ordinary slack it is difficult to obtain more than 2s. 9d. to 3s. 6d. per ton, whilst the common sorts are being sold for much less than this.

In the coke trade there is no improvement to report, and prices continue weak. There is still a good deal of underselling in the iron trade of this district, second-hand lots of north country iron being offered by needy holders at very low prices, and there is so much cheap iron at present being forced upon this market that the local makers, who as a rule maintain late rates, are securing little or no new business. For Lancashire pig iron, delivered into the Manchester district, the quotations remain at 56s. 6d. to 57s. 6d. per ton for No. 3 foundry, and 55s. to 56s. per ton for No. 4 forge, less the usual 2½ per cent.; but Middlesbrough iron, delivered, can be bought at 53s. 9d. to 54s. 3d. per ton for No. 3 foundry, and No. 4 forge at 52s. 3d. to 52s. 9d. per ton. The finished iron trade is quiet, but although there is a little pushing for orders, prices show no material change;

Lancashire bars, delivered into the Manchester district, being still quoted at from £6 15s. to £7 per ton, according to quality.

A meeting of the Lancashire coal trade has been called for to-day (Tuesday) in Manchester, for the purpose of considering the advisability of forming a coal association for the protection of their interests, and a set of rules has been drawn up for approval.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

During the last week the coal ports were entirely cleared of laden sailing ships, and steamers have been kept well employed in coasting business, as the weather has been favourable to their making quick passages. The supply of steam tonnage for coasting purposes is abundant, and little more than 4s. 6d. per ton is paid to steamers to load coals for the London market with other ports in proportion.

Business is dull amongst small coasting sailing ships. Freights consequently do not alter very much. There are very few orders in the market from south country buyers at present. Best gas coals are in average inquiry; but second-class collieries, in the Durham coal district especially are shortening the vend, as a rule, wherever it is practicable to do so. The inquiry for inferior gas coals is only moderate. The iron trade of the Tees, Tyne, and Wear, however, continues to present more favourable symptoms of revival. As the prosperity of a large number of second-class collieries in the Durham district entirely depends upon the local demand for coals, if the iron trade were getting stronger no doubt the tone of the second-class coal trade would likewise improve. In the meantime, until there is some such local revival, second-class coals will not alter very much in value.

Within the past fortnight there has been a more active inquiry for the better sorts of steam coals for shipment to the Mediterranean, at prices ranging from 11s. to 11s. 6d. per ton.

Freights to the Mediterranean have advanced considerably. The figure to the Italian ports has been fully £15 per keel, and to Constantinople above that; whereas freights to Odessa for handy steamers have nearly touched £20 per keel in some instances.

The goods trade to the Continent is no better. Very little business is being transacted for forward delivery. War rumours are stopping fresh business; and but for iron steamship building, of which there is a large amount of tonnage in hand, trade would be quiet in the North of England. Chemicals, however, though they do not advance in price, are firmer in tone, and the most satisfactory aspect of the market is this, that manufacturers refuse to enter upon business for the year at the figures now quoted for immediate delivery. At present the shipments of water and gas pipes, fire-bricks, or other material of that sort, to the Continent, are extremely limited. Until the war rumours are abated, continental merchants seem indisposed to enter upon business for the year.

There is an appearance of a tolerably active spring trade in timber. The recent prices are fully sustained, but house building in the North of England seems to have been over done, and there will be a considerable apparent falling off in the inquiry for wood in that direction this year.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

It is but natural that Sir Windham Anstruther should be greatly enamoured of his Burghs Gas Supply (Scotland) Act. Addressing a portion of his constituents last Thursday night upon recent and prospective legislation, the honourable baronet remarked, in regard to the Act, that it was of far more importance than at first sight appeared, inasmuch as it illustrated a kind of home rule which he would be glad to see our neighbours in another part of the country adopt—it did away with the necessity of applying to Parliament for private bills for lighting burghs in Scotland with gas, and put the whole power for so doing into the hands of the local authority, if they chose to avail themselves of its provisions. The Act, moreover, never lost sight of the social and political axiom, which laid it down that the public good was always best consulted by a due regard for private interests—an axiom which was applicable to other things besides gas.

It may be remembered that a fortnight ago I mentioned that the quality of the gas supplied by the Hawick Gas Company had been brought under the notice of the Town Council, and by the Provost under the consideration of the directors of the gas company. Since then Mr. Smith, the manager of the works, has written to the local newspapers, stating that not a single complaint had been made to the directors throughout the whole winter, and that the quality of the gas for the last four months had an illuminating power of 32 standard candles.

The gas supplied in Glasgow during the week ending the 20th of January showed an improvement upon that supplied in the previous week. In no case was the minimum illuminating power under 25.58 candles, the highest minimum being 26.80 candles at Dawsholm, while the maximum ranged from 27.66 candles to 28.28 candles at Tradeston.

At Alexandria, in the Vale of Leven, Dumbartonshire, a somewhat novel system of raising money for lighting the public street-lamps is being resorted to. The Street Lighting Association are getting up a concert, at which a popular West of Scotland vocalist is to give an entertainment, entitled “Twa Hours wi’ Scotchmen.” The cost of gas for the winter, working expenses, &c., is estimated at upwards of £50.

The last report to hand regarding the illuminating power of the Perth gas is as follows:—Maximum, 28.82 candles; minimum, 27.70 candles; and average, 28.10 candles.

A private meeting of the Police Board of Greenock was held last Friday, when certain millowners and users of water power attended for the purpose of representing the objections held by them with regard to the rating clauses of the new Police Bill, which is now being promoted in Parliament. At present the users of water power are taxed for police purposes at the rate of 4s. per horse power. It is proposed to tax them henceforth on the annual value of their premises, or alternatively at the rate of 12s. per horse power. It is reported that the feeling of the meeting was not favourable to the views of the deputation.

It is understood that the opponents of the Perth Water Bill are most industrious in their endeavours to raise funds for the opposition in Parliament, and, as is not unfrequently the case in connexion with water bills, statements are being circulated that are not quite in accordance with fact. A statement has been issued by the Water Commissioners and the Committee of the Ratepayers, which concludes by saying that they consider themselves warranted in opposing the bill, and that they are convinced that the scheme proposed is not only unnecessarily extravagant, but is not well calculated to provide an additional water supply. It is intended to take the voice of the ratepayers on the subject by voting-papers.

In consequence of the Forgan Parochial Board, as the Local Authority of Newport, having delayed consideration of various schemes and proposals for a proper water supply for the village of Newport, a number of the inhabitants of the village have resolved to move in the matter. It is believed that the present supply of water is impure, and has been the cause of an outbreak of fever, and it is therefore considered necessary that this state of matters should be remedied without delay. A petition has been drawn up for presentation to the Board of Supervision, and it is now being

numerously signed. The memorialists seem to be in favour of having a supply of water from the Dundee Water Commissioners as soon as the Tay Bridge is completed.

A special meeting of the Police Commissioners of Thurso has just been held. The water assessment for the year was imposed at the rate of 1s. 6d. per £1 of rental, and the general opinion of the meeting was that the rate would require to be raised to 2s. 6d. per £1, so as to pay the instalments of the sum borrowed from the Public Works Loan Commissioners for the new water-works.

Large sales of pig iron have been, and are still being, made by speculators in the Glasgow pig iron market. Further reductions are expected, and hence holders are selling out their surplus as fast as possible. The past week closed with prices about 2d. per ton lower than on the previous Friday.

The coal market is very dull and lifeless. Shipping orders are very scarce, which is doubtless partly owing to the continuance of stormy weather. Prices are rather easier, but colliery owners are unwilling to reduce them any further.

SALE OF WATER SHARES.—At the Auction Mart, London, on Wednesday last, one-tenth of a King's freehold share in the New River Company was sold at the sum of £9340, and 87 new £100 shares (£85 paid) for £26,090.

AMERICAN PETROLEUM.—The shipments of petroleum from America last year, including about 40,000 barrels of Canadian oil, amounted to 236,751,446 gallons, against 221,710,049 gallons in 1875, and 222,869,010 gallons in 1874. The shipments appear to have been larger last year than in any previous twelve months; the increase is accounted for by large deliveries made to Japan and other Eastern markets.

GAS EXPLOSION AT HULL.—On Saturday week Mr. George Whitfield, the market keeper at the Hull Corn Exchange, found the gas was escaping in his back bedroom. He cut the pipe and fastened the end up. Soon afterwards he found that the gas was escaping in the front bedroom. He again cut the pipe and fastened the end up, but on applying a light to the pipe to see if it was all right, the accumulated gas under the boards exploded, smashing the windows, ripping the paper from the walls, and knocking down the ceiling of the room beneath. Mr. Whitfield was not injured.

TESTIMONIAL TO MR. RICHARD HART.—We have much pleasure in recording the fact that at a meeting held in the Town-Hall, Folkestone, on Thursday last, a testimonial was presented to this gentleman, who has been long and actively connected with the gas and water supply of the town. The mayor presided on the occasion, and the Right Hon. E. P. Bouverie handed the testimonial to Mr. Hart. It consisted of a large massive elaborately chased silver salver, a silver-gilt vase with cover, two silver-gilt claret jugs, a chased silver flower vase of exquisite workmanship, a magnificent illuminated address in the shape of an album, covered with violet velvet with metal finishings, and with Mr. Hart's monogram, in pierced metal, and a cheque for £300. On the first leaf of the address, facing the title page, was the monogram "R. H." in illuminated characters, and on the opposite side Mr. Hart's coat-of-arms, with the motto "*Via una cor unum.*" Then followed on the other page the address elegantly inscribed, and at its conclusion the names of upwards of 500 subscribers. The address read as follows:—"Record of a testimonial to Richard Hart, Esq., presented on Thursday, Jan. 25, 1877, at the Town-Hall of Folkestone, by the hands of the Right Hon. Edward Pleydell Bouverie. We, whose names are hereto appended, beg you to accept these pieces of silver plate, on which is inscribed, 'Presented to Richard Hart, Esq., on Thursday, Jan. 25, 1877, at a meeting held in the Town-Hall of Folkestone, his Worship the Mayor in the chair, by the Right Hon. Edward Pleydell Bouverie, on behalf of upwards of 500 subscribers, in testimony of the esteem of his friends and fellow-townsmen, and of their high appreciation of his eminent public services and private worth.' And the accompanying purse of money, also in testimony of our high appreciation of your private worth and public labours, and as a mark of the respect and affection in which you are held by your fellow-townsmen. Coming to reside in Folkestone about thirty years ago, you, in concert with the late Earl of Radnor, established the water-works, which have contributed so usefully to the sanitary improvement of this resort, and which undertaking has, by continued additions to the works, afforded a supply to the rapidly increasing population, and has ultimately become eminently advantageous to those who risked their capital on the faith of your administration; subsequently, although holding no official position in the corporation, you were associated with the town-clerk in introducing into Parliament the Folkestone Improvement Act, 1855, and were most instrumental in passing that measure in its various details; and when, at a later date, you became chairman of the directors of the gas-works, you caused those works to be removed from a site where they were a nuisance, to their present position, and while largely improving and extending the supply of gas, you brought the undertaking into a condition which is satisfactory and beneficial to the town; and by your foresight have secured such arrangements, that the company will be able to supply Folkestone, though it should increase to the extent which its most sanguine friends anticipate. But it is not merely as the originator and successful administrator of such and similar public works that we regard you with honour. We remember that, in your year of office as Mayor of Folkestone, in 1851, you rendered especial service to the town; you had the streets and drains improved, and you originated and continued other measures which laid the foundation of subsequent prosperity and progress. The national schools, the enlargement of the parish church, the establishment of the cemetery, are all works in which you have taken a leading part, and to which you have contributed time, money, and exertion, and no effort which your judgment has approved, to extend religious influence or educational agencies, or to promote the cause of the poor and needy, has ever wanted your cordial support, while in your public capacity order has been maintained and justice ably administered. For your indefatigable labour in endeavouring to bring about the proposed new road to Shorncliffe Station, we are grateful, and trust you may still be successful in accomplishing what we conceive will be of incalculable advantage to the town of Folkestone. We trust and hope that many long years of usefulness will yet be vouchsafed to you, and we tender to you and Mrs. Hart, and to your family, the respectful expression of our heartfelt good wishes."

THE EFFECT OF GASLIGHT ON PLANTS may be studied to great advantage at the present time in the Royal Aquarium, Westminster. It will be remembered that this edifice was intended to provide the metropolitan public with an "aquarium and winter garden," and accordingly while the entire boundary line was fitted with tanks for the domestication of fishes, zoophytes, and the rest of the inmates of the aquarium, as the contrivance is now understood, certain of the inner spaces were appropriated to groups of plants, and Mr. John Wills, the celebrated horticultural decorator, made of the place a winter garden as rich and various as the general plan admitted, to the satisfaction both of the directors and the general public. But a change has come over the scene. It is a winter garden still; that is to say, we see it profusely furnished with decorations derived from the vegetable kingdom, but the furniture has no beauty because it has no health. We see, for example, great specimen palms with about half their leafage yellow with decay, instead of grassy green with life and vigour.

We see everywhere dilapidated vegetation; we see a winter garden with an awful blight upon it, and we naturally ask ourselves for an explanation, derived from internal evidence, of the difference between the first state and the last state of that "aquarium and winter garden." It requires but a common-place comparison of the way in which the thing began with the way in which it is carried on to solve the interesting problem. The conditions have changed. When the Aquarium was opened, it was a reservoir of comparatively sweet air—sweet enough for palms, dracaenas, cycads, and many other first-class furnishing plants that are well able to endure a few hardships, even to lack of ventilation, and occasional deficiency of water. The conditions have changed. Herein is the essence of the subject and the solution of the problem. Since the building was first dedicated to the services of the public, the consumption of gas has been increased about five times. At first there were few lights, now there are many. It was a wholesome plant-house originally, now it is in one sense at least—that is, as regards the drying of the air, and the diffusion of carbonic acid and sulphurous acid gases—an imitation of the "Black Hole of Calcutta." It is well known that living plants cannot endure for any length of time an atmosphere loaded with the gaseous products of combustion. In looking round a few days back, and noting the deplorable condition of palms, tree ferns, cycads, pandanads, and the smaller and softer stuff employed in the formation of picturesque groups, it was impossible to avoid the conviction that the illumination of the building is murder to the plants. It happened at the time to be warm and sunny weather, but we could not detect a chink of ventilation in the roof, although we felt with some degree of pain the aridity of the atmosphere: the floor dry as dust, and sending up dust so freely that the atmosphere of the place was of a diluted drab colour, as is usually the case in St. Paul's Cathedral, and other large edifices that are kept dry and subject to the moving of many feet on their floors. It is not for us to cast blame on any one, but it would be the merest squeamishness to conceal the fact that a place originally intended for a winter garden has really ceased to be a garden of any sort, for the profuse use of gas, the aridity of the floors and the general atmosphere, and the neglect of ventilation, are conditions favourable only to the cremation of plants, and not a few of them have apparently passed the final stage and are past recovery. But there is apparently no lack of devotion to his task on the part of the furnisher; we see baskets in various places so furnished that the value of the plants averages from £7 to £10 per basket, and a few days back we estimated the value of the lilies-of-the-valley in the flower-beds to be at least £30, and probably they would not last in a fresh state more than three days. When we turn to such furniture as tree ferns and other first-class decorative plants that are so largely employed, the waste of money in fighting the battle against gas, dust, and destructive drought is seen to be enormous. A glance at the stalls put up for the sale of toys, and at the gas-jets of many kinds that surround them, suggests that in preparing for Christmas there must have been some amount of night work in a heated atmosphere to aggravate the evil, and thus it is easy to account for the deplorable state of many of the finest plants in the place. The subject thus painfully illustrated is one of the utmost importance, and its interest increases every day. Aquariums and winter gardens are multiplying rapidly, and it is to be feared that in many instances the inevitable conditions will be found antagonistic to the primary idea. Promoters of these institutions may, therefore, be properly warned to consider, not only what is to be attempted in the first instance, but what is likely to follow as the plan expands. In the many excellent papers we have been enabled to present from the pens of the most experienced furnishing horticulturists, the lesson has been energetically repeated that a judicious use of water, with a somewhat free ventilation, are matters of the first importance in the preservation of plants in edifices lighted by gas. It is becoming customary to light private conservatories with gas, and the enjoyment of a plant-house is very materially enhanced by such a mode of illumination. But there must also be careful management of the atmosphere to ensure a sufficient degree of humidity, and to keep the whole body of air moving, and this, of course, can only be accomplished by means of the ventilators, which should be thoroughly adapted to the case. In the early days of the Westminster Aquarium, the plants suffered but slightly, but the reduction of watering and the increase of gaslight, have altered the conditions, and it is evident that to adapt the place to the requirements of crowds of visitors, the floral attractions must be abolished, or brought within the most narrow limits.—*Gardener's Magazine.*

Register of New Patents.

426.—LAIDLAW, D., Glasgow, "*Improvements in lighting railway carriages and in the mechanism or apparatus employed therefor, the same being applicable for lighting tramway cars, ships, factories, and other buildings.*" Application dated Feb. 2, 1876. (Void by reason of the patentee having neglected to file a specification of the Letters Patent.)

The invention essentially consists in an improvement in that class of apparatus commonly known as air-gas apparatus; that is to say, in which atmospheric air is converted into illuminating gas by passing it through a vessel or vessels containing a volatile hydrocarbon, such as gasoline.

As applied to railway carriages the apparatus consists of an air-pump driven by means of a tangent screw and worm-wheel from one of the axles of the carriage, by means of which a current of air is driven into an elastic or bellows-like reservoir, one or more of which reservoirs may be arranged beneath the seats of the railway carriage, or a van containing one such reservoir of larger capacity may be used. The reservoir is acted upon by weights or springs, so as to produce at all times a constant pressure on the contained air, and thereby cause it to flow out therefrom into the carburetter in a constant, steady stream. By means of the flexible reservoir the shocks due to the shaking motion of the carriage and the pulsations of the air-pump are absorbed, and the pressure of the weights or springs thereon causing the constant flow of air produces a steady flame at the burners, through which the carburetted air escapes from the carburetter. The carburetters may be arranged beneath the seat of the railway carriages, but they are, by preference, placed in one or more of the vans.

The same apparatus may be used for lighting steam or sailing ships, tramway cars, factories, and other buildings, and in any case where power is conveniently situated for driving the air-pumps.

In place of the flexible or bellows-like air-holder, a holder constructed after the manner of an ordinary gas-holder with a water-tank may be used.

In the case of conveying the gas from carriage to carriage in trains, the pipes forming the gas connexion between the carriages are fitted with water lutes instead of screw or analogous couplings.

In case of any emergency by which a train is caused to stand so that the supply of air is not kept up, one or more hand-pumps are fitted on the train, by working which the supply is kept up until it is re-started.

562.—BRAY, H., Stoke Newington, and GROOM, E., Russell Square, London, "*Improvements in the production of gas for illuminating and for heating purposes.*" Provisional protection only obtained. Dated Feb. 11, 1876. This invention relates to the production of gas from fluid and from solid

excreta in conjunction with hydrocarbons or with other gas-producing materials, and consists in subjecting such fluid or solid excreta to the action of heat in conjunction with a hydrocarbon or other gas-producing material, the same being submitted to the action of heat in a gas-retort, and the gases resulting therefrom, being, if necessary, purified in the ordinary manner.

683.—NIEBUHR, J. F. W., Portland Place, London, "*Improvements in the manufacture of gas for lighting purposes, and in the means therefor.*" Patent dated April 27, 1876.

This invention relates to the manufacture of lighting gas from rice husks. The inventor states that hitherto it has been the practice to burn in an open fire or a furnace the husks of rice for the purpose of utilizing the heat therefrom, in combination with other fuel. It has also been the practice, where large works are situated, to throw the husks away as waste, and often a nuisance has been created thereby; but he has found by experiment that the husks of rice when burnt in a close retort are capable of producing a lighting gas of high brilliancy, and that it can be conveyed through pipes for general lighting purposes. The husks are, for the purposes of the invention, preferably placed in a clay or iron retort heated from the outside, and after the heat has been well applied a passage is opened to lead the gas from the retort to a gasometer, in which it can be stored, and from which ordinary street and other lamps can be supplied with gas. The husks may be placed in retorts in which a creeper screw can be worked to agitate the husks, and thus bring them gradually under the action of the heat for giving off the gas.

713.—PRIESTLEY, J. W., Halifax, "*Improvements in apparatus employed for heating or cooking purposes.*" Provisional protection only obtained. Dated Feb. 19, 1876.

According to this invention a Bunsen burner, or a burner of that class, is enclosed by, or received within, a tube or tubes of fire-clay, copper, or other metal, one end being open to the outer air, the other end being likewise open, but terminating within the heating or cooking apparatus. The heat resulting from the consumption of gas draws a current of air along the tube or tubes to, and in contact with, the flame, where by the more perfect combustion is effected and the heat greatly increased, and the noxious gases destroyed.

751.—WARNER, W. J., Gas-Works, South Shields, "*Improvements in apparatus for indicating and preventing the escape of gas from main-pipes and connexions, parts of which are also applicable to water-pipes.*" Patent dated Feb. 23, 1876.

This invention has for its object the reduction of loss by leakage which occurs in gas-mains, and in the junctions of services thereto, consequent upon the imperfection of the joints, or by fractures; and for means of readily testing the soundness of the same. In jointing the mains, the object is attained by increasing the flexibility of the mains through the improved formation of the joints, giving a greater longitudinal and a considerably increased axial freedom.

The invention consists, in the first place, of making the mains with a turned spigot and cast socket, the spigot being a plain cylindrical one, and the socket formed with two (or more or less) grooves of a V or taper or dovetail section. When the spigot is thrust into the socket the joint is made much in the usual way, with yarn and melted lead, which latter runs into the grooves, and retains a firm hold; but to prevent the yarn getting into the main, and to ensure a space between the end of the spigot and the bottom of the socket, a flanged ring or sleeve of lead may be used therein. Mains so jointed will, in consequence of the cylindrical form of the spigot, permit "drawing" to such an extent as to compensate for any expansion, contraction, or settlement in the mains, without destroying the soundness of the joint; or the socket may be bored, and the spigot left rough with a bead or beads, the joint being such as above described, to ensure greater freedom for settlement, and to allow, in the taking up of such pipes, the withdrawal of one from the other without destroying or injuring the pipes.

The invention, in the second place, consists in the construction of a clip or collar for the purpose of reuniting the ends of broken or fractured mains, and consists in casting the clips or collars in two longitudinal halves, the upper one of which is made with a plain longitudinal flange, and the other with a grooved one, so arranged as to clip the plain one just mentioned. The faces of the flanges and grooves are at a slight angle with the axis of the collar, or wedge shaped, so that when brought together and slid the one into the other, the two may clip and form a "thimble" or double socket around the pipe. The junction—a piece of sheet lead having been first placed round the two ends of the main—is then completed by caulking and running lead into the "thimble," filling it and the interstices between the flanges, a bead, beads, bosses, or studs being cast or formed on the inner side of the collar to strengthen the joint by clipping more effectually the enclosed pipe. Another advantage attending the use of these studs or small bosses is, that if they are cast full long, they may always be clipped off to suit the varying external diameter of pipes of the same bore to which they are applied. Instead of plain flanges and grooves, the collars may be formed with curved flanges, so as to lock into each other. These clips or collars may be made with one or more sockets or bosses cast or formed thereon, and into which other pipes or services may be inserted or screwed, without endangering the main-pipe by separation at the point of junction; they may be also made to serve most effectively in connecting ordinary branches to the mains, especially the smaller sizes. These clips may be made in more than two parts, and with one or more wedge-shaped pieces to fasten the whole together.

The invention, in the third place, has reference to the attachment to the collars before mentioned, or to ordinary mains, of a removable service or stand-pipe suitable for lighting market and other places, for taking pressures, or for any purpose where only occasional or periodical additional public lights or connexions are required. The apparatus consists of a vertical pipe, the lower end of which is fixed to the main or collar, and the upper end to a box something like a common syphon-box. Into this box is fastened a plate, having a plug or valve thereon. The valve or barrel is fitted to a fixed seat or plug capable of turning upon it, and is square on the outside, and of such size as to fit a collar made to slip over it, the joint between the collar and the plug being made gas-tight by the former being forced down upon an india-rubber washer by certain projections coming in contact with other projections formed in the interior of the top of the box which surrounds the valve and collar before described. The top of the box has a round hole, with notches or keyways on its opposite sides to admit of the projections or feathers on the collar passing through and onto the plug. To the collar is fixed the stand-pipe, which is provided with an ordinary stopcock and gas-burner or pressure-gauge at its upper end. The action of the apparatus is simple. When it is desired to make the attachment, a stand-pipe furnished with a collar, as described, is thrust down through the top of the box, and on being turned will fix or jam itself tightly, so as to remain firmly upright, and, at the same time, turn on the gas from the main beneath. The action of removing the pipe effectually shuts off the gas, thereby ensuring great security against fraud, and loss by leakage.

The invention, in the fourth place, consists in intercepting a line of

main at any convenient spot by a box or chamber divided by partitions, so as to constitute a hydraulic valve, and a case in which a meter wheel may revolve, the revolutions of such wheel, and consequently the quantity of gas passed through it, being indicated upon an index attached to the case for this purpose. The arrangement is such that when no test is being proceeded with the gas will pass by the meter without actuating it; but on a test being desired, all that is necessary is to pour water into the box or chamber sufficient to seal the valve, when the gas will be compelled to pass through the meter, and thus register its quantity. The same result may be arrived at, though not so conveniently, by introducing an ordinary hydraulic valve at any suitable place along the long line of main, and attaching one of the valves or connexions, described under the third head of this invention, to the main on each side of it. If a temporary connexion is then made between these two valves and an ordinary meter of sufficient capacity, and the hydraulic valve is sealed, the gas usually flowing at this point will be compelled to pass through the meter, when its quantity may be ascertained by an inspection of the index.

769.—GILLET, J., Melksham, Wilts, "*Improvements in steam-pumps.*" Patent dated Feb. 23, 1876.

This invention is designed to make a single-acting steam-pump capable of working evenly or nearly so at different pressures. For this purpose with the main steam valve, whereby the admission of steam to and from the respective ends of the piston is governed, there is combined a supplementary valve, and means are provided for adjusting, from without the steam chest, the position of such supplementary valve relatively to the aperture in the main valve through which steam is admitted to the cylinder, for effecting the up-stroke of the piston. The valve rod passes through a stuffing-box or gland at each end of the valve chest, and is arranged to admit of being rotated without affecting the position of the main valve, but so as, by means of a screw thread or worm on the rod, to move the supplementary valve more or less over the aperture in the main valve.

796.—BREWER, E. G., Chancery Lane, London, "*A new or improved pump.*" A communication. Provisional protection only obtained. Dated Feb. 25, 1876.

This invention essentially consists in the construction of pumps with two or doublescrews. The lower screw may be a screw with, say, four fans, each fan forming the quadrant of a circle. The rise or pitch of the screw may be varied according to the size or special requirements of each individual case. It is surrounded by a cylinder, above which there is a conical casing containing a screw with, say, four fans or blades, having a rise or pitch preferably larger than that of the lower screw, and in opposite direction. This screw may be a fixture, an arrangement found to be preferable for large pumps, especially where gravel and sludge or slush has to be raised with the water, but where water alone has to be raised a modified arrangement is in some cases advisable. Above the screw there is a stuffing-box to prevent the return of water, gravel, or slush through the centre. The driving rod to which the lower revolving screw is keyed is steadied by bearings where requisite, the number being regulated according to the depth of tube.

799.—HOWARD, J., Peckham, Surrey, "*Improvements in automatic apparatus for regulating the flow of fluids under pressure, and prevention of waste of water.*" Patent dated Feb. 26, 1876.

According to these improvements, to the main water supply tap is attached an apparatus constructed substantially as follows:—A cylinder of brass or other material having one end closed by a cover, through which is an outlet to which a tap can be attached, is fitted with two metal discs, both of them having a seating turned at one end, or a leather washer attached, one of them having a cup leather secured to the reverse end. This disc, which it is preferred should be solid, has a hole drilled through it, which is partially closed with a regulating screw. The cylinder containing the discs is fixed above the water-way of a cottage or other valve having a seating. When water is allowed to enter the pipe leading to the seating, it forces the two discs into the cylinder, and the water passes through the water-way; the upper discs being held firmly against the top of the cylinder closes the outlet through the cover, and the water forcing through the hole in the other disc pushes it down upon the seating of the water-way pipe, closing it. When the main supply tap is closed, the upper disc frees itself from the outlet, and returns to its original position. The cylinder is sometimes placed below the valve, in which case only the disc fitted with a cup leather is used, and the way through it is closed, the water to raise it being admitted by a tube attached to the water-way pipe.

831.—McEVoy, C. A., Piccadilly, London "*Improvements in gas lighting apparatus.*" Provisional protection only obtained. Dated Feb. 28, 1876. This invention has for its object to construct taps for gas-burners in such manner that each time the tap is turned on the gas issuing shall be immediately ignited. For this purpose there is combined with the tap handle an electrical contact maker, in such manner that each time the tap is turned connexion shall be established between two wires leading from the opposite poles of a battery, and an electrical current thereby caused to pass through a platinum wire or fuse above the burner, and ignite the gas. The metallic pipe by which gas is supplied may itself serve as one of the conducting wires from the battery, whilst an insulated wire is employed for the other. By this means each time gas is turned on it is at once ignited; and so soon as the tap handle is relieved from the pressure of the fingers upon it the current of electricity ceases to pass, so that the wire or fuse employed is only in action at the time required for lighting the gas.

832.—JENKIN, F., Edinburgh, "*Improvements in apparatus for regulating the flow of fluids.*" Patent dated Feb. 28, 1876.

The object of this invention is to regulate the flow of fluids in such a way that either a constant flow shall be maintained through a given pipe, or a constant pressure shall be maintained in it, as may be desired.

If the constant flow is required, the fluid is admitted into a chamber by an equilibrium valve of simple construction, separated from a second chamber by a horizontal partition through which a vertical plunger connected with the equilibrium valve works freely. When the plunger is at the bottom end of its range the valve is open, when it is at the top the valve is shut, and at intermediate points the valve acts as a throttle valve, reducing the flow as the valve rises.

The position of the plunger depends on the difference of pressure between the two chambers; the difference of pressure multiplied into the area of cross section of the plunger gives the total force tending to lift the plunger. When this force is equal to the weight of the plunger, the latter remains poised in equilibrium; if the difference of pressure increases, the plunger rises, throttles the fluid so as to reduce the pressure in the first chamber, and assumes a new position of equilibrium. The difference of pressure may be caused by an increase of pressure outside the valve or by a decrease of pressure in the second chamber; the effect is the same in both cases. Quite similarly if the difference of pressure decreases, the plunger and valve fall so as diminish the throttling action. The difference of pressure is therefore maintained constant within such limits as are within the control of the throttle-valve. A constant sized opening is provided between the two chambers, and through this the constant difference of pressure will produce a constant flow. Thus the head on either side of the valve may

vary within wide limits, and yet the flow past the valve will remain constant. The opening between the chamber may be the annular space round the plunger, so as to diminish the friction. In any case it may be made adjustable, so that any desired flow may be obtained.

842.—JENSEN, P., Chancery Lane, London, "Improvements in liquid and fluid meters." A communication. Patent dated Feb. 29, 1876.

According to these improvements the liquid or fluid enters the meter by a pipe at the bottom of the case, and leaves by a pipe preferably at one side. The inlet-pipe extends up within the case, and at the end there is a meter wheel that is upon a shaft free to rotate and move endwise in its bearings, and upon the periphery of the meter wheel are wings that extend down around the outside of the inlet-pipe. These wings are placed at an inclination, so that the water issuing laterally from the space between the meter wheel and the end of the pipe strikes thence and gives rotation to the wheel. The portions of the wings below the top of the inlet-pipe move in quiescent water, and hence form a resistance which lessens as the valve rises by the increased flow of water moving the wheel endwise, and hence the speed of revolution will be increased in proportion to the quantity of water flowing, and the registration will be accurate. There is a conical deflector at the end of the inlet-pipe to direct the water out horizontally; this is preferably upon a stationary stem and placed above the end of the inlet-pipe within the meter wheel, but it may be attached to it. One set of wings may be resisting and the other set propelling, or the wings may all be made alike, and act to propel at the upper part and resist at the lower.

847.—ELLIOTT, A., and BURNETT, C., Stockton-on-Tees, "Improvements in actuating regulating valves for steam, water, gas, and other purposes." Provisional protection only obtained. Dated Feb. 29, 1876.

This invention consists in certain improvements for facilitating the opening and shutting of valves. For this purpose a crank or eccentric is used in combination with an ordinary mushroom or other suitable form of valve, so arranged that the turning of the crank or eccentric to a certain extent in one direction shall open the valve, and the turning of it in the other direction shall shut it. The crank or eccentric is connected with or forms a part of a spindle, which passes through a stuffing-box, and to which a hand wheel or lever handle may be fixed, by means of which the valve can be opened or shut. It is preferred to make the throw of the crank or eccentric in excess of the travel of the valve, so that the valve may be opened before the crank or eccentric has made half a revolution.

848.—BANKS, C., Birmingham, "An improved tap for water and other liquids." Provisional protection only obtained. Dated Feb. 29, 1876.

The object of this invention is so to construct a tap for water and other liquids that the pressure or flow itself may be the means of closing and (until released) keeping closed the valve. This is done by bringing the flow directly upon the valve, and the means employed are as follows:—A piece of tubing so constructed or jointed as to form an elbow, is attached to the supply-pipe, and enlarged sufficiently to allow of the valve seating being formed. Against this seating comes the stop valve, which is constructed of any suitable material, and the flow of liquid constantly pressing this valve upon its seating, the normal tendency of the tap will be to be closed, and the greater the pressure of water the more securely will the tap be closed. Attached to the valve is a rod, which is passed outwards through the elbow joint, and by means of this, when it is desired that liquid shall flow through the tap, the valve is pressed away from its seating, and thus liquid is free to flow through the tap. When it is desired to stop the flow, nothing is needed but to release the pressure applied, when the stream acting directly upon the valve stops the supply.

858.—STRONG, M. H., Brooklyn, U.S.A., "Improvements in the manufacture of gas for illuminating and other purposes." Patent dated Feb. 29, 1876.

This invention is for making gas from petroleum or similar oils. There is a vertical retort filled, or partially so, with pieces of brick; these are heated to a high temperature by petroleum admitted and burned in the presence of a blast of air, preferably heated. The products are allowed to escape by a valve into a chimney; the air supply and the valve to the chimney are now shut, and the supply of petroleum is continued. The result is that the hydrocarbon is decomposed, most of the carbon deposits upon the bricks, and the hydrogen passes through the retort to a hydraulic main and gasholder. When the bricks in the retort become of too low a temperature the petroleum is shut off, the chimney damper opened, and the blast of hot air again sent through the retort, and the same is highly heated by the combustion of the carbon that had been deposited upon the bricks. When this has been consumed, the gas-making operation is resumed as before, and so the processes of gas-making and heating alternate.

It is preferred to use two retorts and two chimneys, and to alternate the operations. The heat from the combustion of the carbon deposited in one retort heats the bricks in the other retort, and burns out any carbon deposited in the flue connecting the two retorts.

The air used may be heated by pipes immersed in the coal tar that is used for the seal in the hydraulic main.

Where desired a jet of steam may pass in with the petroleum while the gas-making operation is going on, and a second supply of petroleum may be introduced into the flue, between the retorts, to produce olefiant gas to mix with the hydrogen from the retort. The retorts are to be covered with non-conducting material to retain the heat.

APPLICATIONS FOR LETTERS PATENT.

169.—TONGUE, J. G., Chancery Lane, London, "Improvements in means and processes for obtaining colouring matters from cannel, anthracite, and other coals, applicable to various useful purposes." A communication. Jan. 12, 1877.

196.—GROUD, H., Paris, "Improvements in rheometric regulators for gas-burners." Jan. 15, 1877.

209.—WATERSON, H., Birmingham, "Improvements in ratchet braces." Jan. 16, 1877.

245.—HARRIS, J., Montreal, Canada, "Improvements in rotary pumps and engines, which improvements are also applicable to rotary fans or blowers, and to the transmission of motion or power." Jan. 18, 1877.

258.—NAWROCKI, G. W. von, Berlin, "Improvements in apparatus for raising fluids." A communication. Jan. 19, 1877.

259.—TASSIE, P., Manchester, "Improvements in means or arrangements for closing the mouthpieces of gas-retorts, and in tools for applying the same." Jan. 20, 1877.

263.—HOUSSEAU, J., DEVEDEIX, E., and HOLDEN, J., Rheims, France, "A system of purifying town sewage and waters previously used in industries." Jan. 20, 1877.

272.—WALLACE, R. W., Battersea Park, and CLAUS, C. F., Great St. Helen's, London, "Improvements in the purification of gas, and the utilization of bye-products by the manufacture of secondary products therefrom." Jan. 20, 1877.

308.—BREWER, E. G., Chancery Lane, London, "Improvements in taps or valves." A communication. Jan. 24, 1877.

315.—DUFRENE, H. A., Paris, "Improvements in burners for mineral and other oil, vapour, and gas." A communication. Jan. 25, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

3010.—SMITH, W., San Francisco, U.S.A., "Improvements in fluid-meters or engines for measuring or obtaining power from water, air, or gas." July 26, 1876.

3073.—MAGNIAT, H. L., Paris, "A new or improved steam, gas, and water tight metallic joint." Aug. 1, 1876.

3376.—SIEB, P., and SCHWARZ, T., Hamburg, Germany, "Improvements in gas regulating and saving apparatus." Aug. 28, 1876.

4085.—SIEVIER, J. C. H., Holloway, London, "Improvements in the manufacture of gas, and in the apparatus to be employed therein." Oct. 23, 1876.

4459.—GENT, P., Congleton, Chester, "Improvements in and appertaining to gas stoves." Nov. 18, 1876.

4519.—GREENHILL, W., Hampton Court, Middlesex, "Improvements in connecting service-pipes with drains to prevent sewage gases entering buildings." Nov. 21, 1876.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

77.—FOTTELL, J., "Improvements in artificial stone pipes and tubes, and in the coating or lining thereof, to render them suitable for the conduit of alkaline liquids and acid products from chemical, manure, and gas-works, for sewage, saline liquids, and gas." Jan. 7, 1874.

84.—BROOKES, W. H., "Improvements in pumps." Jan. 7, 1874.

121.—BENSON, M., "Improvements in pump-valves." Jan. 9, 1874.

138.—JENSEN, P., "New or improved modes of and means and materials for the manufacture of gasholders and other vessels." Jan. 10, 1874.

207.—HUERNE, P., "An improved self-cleaning water filter and connections." Jan. 16, 1874.

219.—GRIFFIN, J. T., "Improvements in the construction of wrenches for turning pipes, bars, and other similar articles." Jan. 16, 1874.

232.—FORBES, G. H., "Improvements in the purification of gas." Jan. 17, 1874.

239.—BROADFOOT, J., "Improvements in pumps." Jan. 19, 1874.

242.—GEDGE, W. E., "Improvements in gas-burners with lateral and covered jets." Jan. 19, 1874.

246.—VAUGHAN, E. P. H., "Improvements in apparatus for generating inflammable gas by the carburization of atmospheric air." Jan. 19, 1874.

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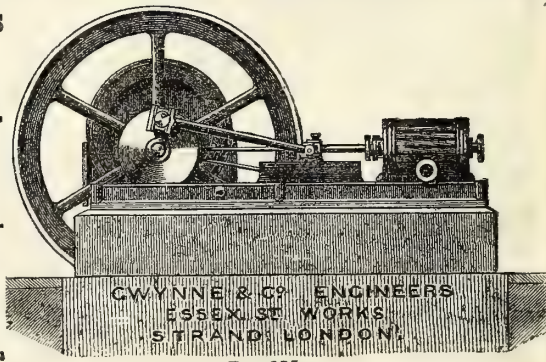


FIG. 225.

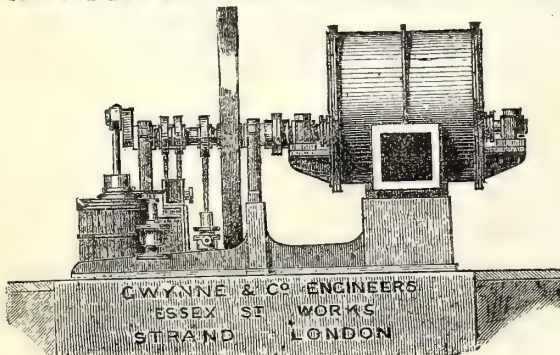


FIG. 224.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the most perfect system of action yet discovered. Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement. Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters at alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

J. P. R.—It is not correct, if stated by Sir E. Beckett in his book on building, that "gas tar rusts iron very quickly instead of preserving it." It is a well-known fact that gas tar is a preservative of metal as well as of wood.

A. LOVER OF FREE TRADING.—It does not appear to us expedient to publish your letter. Doubtless such cases exist, but we hope they are rare.

H. W. and V.—The information you require can be obtained from any respectable gas engineer.

N. T.—1. The Gas-Works Clauses Act, 1847, and the Gas-Works Clauses Amendment Act, 1871, contain all the general legislative enactments applicable to the case you name. 2. The air in the gasholder, at its lowest, must be removed by displacement. 3. You may use canal in a separate retort, bearing in mind that canal charges are shorter than those of common coal—the two gases will mix in the holder. 4. Perfectly clean gas would not become foul if passed through a third purifier which was soiled; but gas containing carbonic acid, if passed through a foul lime purifier, would take up sulphuretted hydrogen.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 6, 1877.

Circular to Gas Companies.

THE half-yearly report of the Chartered Company, which we published in our last number, and the statements of account which we print to-day, constitute together a most interesting

and important document. The gigantic undertaking works with the utmost smoothness, and the fear that some entertained, or professed to entertain, that the many parts of the huge concern could not be easily organized into a harmonious whole, may now be dismissed. How vast the undertaking is may be gathered by a careful study of the figures in these accounts; and, although the story may be trite in the estimation of some of our readers, yet, for the information of others, it may be useful to quote some figures, to show the immense dimensions that the Company have attained. When these accounts were closed, the paid-up capital of the Company, share and loan, amounted to the enormous sum of £8,101,486. We are quite justified in calling this amount enormous for a Gas Company, but it is, of course, small when compared with what is engaged in some of our large railway undertakings. When the capital of a Gas Company is stated, one of the first questions which arise in the mind is, what it would fetch if a purchase, compulsory or other, were proposed, as may possibly be the case here before long. We make only a rough guess when we say that if bought up to-morrow the undertaking would be worth, to the Metropolitan Board of Works, or whatever authority might become the purchaser, about twenty millions of money, and would be cheap at the price. The revenue of the past half year amounted to no less than £1,181,000, and it yielded a gross profit of £409,497. It results that when all interest and dividends have been paid there remains, as a consequence of the half year's working, a balance of undivided profit amounting to £43,426. It will be seen that the balance brought forward from the previous half year, and some of the profit of the past half, have been expended in commuting the annuities payable under the several amalgamation schemes. The step taken by the Directors to get off the annual charge for these annuities has been most wise. They figure in these accounts for no less than £10,369, a sum considerably smaller than appeared under the same head in the accounts of the previous half year. In the next accounts we shall find that the charge has undergone a very much larger reduction, and is, in fact, rapidly disappearing.

No direct appropriation of the undivided balance could be made, because the present Act forbids any addition to the reserve-fund while the Company are charging the initial or standard price. Now, however, that a reduction of threepence per 1000 feet has been made, the Directors will have power to place the amount to the credit of a reserve-fund.

Turning to the details of manufacture and distribution, we find that everything is proceeding in the most satisfactory manner. The quantity of coal and canal carbonized during the half year was 504,099 tons, which is a daily average of nearly 3000 tons—a quantity beyond the conception of all but instructed minds. The bulk of gas obtained was over 10,000 cubic feet per ton, and the gas per ton accounted for was something more than 9500 cubic feet, showing a leakage of only about five per cent., which, considering the vast extent of the distributing plant, and the varying conditions of supply, must be regarded as an immense success in management.

The worst feature of the revenue account is the depreciation in the value of coke shown, and as no improvement can be expected until next winter—if we ever get another winter—it is a serious matter for the Company, and we may say the gas consumer also. More of the profit must be made out of gas, and this will prevent a further reduction of the price of the commodity. It is this which will prevent the consumer from deriving all the advantage he might have from cheap coal. But, apart from the advent of cold weather, which is not now to be anticipated for months to come, we do hope for a revival of industry within a short time, which will send up the price of coke. In the meantime, it will be well for the company to exercise caution in the making of contracts.

We are glad to see that the Directors have under consideration a scheme for uniting all their manufacturing stations by means of large trunk mains. It has always seemed to us that this was highly desirable for several reasons, some of which need not here be mentioned. The risk and possibility of an accident, however, such as that which occurred at Dewsbury the other day, is sufficient to show the necessity for making such connexions that, in the event of a failure from any one station, the supply of no particular district would be affected.

An allusion to the Bill the Company are now promoting, in order to get rid of the "sulphur" difficulty, was natural, and, indeed, necessary. The Directors express a hope that the measure they have brought forward will receive public support. So far as the metropolitan authorities are concerned, they will be disappointed, for we believe it will be opposed both by the Corporation of the City of London and the Metropolitan Board of

Works. It does not follow, however, that the Bill will be rejected; but it will involve a serious discussion before a parliamentary committee, which we wish could be avoided. We shall not now attempt to anticipate the course the dispute will take; but it may be accepted as certain, that it will involve points of great interest. We shall miss the once familiar faces of old disputants when the question was raised in former years, and, as we have said, we shall not pretend to predict the result of the coming inquiry.

Oddly enough, the "sulphur" difficulty has, as another column shows, turned up in Canada. The General Act of the Canadian Legislature, against the stringency of which the Gas Companies protest was, we rather think, based, so far as the conditions of purity were concerned, on the Metropolis Gas Act, 1860, which prescribed a maximum of sulphur of twenty grains in one hundred feet of gas. With such conditions, the Canadian Gas Companies find it difficult, if not impossible, to comply, and hence the earnest remonstrance we publish. The "protestors" are not particularly fortunate in their illustrations. Dr. Versmann, we believe, based his calculations on a gas in which he discovered only an average of six grains of sulphur in one hundred cubic feet—a gas of which no living soul would think of complaining. Dr. Odling's argument, that the discomfort felt in rooms where gas is burnt is due to carbonic acid, may be taken for what it is worth, when it is remembered that carbonic acid does not deposit oil of vitriol on fabrics and materials which are susceptible of being damaged or destroyed by that corrosive agent. That much unnecessary fuss is made about sulphur in gas, every one who has thought over the subject well knows. Still, as we have many times remarked, enough is known of the consequences of its presence, to make it the clear duty of all Gas Companies to keep as much out as they can. The ammonia difficulty, we might say, is peculiar to Canada. We, in England, know well the mischief it does, and, further, how profitable it is to take it out of gas. But at present the almost virgin soil of Canada does not require much manure, and the virtue of sulphate of ammonia is not yet recognized in the Dominion. The notion that the ammonia in the gas, submitted to combustion, acts as a neutralizer to the sulphuric acid formed, is not original in Canada. We have heard the same story in this country from people who forget that ammonia may possibly be burnt to form *aqua fortis*, and so rather add to the corrosive action of the products of the combustion of coal gas. We sincerely sympathize, however, with our Canadian brethren under their difficulty. We object entirely to hard and fast lines of legislation. Gas Companies should everywhere stand on their merits, and only be compelled to do the best they can under the circumstances in which they are placed.

The report of two of the Metropolitan Gas Referees on the alleged nuisance at the Fulham Gas-Works must have been read with much interest. From that report we draw the natural and inevitable inference that the complaints made have grossly exaggerated the actual state of affairs. We are hardly inclined to agree with the Referees that the fine dust, carried, it may be, a mile from the works, occasions the complaints—we will not say causes the nuisance. Our own experience induces us to suppose that such impalpable dust, even if it consisted at first of sulphide of calcium, would, in the space of a very short time, and the limits of a very short distance, by rapid oxidation, be converted into inodorous sulphate of calcium. Everybody knows how rapidly foul lime "weathers." We have seen an immense heap of it, the emanations from which did not discolour a gate covered with lead paint not fifty yards away. The suggestions of the Referees are, however, well deserving of attention. Mr. Evans's plan is particularly worthy of adoption. On theoretical grounds we might object to the wetting of the contents of the purifiers, but, as we have had no practical experience with this plan, we make no objections to it. We only hope that the advice of the Referees will be followed, and that we shall hear nothing more of the complaints.

We publish to-day the report of Mr. H. Woodall, the able manager of the Leeds Corporation Gas-Works, on the proposal of the Gas Committee to increase the illuminating power of the gas by two candles. It will be seen that Mr. Woodall agrees with us in the opinion, that to do so would be a pure waste of money. We shall not follow his calculations, nor repeat his very ingenious argument. We take our stand on the broad proposition stated in the last paragraph of the report—viz., that supposing the proposal of the Gas Committee carried out, the Corporation would spend £10,000 a year in doing, very imperfectly, what each consumer could do for himself more perfectly, by the expenditure of a few pence. To our minds, it would be very much better if the Corporation spent a few hundreds in

taking a shop in Briggate, where they could exhibit a number of good and bad burners in operation, providing, at the same time, an intelligent attendant, who could explain matters to all inquirers. Such a plan is found to answer by the Paris Gas Company, and the lectures and illustrations of Mr. M'Crae recently quieted all complaints in Dundee.

Our readers know that the Corporation of Lichfield are very anxious to acquire the undertaking of the Gas Company, and, in order to do so, have applied to the Local Government Board for a Provisional Order. There seems, however, to have been some informality in the application, which, therefore, will stand over for this session.

The resolution adopted by the Town Council of Salford to expend £160,000 in amending and extending their gas undertaking, was not carried without some acrimonious discussion. The gas undertaking is, to say the truth, in a very bad way. It barely pays its expenses, and the ratepayers of Salford have the mortification of seeing across, on the other side of the river, a Corporation who sell gas very much cheaper, and make a large profit. The cases are not at all analogous, but there is something in the difference which might excite suspicion. Hence hints of "corruption," and the statement made by an Alderman, that he must hold his tongue, or otherwise what he might say would be actionable. We do not know much of Salford, but we understand that the gas-works have been much neglected, and that long and extravagant coal contracts have been made. The neglect may have arisen from errors of judgment, the long and high-priced coal contracts, or from some other cause. We have, however, nothing to do with either. We simply put the case before our readers in order that they may see that it is not every corporate gas undertaking which works profitably and smoothly. We honestly believe that in most cases the fault lies with a "committee," composed of individuals who know nothing whatever about the business they have undertaken, and whose ignorance only perplexes the managers whom they affect to control and guide. We might say a good deal on this subject, but we may conclude with a repetition of this general advice to Corporations with gas undertakings: Select a good manager, pay him liberally, and hold him responsible for everything. To ratepayers we would say: Trust as little as possible to committees who sit with closed doors. What is thought in Salford may be gathered from the following extract from a leading article in the *Salford Weekly News*:—"Alderman Lee says the management (of the gas undertaking) has been such as to 'verge upon criminality.' 'We do not go so far as that, but we do not hesitate to say that the gas-works of this borough have, for years, been managed quite as vilely as were any of the many municipal offices in New York. People talk about Americanizing English institutions; but, whatever might be done in that respect, we could not possibly have a much worse state of things in this country than that which in some towns exists already. What Alderman Lee was 'driving at,' as the phrase goes, when he said 'he should be sorry to say anything respecting the management in the past, for fear that he should say something 'actionable,' we can only surmise. But, if there has been something done by anybody which was not justifiable, why has it been connived at and passed over? The truth is that the gas department of the borough seems to have been worked either by committees and men, or both, who did not understand or know what it was they were doing, or by committees and men who neglected their duty to the ratepayers. It is absolutely monstrous—we might use a much stronger adjective than this and still be within bounds—that in an age of scientific improvement and discoveries, and we will add of cheap coal, the gas-works of this borough, with a capital of nearly £127,000, have not this year yielded the ratepayers one penny of profit."

Water and Sanitary Notes.

THE proposal, or rather the suggestion, is once more made, that the Metropolitan Board of Works shall take over the undertakings of the several Metropolitan Water Companies, and continue the supply of water to London. What advantage would result therefrom to the Metropolis no one professes to know. There would seem to exist a general belief that private water-rates would be lower, as they probably would be if the Board obtained possession of the undertakings; but then, in all probability, we should have to submit to a considerable "public rate," and the ratepayers would stand in just about the same case. The actual water-rate would not be altered, unless, indeed, it was somewhat increased, which would be the far more probable result of the transfer. Be that as it may, however, a

committee of the Metropolitan Board have once more to consider the advisability or not of purchasing the London Water Companies. It will probably be several months before we learn the result of the lucubrations of the committee, for the Board can do nothing in this session of Parliament; and, according to Mr. Slater-Booth, the Government have so much domestic legislation under consideration, that they have no time to think of anything—not even the reform of our local government institutions. They have enough in their pigeon-holes at present to furnish them with occupation for many sessions to come, so we may fairly expect that the Metropolitan Water Question will remain in abeyance. Still, as both the Metropolitan Board and the Corporation of London have the water supply under consideration, we may remark on two points which must come under discussion. First, the rate for a water supply. It is perfectly clear that, wanting a perfect water-meter, the charge for a supply must be based on the rateable value of the premises, which must, we candidly admit, represent the supposed capacity of the tenant to pay, rather than the value of the water consumed. If any committee of the Metropolitan Board or the Corporation of London can devise a more equitable system of payment, we shall be happy to give it our countenance; but, having looked at the matter from every point of view which has occurred to us, we fall reluctantly back on the rateable value as the only one at present available. Then, as regards purchase. We have said, over and over again, that the Metropolitan Water Undertakings can any day be bought up, if a proper price will be paid for them. Their worth, to-day, is about twenty-five millions, and they could not possibly be bought for much less. But supposing them purchased by some authority or other, then would come the question—which some parties are interested in keeping constantly before the attention of the dismal part of the metropolitan public—of the substitution of other sources of supply. Any one of the schemes at present before us would cost from five to ten millions—and some would certainly be more expensive—to carry out. Thus we may assume that, let whatever change happen, the Metropolis would have to rely on the present sources of supply. That no better could be found we confidently believe; and, further, we recognize the fact that nothing beyond careful filtration is required to make the water safe for distribution. *The Times*, we see, has taken Professor Bischoff under its wing. That accomplished chemist has a patent for filtering water through what is called “spongy iron.” We hardly know what is meant, and we forbear from making jokes, which must necessarily be bad; but this material, whatever it may be, is said to remove perfectly all “germs” from water. Scientific men, or men of science—Dr. Frankland among them—have hitherto induced us to rely on animal charcoal as an effective filtering medium. But it seems that animal charcoal somehow or other breeds worms, so that we have for the perfect purification of water to rely solely on “spongy iron.” *The Times* confers an immense favour by making this announcement to the universe. When all the water supplied to London is filtered through “spongy iron”—well, Professor Bischoff will not be dissatisfied, and no doubt *The Times* will be perfectly satisfied.

Water affairs at Richmond (Surrey) can hardly be said to have much improved since we wrote last week. The work of connecting the houses with the mains goes on slowly. It has been endeavoured to account for the laziness of the workmen by the assertion that they are bribed to be idle by the agents of the Southwark and Vauxhall Water Company. We do not for a moment believe in the truth of the statement, but some of the innocent inhabitants of Richmond do. What is really wanted at the present moment in Richmond, to stir all parties into activity, is a “good” fire. There would be no water wherewith to extinguish it, and if a large part of the ramshackled old town were burnt to the ground, none but the suffering tenants or insurance companies would have reason to regret it. We have reason to believe that a great part of the water now supplied to Richmond is taken from the Thames, about half a mile below the last outlet of the Richmond sewage system. It is received, we are told, directly from the river into the artificial lake in Kew Gardens, and from thence is pumped to a filtering-bed and reservoir in Richmond Park, and thence supplies a Royal residence and the houses of some officials. This water, we are told, though taken from the Thames, not far from a sewer outfall, is reputed as quite free from “previous sewage contamination.” As yet we do not know whether “spongy iron” is the medium through which the water is filtered.

WATER SUPPLY OF CITIES AND TOWNS.*

FIRST NOTICE.

Few works have come under our notice of greater professional importance than that on the water supply of cities and towns by Mr. Humber, and very few indeed have given us greater satisfaction in the perusal.

In the preface it is stated that the work was suggested, not so much by any deficiency in published information on the subject of which it treats, as by the entire absence of any English treatise on water supply, of extent and comprehensiveness adequate to the importance of this branch of sanitary engineering. This sentence shows fully the purpose and scheme of the author, and well indeed have the details of the work been considered and matured.

We have not been hasty in our examination of this volume, and we have been well repaid by finding in it the most complete information that can be desired on that most important subject, water supply, which is at all times one on which we feel bound to enlarge, and which, in periods of drought, takes such strong hold on the public mind.

An introductory historical sketch is followed by two grand divisions, the one embracing what is called a theoretical division, and the second the practical division. To the first are appended various formulæ necessary for the practical engineer, and to the latter numerous illustrations from executed works.

In the history of this subject allusion is made to Roman wells, such as that we have seen at Pompeii, and may we add that wells attributed to the Romans exist on the line of the Ermyng Street, a few miles north of Lincoln. We have brief but satisfactory particulars of Roman covered reservoirs at Constantinople, and also of the tanks in India, constructed previous to British rule. Of the latter, Mr. Vignoles computed that in the presidency of Madras alone there were 53,000 tanks for irrigating purposes, exclusive of smaller tanks, the aggregate length of the embankments being fully 30,000 miles, or double the length of all the railways in the United Kingdom, with more than 300,000 bridges, culverts, and sluices.

What suggestions these facts give to ourselves at this present period, when the country has suffered so much from a deluge of rain, to be followed, doubtless at no distant date, by a scarcity of that precious commodity we are now doing our best to get rid of!

We have a description of the aqueduct for the supply of Carthage, which, after a lapse of more than 2000 years, is used for more than three-fourths of its length for supplying the city of Tunis.

But more important still are the details of the water supply of ancient Rome, described tersely, but yet satisfactorily. We have given to us as a summary that in the time of Nero the aqueducts were of an aggregate length of 255 miles, and supplied an average of 50 cubic feet for each inhabitant per day. So abundant, indeed, was the supply, that Strabo says “whole rivers flowed through the streets of Rome.”

Nothing is more striking at the present day, to a traveller in this Imperial city, than its profuse supply of water—reservoirs, fountains everywhere pouring out streams of copious volume.

Quotations are given which show that the Romans were better acquainted with the principles of hydrostatics than has in our day been generally supposed, and which leave the impression that our sole advantage over them is in being able to cast pipes that will sustain a greater pressure.

The supply of Paris is examined in brief but interesting detail from the year 1550, when the inhabitants received a supply of only one quart per day, to the year 1868, when the average of the whole year is given as 46,500,000 gallons per day, or 24·6 gallons per head of the population.

The history of the water supply of London follows that of Paris, and introduces the early supply from conduits, followed by the London Bridge Water-Works, and then of the New River Company.

The mode of distribution, first by lead pipes, then by pipes of wood, and lastly of iron, and we have full details of the different sources of supply, the capacity of the reservoirs, and the size of the mains.

This part of the work is a most useful compilation, and from it we take the following abstract of the daily supply from the different water companies:—

	Gallons.
New River Company	35,000,000
Chelsea Water-Works	8,000,000
Lambeth	10,000,000
Grand Junction	10,500,000
West Middlesex	9,000,000
East London in 1871	20,437,000
Additional since that date	10,000,000
Southwark and Vauxhall	15,000,000
Kent	7,000,000

Giving a grand total of an average daily supply of 126 million gallons for this great Metropolis.

Note.—These round numbers are only approximately correct, as will be seen by comparison with the average daily returns as given in Major Bolton's reports for all the companies during the year 1876, which we append.

* REDUCTIONS IN THE PRICE OF GAS.—The Northampton Gas Company have made a reduction of 3d., to take place from Christmas last—the price is now, therefore, 3s. 6d. per 1000 cubic feet.

* “A Comprehensive Treatise on the Water Supply of Cities and Towns.” By William Humber, Assoc. Inst. C.E., Mem. Inst. M.E. London: Crosby, Lockwood, and Co., 1876.

Average daily supply—

	Gallons.
January	112,034,841
February	110,394,813
March	110,441,128
April	114,316,265
May	121,146,297
June	123,192,994
July	137,135,102
August	134,139,552
September	121,622,500
October	117,228,394
November	112,638,531
December	110,454,197

1,424,744,614

Average for the year, 118,728,718 gallons daily.

Following this come the several schemes which resulted from a Royal Commission, appointed in the year 1866, to ascertain "what supply of unpolluted and wholesome water can be obtained by collecting and storing water in the high grounds of England and Wales, and to report on those best suited for the supply of the Metropolis and its suburbs."

Particulars are given of five engineering projects submitted to the Commission, as follows:—

Mr. Bateman proposed to collect water in reservoirs in North Wales, near the sources of the Severn. The distance the water would have to be brought was a little more than 180 miles, and the conduit, as designed, was capable of conveying 230 million gallons per day, at an estimated outlay of £11,500,000.

Messrs. Hemans and Hassard proposed to supply the Metropolis from the Cumberland lakes, at a distance of 240 miles, estimating the supply at 250 million gallons per day, at a cost of £13,500,000.

Mr. Hamilton Fulton proposed to take water from the upper sources of the river Wye in Mid-Wales, at a distance of 180 miles, giving an estimated supply of 230 million gallons per day, at a cost of £9,000,000.

Mr. Remington introduced a scheme to bring water from the hills of Derbyshire, 135 miles, at a cost of £5,000,000; and Mr. Dale, of Hull, introduced a project similar to the second mentioned above, to bring water from the northern lakes.

In addition to these there are the schemes of Mr. McClean, Mr. Bailey Denton, and Mr. R. W. Mylne, and others, which may be stated as being for improving existing sources of supply.

After giving the judgment of the Royal Commission on the question of future supply—"That the River Thames, supplemented, if necessary, by works for storing the flood waters, together with the River Lea and the water obtainable from the chalk from the south and south-east of London, as well as, probably, from the lower green-sand, will furnish a supply sufficient for any probable increase of the metropolitan population; . . . that a probable increase of population of 4,500,000 to 5,000,000 may have to be provided; that 200 million gallons per day is the highest demand that need be reasonably looked forward to for the metropolitan supply," &c.—this chapter finishes with allusions to supply, and the quality and quantity of the article supplied, in these words: "In ancient Rome the daily consumption was at the rate of 300 gallons for each individual, so liberal was the use of water for baths and fountains. In the present day, 30 gallons are considered a wasteful quantity; this is the change in the estimate of what is necessary for comfort and for health! This is the progress of the last 2000 years."

A TREATISE ON THE SCIENCE
AND PRACTICE OF THE MANUFACTURE AND
DISTRIBUTION OF COAL GAS.

CXXVII.

MAIN-PIPES (continued).

Kay's ball and socket joint (fig. 29) has been used not only under

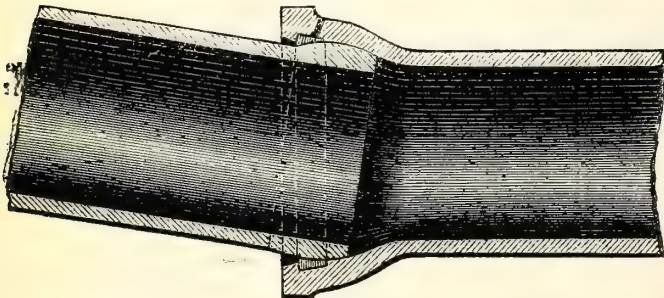


FIG. 29.

the ordinary circumstances of gas distribution, but for crossing rivers and harbours, and it is stated, such is its flexibility, that it can be paid out over the stern of a vessel after the lead is run in and caulked; and, being like a chain, it finds its own bed at the bottom of the river. To draw off the water due to condensation or other causes, a small pipe of the requisite length is inserted through a hole in the accessible portion of the main, to the near end of which a hand-pump is attached. Both the latter description of pipes are manufactured by Messrs. Thomas Edington and Sons, of Glasgow.

Another joint on the ball and socket principle, very similar to

Kay's, is that of M. Doré, which will be sufficiently understood from the annexed fig. 30. The space in front of the socket is intended to receive the lead, which is poured in and caulked in the usual manner.

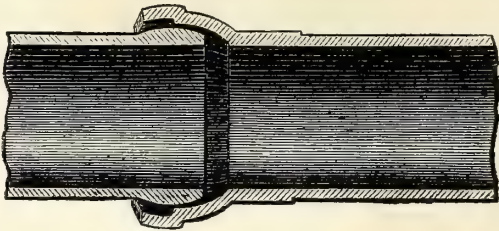


FIG. 30.

Mr. Warner's recently patented joint is shown in fig. 31. This consists of a turned cylindrical spigot, fitting loosely into an ordinary open socket, having a groove cast round its inner circumference. The

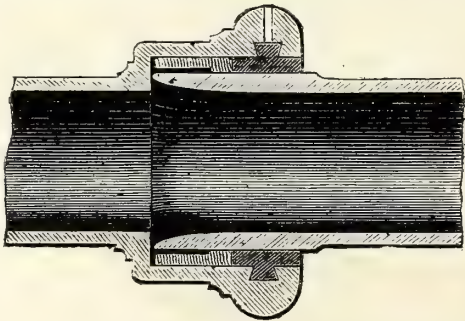


FIG. 31.

method of jointing is as follows:—A flanged sleeve or sheath of thin sheet lead is placed over the spigot; this is then pushed into the socket, and a packing of spun-yarn is caulked round it. After that a coil of greased yarn is inserted, and, a fence being placed against the lip of the socket, molten lead is poured through the hole on the top, as shown, filling up the groove and the intervening space. When this has been caulked, the joint is complete. There are several modifications of the arrangement, but the above explains fully the principle of the invention. The cost of making this is more than that of the ordinary joint, but the patentee claims the superior advantage of great elasticity, without danger of leakage, from his method of connecting.

For repairing broken mains, Mr. Warner employs a thimble in two halves, so arranged that on being placed together against the main, they slide into each other, and wedge themselves round the pipe, a piece of sheet lead being first placed over the fractured part. A packing of yarn is then inserted, and lead is run in, and caulked on both sides. Fig. 32 is a longitudinal elevation of the thimble or collar, and fig. 33 a transverse section through the middle. The

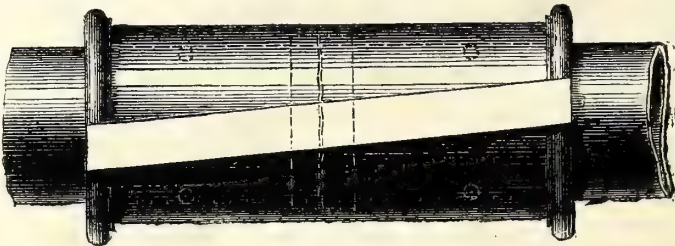


FIG. 32.

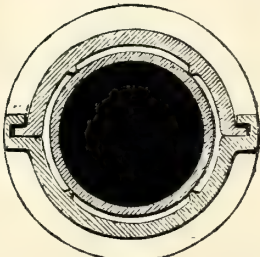


FIG. 33.

studs shown on the inner side of the collar are intended to add strength to the joint; or they answer as chipping-pieces that may be cut to suit the varying external diameter of pipes of the same bore. By the use of these collars, it is not necessary to cut out the broken pipe, as is done in the case of the ordinary thimble.

The following are the various forms of special pipes most commonly in use in the laying of mains. Fig. 34 is the ordinary quarter bend, with socket. Fig. 35 an elbow or knee-piece. Figs. 36 and 37 are eighth and sixteenth bends respectively. The latter are also called obtuse bends. Fig. 38 an S or double bend. Fig. 39 a Tee or branch-pipe. Fig. 40 the same, with the branch at an angle of 45 degrees. Fig. 41 a saddle-branch and socket. Figs. 42 and 43 clip-branches. Fig. 44 a diminishing pipe, and fig. 45 the ordinary thimble, about 16 inches long.

The due proportioning of the distributing mains for the adequate

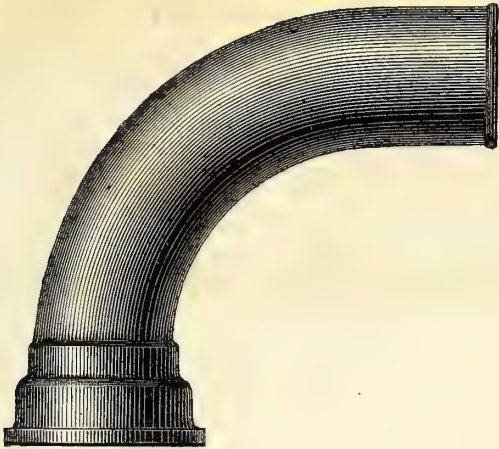


FIG. 34.

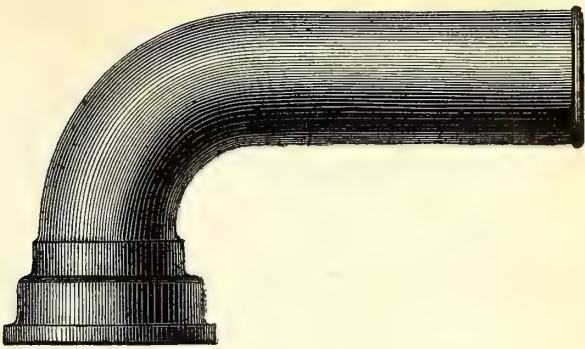


FIG. 35.

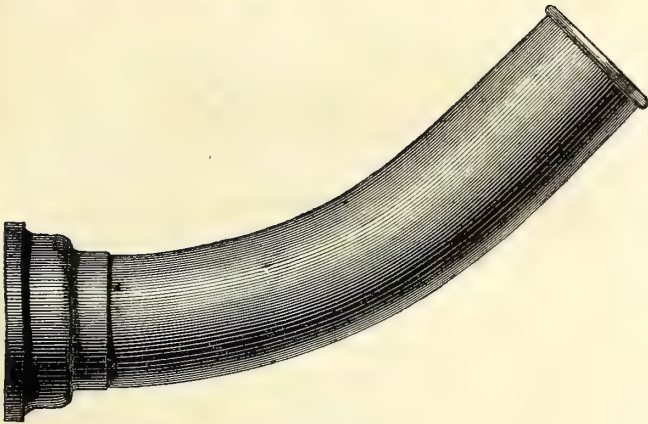


FIG. 36.



FIG. 37.

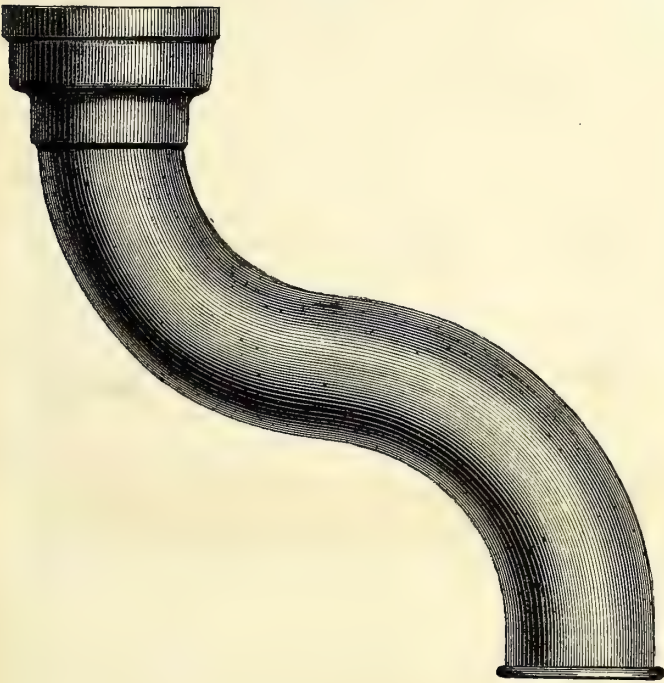


FIG. 38.

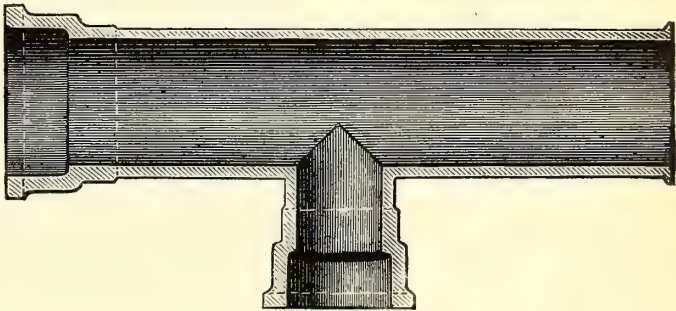


FIG. 39.

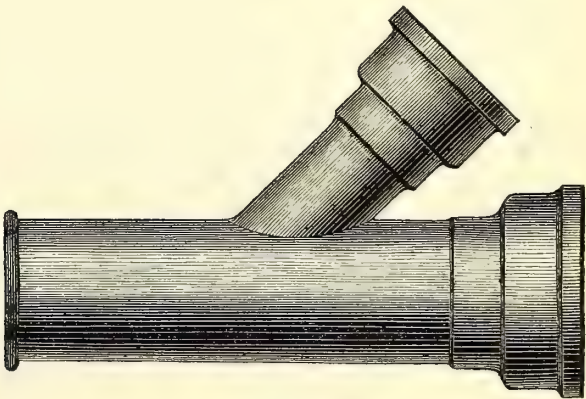


FIG. 40.

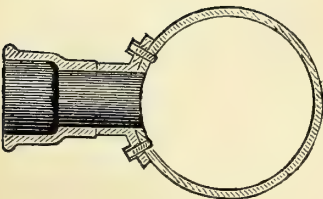


FIG. 41.

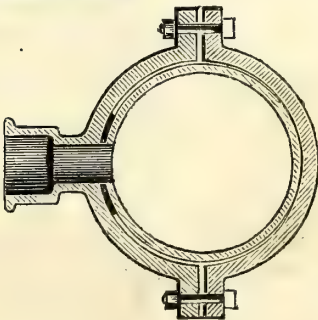


FIG. 42.

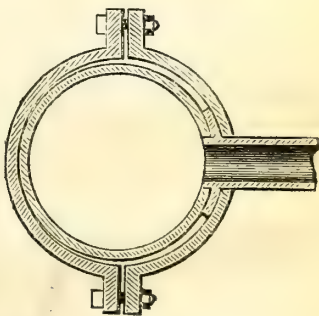


FIG. 43.

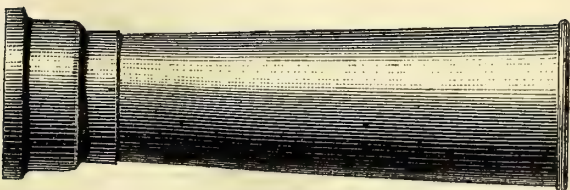


FIG. 44.

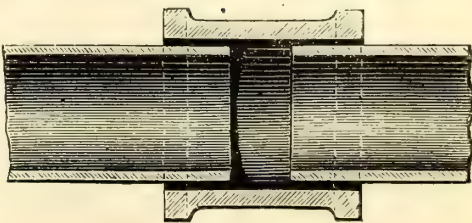


FIG. 45.

supply of a district, requires the exercise of foresight and judgment on the part of the gas engineer. Not only are the immediate wants of the town and neighbourhood to be carefully estimated, but the probable requirements of these for some years to come have to be fully considered and provided for. The mistake is frequently made of canalizing a district with a system of mains of a size altogether insufficient to the obvious immediate or prospective wants of the place. The consequence is, that, in a brief space of time, before the gas enterprise has had time to develop itself, the mains are found to be too small for their work. To remedy this evil, an additional expenditure has to be incurred for enlargements, by which the capital account is unduly weighted; or a resort is had to a gradually augmented initial pressure, resulting in widespread dissatisfaction amongst consumers in the neighbourhood of the works, the amount of whose bills is materially influenced by the excessive pressure, whilst a growing leakage eats up from 30 to 50 per cent. of what might otherwise have been profit. This is no fanciful or exaggerated description; its counterpart, unfortunately, will occur to the recollection of most gas managers.

The leading main from the gas-works is, of course, the largest in diameter; and this should be continued in as direct a line as possible through the centre of the district of supply, without any very sudden transition in size, to the farthest boundary. From this trunk or leading main, the subsidiary mains are made to branch in every direction through the various streets, and the experienced engineer will take care to ensure that these shall be connected together, by full-sized branch pipes, at every possible point of intersection. By that means he will equalize the pressure throughout the district, and be enabled to employ a less diameter of main than without this mutual assistance would be practicable. In rural districts, with a widely extended area of supply, it is not always possible to connect the mains so as to form a network such as we have described; hence, as a rule, the mains have to be of larger size, in proportion to the supply, than in compactly-built towns, and consequently their cost bears a greater proportion to the rental than in the other case.

Mains should, if possible, be laid at such a depth in the ground as to ensure their not being materially interfered with by the weight of the traffic overhead, and the changes of temperature in the atmosphere. The depth of cover from the surface of the ground to the upper side of the pipe should not usually be less than twenty-one inches for the smallest mains, and those above eight inches in diameter should have a covering of two feet or two feet six inches in thickness. In countries where the extreme cold is more severe and of longer continuance than with us, they should be placed at a still greater depth. On the other hand, in tropical climates, where the temperature of the ground at a depth of two feet from the surface is equal to the mean temperature of the air, a greater depth than two feet is unnecessary. A good covering is rendered all the more desirable now that the steam-roller is used in most large towns, and heavy agricultural steam-engines in rural districts. The earth beneath the pipes, particularly if it has been disturbed and loosened, as well as that above, should be firmly rammed in, so as to afford the pipes adequate support, without danger of settlement. No pipe should be laid in position without being first cleared of soil, stones, or other substances that may have got into it accidentally, or been put there from malice prepense. With this object in view, the main-layer in charge of the work should personally examine every pipe when it has been rolled on to the cross supports over the trench. Neglect of this necessary precaution frequently leads to future expense and annoyance.

In wide streets it is advisable to lay two mains, one on each side. The first cost of doing this is considerably more than if only one were employed, notwithstanding that the size of each of the two would be smaller than the single one; but the expense of long services, and the leakage that is apt to arise therefrom, with other disadvantages attending their use, is saved, and this eventually compensates for the extra original cost incurred. In sparsely populated neighbourhoods, the main should be laid on that side of the street or road where the largest number of services will be required.

Cast-iron mains of less diameter than 3 inches ought never to be used. The difference in the cost of these and anything smaller is scarcely appreciable; whilst the loss of gas from fractures at the points of junction of the service-pipes, occasioned by the weakening of the main in drilling, and the still more serious loss throughout the whole district that is entailed in having to maintain excessive pressure to afford the necessary supply of gas, are great and continuous.

(To be continued.)

RICHMOND (YORKS) CORPORATION GAS-WORKS.—Owing to the increased demand for gas in this town, the Corporation, at a large expense, some time since, erected a new gasholder and otherwise extended the works. Now it has been found necessary, owing to the demand on account of the new barracks and other places, to make a still further enlargement of the gas-works, and for that purpose it was resolved at a meeting of the Town Council on the 29th ult. to expend about £1600 in extensions under the direction of Mr. Smith, the engineer of the Darlington Corporation Gas-Works.

NATURAL GAS.—There are now three gas-producing wells at Beaver Falls, Pa., one of which has been in operation over seventeen years. Two of the wells are nearly 1100 feet in depth, one having been reamed out, and is said to produce about 100,000 feet per day, which is utilized in the cutlery works, except what is used in the gas lighting works, where it supplies about 60 per cent. of what is used. The other well is to be bored out to eight inches. The third well was recently bored, and struck a good vein of gas at 500 feet. This well is to be cased twelve inches, with a small tube inside to continue the boring to a greater depth, while the present product of gas, which is much greater than the other wells, can be utilized.—*American Coal Trade Journal.*

Correspondence.

THE EXPLOSION OF A GAS-METER.

SIR,—In answer to the inquiries put to me by your correspondents, I can only say that all the information I have been able to obtain is the following:—I learn that the gas was seldom or never turned off, as the proprietor of the premises requires it during the night in his nursery. One jet is kept constantly burning all the season during the day in his back shop, which is very dark. On the day in question, the 30th of December, this jet had been burning for about two hours, and while the master was standing in the middle of the shop, talking, one of his lads being behind the counter, but not within three yards of the meter, the explosion took place. The jet, of course, went out at once, as the supply of gas to it was then cut off. I do not think, however, we have yet elicited from your correspondents the true cause of the explosion.

In reference to "R. F.'s" questions, I may state—1st, that nothing peculiar was observed in the burning of the jet up to the time of the accident; 2nd, nothing had been done to the mains or service-pipes for days, if not for weeks, previously; 3rd, the premises are from 1200 to 1300 yards from the gas-works; 4th, there was no oxygen gas in the neighbourhood that day. S. E.

QUANTITY OF BRICKWORK IN RETORT-SETTINGS.

SIR,—“C. T. S.,” in a note under the above heading, which appeared in the JOURNAL of Dec. 26th last, objects to chequered walls in retort-settings, and in support of the less-brickwork-the-better theory, refers to what he is pleased to call a “demonstration” of the correctness of it, contained in the chapter of the new “Treatise,” in the JOURNAL of Aug. 14, 1874, in which this subject is treated. Since reading “C.T.S.’s” remarks, I have re-read the article he alludes to, but must confess my inability to discover the said demonstration. There is a theory advanced, which is to be taken for what it is worth; but if a demonstration is “the highest degree of evidence, or such proof as establishes a fact or proposition beyond a possibility of doubt, or as shows the contrary position to be absurd or impossible,” then to me it is conspicuous by its absence.

The endeavour to show that, theoretically, retorts ought to be “as thin as a sixpence,” and, like Mahomet’s coffin, hung between heaven and earth by the neck and heels, by reference to the incrustation of steam boilers, was so conclusively answered in Mr. Newbigging’s admirable criticism in the JOURNAL of Oct. 20, 1874, that little remains to be said, except perhaps that, after all, the chief objection to the accumulation of a medium between the shell of the boiler and the contained water is not so much a question of fuel as of danger in burning the plates over the furnace. But since the writer of the article has adduced steam-boilers to, as he believes, strengthen his position, I may be permitted to follow suit, and refer to steam-boilers too.

Mr. R. Armstrong, in his “Rudimentary Treatise on Steam-Boilers,” in the Weale series, relates how, in experimenting with a waggon boiler, with the view to lessen the mass of water in it without lowering its level, on account of the side flues, he resorted to the expedient of using filling-up blocks in the water-room, resting on a framework of iron rods laid across the internal stays of the boiler, sufficiently clear of the bottom and sides, when it was invariably found to effect a saving in fuel of from 5 to 10 per cent. He says: “The most convenient articles for the purpose were large fire-bricks, 18 to 20 inches long, 12 inches broad, and from 4 to 6 inches thick. [The woodcuts show them laid with spaces between them.] There can be little doubt that these filling-up blocks have a beneficial effect in producing an uniformity in the evaporation, independently of the effect arising from the displacement of the water, and which may be likened to that of the fly-wheel on the engine, by becoming a sort of reservoir of heat, or regulator of the evaporating power of the boiler. This effect is especially observable if compared to the irregular action of a boiler, with a large inside flue, when fired by hand, the steam being liable to vary very considerably every time the furnace door is opened.” He also says: “It is proper to mention one practical disadvantage in using the fire-brick blocks to any great extent. They were found to keep the steam up for some time after the fire was put out, a fact decisive of their economy in a theoretical point of view, yet, owing to the waste of water caused by the steam blowing away after the engine was stopped, there was danger of the water getting too low.”

As a further evidence of the natural law so opposed to the erroneous views of which the writer of the “Treatise” article and “C. T. S.” are the advocates, I would refer to a letter which recently appeared in an American newspaper, from a correspondent writing from Gottenburg, Sweden, favourably contrasting the Swedish stove, or “*kakelung*,” with the American stoves, in the economy of fuel. He writes: “A ‘*kakelung*’ is simply a great stove of masonry, covered with porcelain plates, having flues through which the gases of combustion must pass up and down a distance of 30 to 50, or even 60 feet, before escaping into the air. The quantity of material in the ‘*kakelung*’ is so great that the temperature from one fire (consisting of eight to ten billets of wood, 12 inches long), will not raise the temperature of any part so much that the hands cannot be held on the outside. Two hours after the fire is made, and after the wood has burned up and the flue closed, the ‘*kakelung*’ begins to get warm on the outside, and ten hours later there will not be much difference in the temperature of the stove or the room.”

These examples are so entirely in accord with the practical experience of the advantage of transverse or supporting walls in retort-settings, that, from the fuel point of view alone, one wonders how their utility could ever come to be doubted. The brickwork clearly does not annihilate any heat, but very conveniently absorbs and retains the surplus, or so much of it as it can take, during the time the quantity generated in the furnace is in excess of its absorption by the retorts, and beneficially exhales or restores a part of it when the reverse occurs.

Now, when it is remembered that the great absorption of heat by a retort containing a fresh charge of coal is during the first two hours or so, within which time over half the gas is evolved and the coking taking place, and that thereafter the production of gas rapidly lessens, while the retort becomes charged with a mass of highly-heated coke, it

is self-evident that the furnace has very unequal duties to perform during the time the charge is "burning off," and that any compensating arrangement by which the whole or part of the surplus heat, when there is an excess during the latter part of the distillation, can be retained, to be restored when there is a deficiency during the early part of the succeeding charge, must be beneficial; and the transverse walls, so thoughtlessly condemned, answer that purpose, and, I repeat, would be well worth putting in, if for no other purpose.

But there is another important aspect of the functions of these walls. Every practical man not blinded by prejudice knows that they serve as jambs to prevent pieces of the retorts falling out when they have been long enough in use to become cracked (I have never been fortunate enough to get any of these charmed retorts that do not crack, if heated and worked properly), and I do not think it an over-statement to say that that generally means an additional season's work got out of them.

Gas-Works, Montreal, Jan. 15, 1877.

E. S. CATHELS.

P.S.—Since the foregoing was written, the JOURNAL of the 2nd inst. has come to hand, containing the "snarl" of "S. N. A. P.," and a very sensible snarl too, so pungent and pithy in its demolition of "C. T. S.'s" cherished "demonstration," that doubtless that gentleman is ere this converted to the true faith, and so possibly saved from experience hereafter of "highly-heated" gases, the purification of which from sulphurous compounds would certainly not satisfy the Gas Referees.

E. S. C.

Parliamentary Intelligence.

GAS AND WATER BILLS, 1877.

Last week the Examiners reported compliance with the Standing Orders in respect of the unopposed petitions for the following bills:—Middlesbrough Corporation; Rotherham Corporation; Wakefield Gas; Colne Gas; Louth Gas; Sittingbourne Gas; Bishop Auckland District Gas; Ashton-under-Lyne Improvement; Edinburgh and District Water; Carnforth District Water; Glasgow Corporation Water; Stamford Water; Bridgwater Corporation Water; Ramsgate Local Board; Coatbridge Gas; Perth Water; Tunbridge Wells Water; Lowestoft Water, Gas, and Market; Maryport District and Harbour (Gas); Christchurch Gas; Sevenoaks and West Kent Water; Epsom and Ewell Gas; Woolwich, Plumstead, and Charlton Consumers Gas; Stretford Gas.

In the cases of the opposed petitions for the Bromsgrove, Droitwich, and Redditch and the Dublin Improvement Acts Amendment Bills, the memorialists established some of their allegations of non-compliance, which will be reported accordingly.

The petition for the Brighton Corporation Bill was withdrawn.

The consideration of the petitions for the Newport (Monmouthshire) Gas and the Bristol United Gas Bills was adjourned till Monday next.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

SATURDAY, FEB. 3.

(Before Vice-Chancellor BACON.)

In re THE NEW GAS GENERATOR COMPANY.

In this case a petition has been presented to wind up the company, and on its being called on,

Mr. OSWALD applied that the petition might stand over for a week.

Mr. KAY, Q.C., for the company, objected to its standing over.

Mr. OSWALD said that he had only just had put into his hand three affidavits filed the previous day in answer to the petition, and these affidavits he wished to answer.

The VICE-CHANCELLOR: For whom do you appear?

Mr. OSWALD: For the petitioners.

The VICE-CHANCELLOR: Then it must stand over till next petition day.

EXCHEQUER DIVISION.

TUESDAY, JAN. 30.

(Before Barons CLEASBY and POLLOCK.)

PRICE OF GAS TO EXTRA-MUNICIPAL CONSUMERS.

CORPORATION OF BATLEY v. STUBLEY.

This was an appeal from the judgment of the Dewsbury County Court in a case in which the plaintiffs brought an action to recover from the defendants, who are inhabitants of the suburbs of Batley, a sum of £29, being the difference on half a year's supply of gas, between the rate of 4s. 6d. per 1000 feet which the defendants were charged by the corporation, and that of 4s., which the corporation charged those residing within their own bounds. The result of the proceedings at the county court having been in favour of the plaintiffs, the case now came before a superior court on an appeal against that decision.

Mr. GULLY, as counsel for the appellants, explained that the Corporation of Batley some time ago purchased gas-works which had originally been started by a company under powers obtained by Act of Parliament; that the gas-works were situated in the township in which the defendants resided, and which adjoined, though it was outside, the municipal boundaries of Batley; that, under their parliamentary powers, the corporation supplied gas both to the borough and to the township; that they gave out a notice that they would in future charge 4s. 6d. per 1000 feet for the gas all round, both to this township and to Batley, but that as regarded those persons in Batley who took gas from them, they would allow a discount of 6d. in every 4s. 6d. if paid within two months. To the people of the adjoining township, although the gas-works were situated there, the corporation did not allow that discount, permitting it only to their own constituents, which the learned counsel said was putting all the profits of the undertaking into their own pockets—i.e., into the borough funds. His clients in the township not unnaturally complained of that course on the part of the corporation—complained that the people of the township, where the gas-works themselves were, should by this differential charge be made to contribute to the Batley Corporation funds. He (Mr. Gully) contended, on all the circumstances of the case, that the corporation were bound to charge equally all round.

Baron CLEASBY reminded the learned counsel of the terms of the corporation's notice as to the charge of 4s. 6d., which his clients appeared to have accepted.

Mr. GULLY argued, however, that the corporation were bound to supply the gas, and on equal terms—that they had no right to supply it on these unequal terms for their own benefit. It came to this, that they charged people outside the municipal boundaries 4s. 6d., while they charged their own electors, those people who were inside the municipal boundaries, 4s.

Baron CLEASBY: Provided payment is made within a certain time.

Mr. GULLY: Practically it is putting us to a disadvantage as compared

with their own constituency, although they are trustees for the whole body, whether constituents of theirs or not.

Baron CLEASBY: The same would have been the case with the company.

Mr. GULLY: That depends on a different Act of Parliament, which I have not considered. It certainly seems contrary to natural justice to make this difference of charge, and put the balance into the borough fund, at the expense of the adjoining township.

After some further discussion on the subject, the Court eventually dismissed the appeal.

GLASGOW SMALL DEBTS COURT.—FRIDAY, FEB. 2.

(Before Sheriff SPENS.)

ACTION AGAINST THE CORPORATION FOR CUTTING OFF GAS.

John Guthrie, of 198, Woodside Road, sued the Corporation, acting under the Glasgow Corporation Gas Act, 1869, for the sum of £12.

The grounds of the action were that the corporation had cut off the pursuer's supply of gas in consequence of alleged non-payment of 4s. 7d., notwithstanding that a deposit of 5s. was lying in their hands, whereby he had been deprived of gas, and sustained much inconvenience, expense, and unnecessary exposure to his friends and neighbours.

The defence set up was that the pursuer was not the occupier of the house, but had merely put his name in for it to save a woman who already owed £1 15s. on an old account, and such being the case the gas was cut off.

Evidence was led for both parties, that for the pursuer being to the effect that he was in reality the occupier, and that the woman was merely his housekeeper.

Mr. BOWERS, who appeared for the defenders, wished to assert that this was a case of fraud; and, further, that after the gas had been cut off the pursuer had been using the gas by some means, the meter indicating a consumption.

The SHERIFF, however, thought that the agent should be very careful in making this statement, as it was quite within the pale of libel, and considered that it was very likely that the meter was wrong. His lordship held that the defenders were not justified at all in cutting off the pursuer's gas, on the grounds that the woman, who was not his (pursuer's) wife, was owing an account; and as to his own account, they admitted having a deposit of 5s. The case was not one for large damages being awarded, and he would therefore give decree for 5s., with 6s. for witnesses, as well as court expenses.

HAMPSTEAD POLICE COURT.—WEDNESDAY, JAN. 31.

(Before Messrs. MARSHALL, FAULCONER, and SMITH.)

CONVICTION UNDER THE CONSPIRACY AND PROTECTION OF PROPERTY ACT, 1875.

John Smart was charged on two summonses, one accusing him of having wilfully and maliciously broken a contract of service with Mr. Henry Skoines, who supplied the district of Child's Hill, Hendon, with gas, knowing or having reasonable cause to believe that the result of his doing so would be to deprive the inhabitants of the said district wholly or to a great extent of their supply of gas; and the second summons charged him with wilfully and maliciously breaking a contract, knowing or having reasonable cause to believe that the probable consequence of his so doing would be to endanger human life, or cause serious bodily injury.

Mr. MOORE, who attended to prosecute, stated that the maximum penalty provided by the Act in each case was a fine not exceeding £20, or imprisonment not exceeding three months.

From the evidence it appeared that Mr. Skoines was the proprietor of the Child's Hill Gas-Works, and had the contract for supplying with gas the important district of Child's Hill, Hendon, extending on one side to The Hyde, Edgware Road; on another to Golders Green, Finchley Road; and in a third direction to a house near Hampstead Heath. The defendant was a night stoker in complainant's service, engaged as a weekly servant, at 24s. per week, a week's notice to be given on either side. On Sunday, the 14th ult., he should have gone on duty at twelve o'clock noon, and continued on until six on Monday morning. There had been some previous dispute between him and the complainant, and he had given notice of his intention to leave. On the Saturday, however, he told Elliott, complainant's foreman, who asked him to stay, that he would stay for him but not for Mr. Skoines. On Sunday defendant went to the gas-works but did not commence work, and, after staying about a quarter of an hour or twenty minutes, declined to resume work, and, though warned of the consequences, went away. The result was that the whole work was thrown on the foreman, and there was a defective supply of gas the entire evening. The previous dispute with Mr. Skoines had arisen through defendant absenting himself (through missing a train, as he alleged) on the preceding Sunday, when Mr. Skoines had to do his own stoking in order to keep Child's Hill Church and other places supplied with gas. In consequence of similar conduct by other workmen, complainant had been obliged to pay compensation for damages in two cases. Defendant alleged that he gave proper notice, and only went on Sunday to get the money due to him for Saturday's work.

The BENCH fined the defendant 20s., including costs, or 14 days imprisonment in each case. He was locked up in default.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board on Friday last—Sir J. Hogg, M.P., in the chair—

The Works and General Purposes Committee brought up a report upon the Bill of the Woolwich, Plumstead, and Charlton Consumers Gas Company, recommending that the promoters be informed that if they will adopt the provisions of the South Metropolitan Gas Act of last year, the Board will not oppose the Bill.

Mr. FREEMAN, in moving the adoption of the report, said the present capital of the company was £60,000, and it was proposed to raise additional share capital to the amount of £60,000, the dividend on which was not to exceed 7½ per cent. per annum, and to borrow on mortgage a sum not exceeding £30,000. As the district supplied by this company was in the area under the jurisdiction of the Board, it appeared to the committee that the Board should seek to obtain for the consumers advantages similar to those which were obtained by some of the Gas Acts of last year. Before deciding, however, to petition against the Bill, and to lay the case before a committee of the House of Commons, the committee thought it desirable that the company should be asked whether they would adopt the provisions of the South Metropolitan Company's Act of last year, so far as it related to the sliding scale of price and dividend, the initial price, the illuminating power of the gas, and the mode of raising the additional capital required. The committee accordingly recommended that a communication should be addressed to the company, to the effect that if they would adopt these provisions of the South Metropolitan Gas Act, the Board would not oppose the Bill.

Mr. E. D. ROGERS seconded the motion, which was adopted.

The committee further recommended that The Gaslight and Coke Company's Bill and the Crystal Palace Gas Company's Bill be opposed, and that petitions be presented against them. With regard to these two Bills the committee said: The Bill of the Chartered Company is confined to one point only, that of the purity of the gas, with respect to which the company ask for the repeal of sections 30 and 51 of their Act of last year, by which the Gas Referees are required to ascertain and fix the maximum amount of impurity to be allowed, and the company are subjected to penalties in the event of the impurity exceeding the maximum prescribed by the Referees. If, therefore, the Bill were passed in its present form, the company would be under no obligation to supply the gas as free as possible from the various impurities which are generally found in gas, excepting always sulphuretted hydrogen, the presence of which is prohibited by the Act of Parliament. It appears to the committee to be quite unnecessary to alter the present law upon this subject. It is now the duty of the Gas Referees to prescribe from time to time the degree of purity with which the company can reasonably be required to make and supply gas without occasioning a nuisance to the neighbourhood in which the works are situated, and it may be assumed that the Referees are always ready to consider any real difficulty in which the company may be placed, and any representations which may be made to them on the subject. The Crystal Palace District Gas Company's Bill, which was referred to the committee on the 22nd of December last, is much to the same effect as that of The Gaslight and Coke Company. It is proposed to repeal so much of section 17 of the company's Act of 1873 as provides that the gas made by the company shall not contain more than 20 grains of sulphur, in any form, in each 100 feet of gas. If, therefore, the Bill were passed, the company would be under no restriction as to the amount of sulphur in the gas made by them, a position which the committee consider undesirable.

Mr. FREEMAN moved the adoption of the report, and the motion, having been seconded by Mr. E. D. ROGERS, was put and carried.

METROPOLIS WATER SUPPLY.

DEPUTATION TO THE HOME SECRETARY.

On Monday, Jan. 30, a deputation consisting of members of some of the Vestries and District Boards, and of the "National Chamber of Trade," waited upon the Home Secretary (Mr. Cross), at the Home Office, with regard to the water supply of London.

Sir C. RUSSELL introduced the deputation, and said there was no need for him to suggest to the Home Secretary the great importance to the inhabitants of the Metropolis that they should have water—one of the first necessities of life—supplied to them in good quality, quantity, and at a fair and reasonable cost. Under the present Acts the companies were enabled to charge for the water they supplied upon the annual value of the houses. The Acts had been interpreted to mean the gross rateable value of the Metropolis, and the fact existed that in the last 20 or 25 years the rateable value of London had doubled, and they were of opinion that at the time those Acts gave that very vast power to the companies it was not contemplated that so great an increase would occur either in the powers of charge or in the requirements of water. They wish to suggest to the Government, if the companies were amalgamated under some central authority, that there would be such an economy in management at the least, and such other good results would be likely to supervene, that they would be able to obtain a better and more continuous water supply, at a cost which would not be, as it was at present, a severe burden on the ratepayers of London. The difficulty of obtaining a supply of water by meter was very great, the companies refusing to put a meter unless the person wanting it would use 25,000 gallons of water in one quarter.

Mr. ATTENBOROUGH said he was chairman of the sub-committee of the National Chamber of Trade, which had been appointed to take the opinion of the Government as to the wisest course to pursue to obtain relief in regard to the matters complained of in the water supply. At present ratepayers were entirely in the hands of the water companies, who possessed a joint capital of £14,000,000, and very arbitrary powers, which had been obtained by promises that had never been fulfilled. It was a very great hardship on houses of business that they should be rated as if they used water for domestic purposes, and should be charged on the gross rateable value. If the companies were all put under the control of one central authority, such as the Board of Works, he thought purer, more continuous, and cheaper water must result.

Sir J. C. LAWRENCE, M.P., said he was in Parliament when the Water Supply Act was passed, and he contended that the companies put a different interpretation upon that Act to what was intended by Parliament. In the Act obtained by the New River Company, the term domestic use was employed as referring to dwelling-houses, and a clause was inserted giving power to charge £1, £2, £3, or £4 for each closet. There were many commercial buildings in London where there was really no water laid on except for the closets, and yet the company charged for each one of them, and also on the rateable value of the house. That was in entire disregard not only of those who applied for the Act, but of the Legislature, and of the terms and spirit of the general Act of Parliament itself. As regarded supply by meter, he had sat on more than one committee, and the officials of the water companies had always represented that any one could obtain a meter who was content to pay for a certain minimum quantity of water. He was afraid that the companies had absolutely refused in some cases to supply by meter to very large premises occupied by wine merchants and others, on the plea that they considered it to be applied for domestic use, the place not being a manufactory or factory. As to the increase of dividends, friends of his, connected with water companies, had not hesitated to tell him that the reason for this—some five or six years since, when there was talk of their being bought up like the railways and telegraphs—was that their value might be estimated not by speculation, but be ascertained by actual knowledge of the dividends they were paying.

Mr. McCULLAGH TORRENS said the question they would like to put before the Government was whether joint-stock profits at the expense of the community was not becoming in a certain sense obsolete. In 1852 he sat on the committee, which was supposed to put a suitable check on the powers of exaction of the water companies, by limitation in proportion to the value. At that time the valuation of the Metropolis was 11 millions, and now it was 23 millions, and, therefore, the state of things then contemplated had entirely changed, and now the companies should be put back to where Parliament intended to put them in 1852. If such a check was imposed in any form that was legitimate, immense benefit would be conferred upon the ratepayers.

The HOME SECRETARY said the deputation would not expect him to answer all the questions they had raised. First, they said that the interpretation of the Acts of Parliament was wrong. Of course, he could say nothing about that, as it was a question for the courts of law. Then he understood them to say that in certain cases the interpretation which had been put on them, either by the courts of law or by the companies themselves, was not the meaning Parliament meant to attach to them. So far at least, as courts of law, which determined that Parliament meant what it

said as to the interpretation put upon them by the companies themselves, he presumed they had a ready way of trying the matter. If they found that the interpretation was directly contrary to the spirit of what Parliament determined, that was a question which they should bring before Parliament in the usual way. Then they had raised a very large question as to the forming of a central authority for all those water companies. This meant purchasing them. That was a very large question indeed, and he was not at all prepared to say that it was one which would not receive considerable deliberation and attention, but he was not prepared to give an answer on the question. One thing which, to his surprise, they did not mention was fire, which was of vital importance to the public. He understood that question would practically be brought before the committee sitting in the House of Commons at the present moment. It was a subject that had not escaped the attention of the Government; but, as they knew, it was very difficult to deal with, and he could not promise any more.

Mr. ATTENBOROUGH asked whether the Home Secretary would give an opinion as to the prudence of, and whether the Government would support an attempt to borrow money for, buying up the companies. It would take about £14,000,000, which could be borrowed at $3\frac{1}{2}$ to 4 per cent., and that, while giving the companies a very good profit on the capital employed, would be a great relief to the ratepayers. They would be glad if the right hon. gentleman would take the matter into consideration.

The HOME SECRETARY: I am called upon to give opinions on so many matters that do come within my jurisdiction that I do not like to express an opinion on a matter which is entirely beyond my jurisdiction. Indeed, it is very hard to say whether the Government would support you; at any rate, I must not be called upon to give you an answer to that.

The deputation, having thanked the right hon. gentleman, retired.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board on Friday last, the Works and General Purposes Committee presented a report, in which it was stated that on the 25th of February, 1876, the Board passed a resolution expressing the opinion that the most effective mode of dealing with the question of the water supply of the Metropolis would be to obtain power to carry out the recommendation of the Royal Commission of 1869 that the water supply should be in the hands of the responsible public authorities, and the committee were instructed to confer with the committee of the Corporation of London to ascertain from the Home Secretary whether the Government would support a measure for the purpose, if it were introduced by the Board and the Corporation. It having been previously arranged with a sub-committee of the Corporation, who had considered this question in conjunction with a sub-committee of the Board, that a recommendation similar to that adopted by the Board should be submitted to the Court of Common Council, in order that the two bodies might, as far as possible, act in concert, the committee on the 29th of March last directed a letter to be addressed to the town clerk, inquiring what decision the Court of Common Council had arrived at. A reply was received from the town clerk to the effect that the matter was still under consideration, and since then the committee had been awaiting a communication as to the course which the Corporation proposed to take with reference to the question, but as no communication had been received, the committee recommended that the reference made to them on the 25th of February last should be discharged.

Mr. FREEMAN moved the adoption of the report, remarking that the reference to the Corporation appeared to have died a natural death, and the committee, therefore, hoped the reference would be discharged.

The report was adopted.

Mr. WALKER moved—"That, inasmuch as the ratepayers of the Metropolis are, by recent legislation, rendered very dependent upon the water companies as to the rate of charge for water, also as to the mode of supply, it is expedient, in the interest of all consumers, that the charge for the same should be based upon the principle of furnishing a necessary supply as nearly as may be possible at cost price; and, in order to carry out this principle, that it is desirable to promote a Bill in Parliament to enable this Board to purchase the interests of all the Metropolitan Water Companies on fair and equitable terms, and to make this Board the corporate body to administer the supply of water for private and public purposes in the Metropolis; and that with this view the whole question of water supply in the Metropolis be referred to the Works and General Purposes Committee to consider the subject, and to report to the Board in the month of October next as to the best mode of carrying out the proposed scheme in the public interest." In bringing forward this motion, he said ever since the Act of 1852, not only was a great injustice done to the ratepayers, but a man's birthright of a supply of pure water had been taken from him, and was now the subject of an odious monopoly. The time had now come for something to be done, as the vestries and the Board were powerless to deal with the question, and the Corporation of London had been making efforts to do so without success. The Act of 1852 operated most unjustly, by giving the companies a monopoly of water, which was an essential of life—an essential which should no less be monopolized than light or air, and which the Legislature considered was necessary to our civilization and habits. Referring to the New River Company, he contended that they had inflicted a great injustice upon very many ratepayers. The New River Company, under their Act of 1862, were entitled to charge at the rate of 4 per cent. on the assessment. To a great extent they had exceeded that rate of charge; but for some time they refrained from putting their full powers in this respect into force, although latterly they had been more alive to what they supposed were their own interests, and now great discontent was rife in all parts of the Metropolis with regard to this subject. The one great principle of the Act of 1852 was, he argued, that there should be a constant supply; but that principle had only been carried out to a very limited extent. He contended that it was of the greatest possible importance to the health of the inhabitants of London that every person should be provided with an abundant and constant supply of pure water; but, looking at the manner in which the water companies generally had conducted their operations, he considered the time had come when the Board should take the matter up in some practical manner. The City authorities had recently sent out a number of letters to various persons for information on this subject, and he was assured that they were startled by the state of things revealed by the replies that had been received. In one case, a short time ago, a gentleman who resided with his family in the City paid for water less than £2 per annum. At the present time, although his family now resided in the suburbs, he was called upon to pay £8 a year for water supplied to the same premises, although the quantity used was of necessity considerably less. This was a striking illustration of what he termed a great injustice. There were other instances where citizens were compelled to pay largely-increased rates for less water, and he submitted that on this point alone it was the duty of the Board, as representing the whole Metropolis, to take action, with a view to a clear statement being laid down as to what a fair charge for water really was. As to the mode of supply, he could not think of regarding it as satisfactory until there was universally adopted in the Metropolis the constant system. It was within his knowledge that last year a most important measure received the sanction of the Legisla-

ture with regard to this subject. It was entitled the Stockton and Middlesbrough Water Act, and was the first instance where Parliament had granted powers to a corporation for the compulsory purchase of the undertaking of a water company. At Glasgow, Manchester, and other places the corporations had acquired the water-works by agreement; but in the case of this Act, Parliament, for the first time, granted compulsory powers, and his primary object in referring to this matter was to show that if the Board decided, as he proposed, to go to Parliament for a Bill for the purchase of the London Water Companies, they had already at hand the terms on which the Legislature would sanction such purchase. His first point, however, was that the supply of such a necessity of life as water should be in the hands of the responsible public authorities, and not in the hands of private companies, whose first consideration was profit. Referring to the very high charges made by the companies for water required for public purposes, he said he thought the Board ought to have such a supply as to enable them to flush all their sewers daily during the summer months. In this matter, they were lamentably behind other large towns in the country, and it was well the Board should make good their position in regard to it. Alluding to the cost of the purchase of the undertakings of the water companies, he said it was extraordinary to notice how that cost increased the longer the purchase was delayed. In 1814 the value of one of the original King's shares in the New River Company was £7450, in 1822 it increased to £9450, in 1858 the price was £9800, but in 1870 the value had increased to £39,950. In 1873 the price was £49,000; in July, 1876, £88,050; and in November, 1876, £94,000. Those were the prices realized by public auction for one of the 64 original shares, and he asked honourable gentlemen to consider for a moment how it was that those shares were so valuable. It might be said that he had committed a great blunder in bringing this motion forward, and that he should have left it in the hands of the older members of the Board; but he had waited patiently for 18 months for one of his seniors to deal with the subject, in vain, and he now felt it his duty to move in the matter himself. He knew that it was a gigantic question, that it was a most difficult question to deal with, and that there would be a tremendous opposition to any action they might take; but let the members of the Board first of all relieve their own consciences by doing their duty, leaving the Legislature to do theirs hereafter. If they delayed, the difficulties of dealing with the question would be continually increasing, and bearing in mind that the matter was not now before either the Board or a committee in any practical shape, it was with some confidence that he submitted this proposition for their consideration. He trusted that the Board would co-operate as far as possible with the Corporation of London in this matter. He specified the month of October, because that would give ample time for the consideration of the details of the Bill. He trusted the Board would recognize the motion as one worthy of their adoption, and if it were adopted, it might be the means of conferring one of the greatest boons on the Metropolis that it was within the power of this Board to bestow.

Mr. FELL seconded the motion.

Mr. ROCHE moved, as an amendment—"That the whole question of the water supply of London be referred to the Works and General Purposes Committee, to consider and report on the advisability of introducing a Bill into Parliament authorizing the Board to purchase the interests of the several water companies." He said he hoped the Board would consider the motion submitted by Mr. Walker upon its merits, although he rather regretted the manner in which the mover had altogether ignored everything that had previously been done by the Board on this subject. Had he inquired more carefully into what had been the course of action hitherto adopted by the Board, he would have found that they had, on more than one occasion, expressed themselves strongly in favour of the very object which he sought to accomplish by his motion. Indeed, only that day the Parliamentary Committee had presented a report on a resolution of the Board to that effect. As he understood the motion, the object was that in the opinion of the Board the time had arrived when some steps should be taken to impress on the Government the necessity for the supply of water being made a municipal concern. If that really was the meaning of the motion, he thought it would be the desire of the Board to give it their cordial support. The Parliamentary Committee had been unsuccessful in their

endeavours to proceed conjointly with the Corporation, so that they now reverted to their original position as to what course they should take. The honourable member for St. Luke's proposed to refer the matter to the Works Committee with certain instructions. For his own part he thought it would be wiser to refer the subject to the committee as an entirely open question, and, therefore, believing that the members generally would not like to pledge themselves, at once, to all that was stated in the motion, he proposed his amendment.

Mr. RUNTZ seconded the amendment, and referred to the various attempts made by the Board with the view of placing the water supply of the Metropolis upon a more satisfactory footing. As a reason, however, why the matter should now be taken up again, and as a proof of the importance of the question, he stated that several of the contagious diseases, notably typhoid fever and cholera, had been traced to the consumption of impure water. During the existence of the last Government, Mr. Bruce, the Home Secretary, had brought in a Bill authorizing the Board to purchase the companies, but it received so much opposition that it had to be withdrawn. He thought the time had now come when they should again appeal to the Government, on account of the pressing nature of the case, and urge upon them the necessity of doing something at once.

Mr. Cook supported the amendment, which was put and carried.

On its becoming the motion before the Board,

Mr. RICHARDSON moved another amendment to the effect—"That it is desirable to promote a Bill in Parliament to enable the Board to purchase the interests of all the Metropolitan Water Companies on fair and equitable terms, and with this view the whole question of water supply in the Metropolis be referred to the Works and General Purposes Committee to consider and report to the Board."

Mr. THOMPSON seconded the amendment.

MR. E. D. ROGERS, in supporting the motion, said he was quite sure that those of them who had any knowledge of the subject would know that there were difficulties in the question that required mature consideration by a committee. There could be no doubt that Mr. Walker was right in calling attention to the matter. The "outside public" had the other day taken upon themselves to apply to the Home Secretary on the subject. He did not know if they were particularly called upon to do it, but of this he was sure, that before the Board attempted to discuss the matter it ought to be considered in committee.

The amendment was negatived, and Mr. Roche's motion carried.

The following are the returns of the Society of Medical Officers of Health, on the composition and quality of the metropolitan waters in January, 1877 :—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by	Nitro- gen.	Ammonia.		Hardness (Clarke's Scale).	
		Organic Matter, &c.	As Ni- trates, &c.	Sa- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.
<i>Thames Water Companies.</i>	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	18·90	0·135	0·120	0·001	0·007	13·2	3·8
West Middlesex	18·40	0·133	0·150	0·000	0·008	13·2	3·8
Southwark and Vauxhall	19·00	0·138	0·105	0·001	0·006	13·2	3·8
Chelsea	18·80	0·120	0·150	0·007	0·009	13·2	2·9
Lambeth	20·90	0·094	0·210	0·006	0·009	14·8	4·2
<i>Other Companies.</i>							
Kent	27·90	0·003	0·300	0·000	0·003	20·6	6·0
New River	20·50	0·094	0·216	0·000	0·006	14·9	3·3
East London	22·70	0·079	0·150	0·001	0·008	14·9	3·3

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be slightly turbid in all cases.

C. MEYMOTT TIDY, M.B.

THE GASLIGHT AND COKE COMPANY.

The following Statements of Account, for the Half Year ending Dec. 31, 1876, have been circulated with the Report of the Directors:—

No. 1.—STATEMENT OF STOCK AND SHARE CAPITAL, on Dec. 31, 1876.

[illegible]

No. 2.—STATEMENT OF LOAN CAPITAL, *on Dec. 31, 1876.*

Acts of Parliament authorizing the Loan Capital.	Total Amount authorized.	Description of Loan.	RATES PER CENT. OF INTEREST.						Total Amount borrowed.	Remaining to be borrowed.
			4 per Cent.	4½ per Cent.	4¼ per Cent.	4½ per Cent.	5 per Cent.	10 per Cent.		
The Gaslight and Coke Company's Act, 1868.	£462,500									
The City of London Gas Company's Act, 1859	60,000									
The Great Central Gas Consumers Act, 1851	66,000									
The Victoria Docks Gas Act, 1857	25,000									
The Companies Act, 1862, as applied to the Western Gaslight Company, Limited	200,000									
The Imperial Gas Act, 1854	173,000									
The Imperial Gas Act, 1866	81,250									
The Imperial Gas Act, 1869	243,750									
The Gaslight and Coke Company's Act, 1872.	250,000									
The Gaslight and Coke Company's Act, 1876.	1,000,000									
	£2,561,500									
			£147,355	£20,000	£216,450	£916,695	£6,000	£130,000	£1,436,500	£1,125,000

Dr.		No. 3.—CAPITAL ACCOUNT.				Cr.	
		Expended this Half Year.	Total Expenditure to Dec. 31, 1876.		Receipts to June 30, 1876.	Received since that date.	Total Receipts to Dec. 31, 1876.
		£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.
To Expenditure to June 30, 1876 . . . . .		..	7,422,240 19 7		By A Ordinary stock	3,797,770 0 0	3,804,310 0 0
Expenditure during half year to Dec. 31, 1876— viz.:					A 5 per cent. preference convertible stock	*6,370 0 0	2,750 0 0
Lands acquired, including law charges		727 4 3			A 5 per cent. preference convertible stock, 2nd issue	*5,860 0 0	2,940 0 0
Buildings and machinery in extension of works		143,416 9 9			A 5 per cent. preference shares, 3rd issue	300,000 0 0	300,000 0 0
New and additional mains and service-pipes		18,797 19 16			A 5 per cent. preference shares, 4th issue	200,000 0 0	299,986 0 0
New and additional meters		1,903 8 3			A 5 per cent. preference shares, 5th issue	100,000 0 0	100,000 0 0
Parliamentary costs		3,201 11 1			B 4 per cent. maximum stock	100,000 0 0	100,000 0 0
Cr.		168,046 13 2			C 10 per cent. preference stock	200,000 0 0	200,000 0 0
By Sale of disused plant.		£2,529 18 2			D 10 " " "	300,000 0 0	300,000 0 0
,, surplus land		4,471 11 3			E 10 " " "	165,000 0 0	165,000 0 0
		7,001 9 5	161,045 3 9		F 5 " " "	30,000 0 0	30,000 0 0
					G 7½ " " "	60,000 0 0	60,000 0 0
					H 7 per cent. maximum stock	1,300,000 0 0	1,300,000 0 0
					Debentures	+896,150 0 0	853,095 0 0
					Debenture stock, 4½ per cent.	265,350 0 0	265,350 0 0
					" " 4½ " "	20,000 0 0	50,000 0 0
					" " 4 " "	125,000 0 0	138,055 0 0
					Bonds for capitalized profits	130,000 0 0	130,000 0 0
						7,876,500 0 0	224,986 0 0
To Balance of capital account			7,583,286 3 4		* £6540 of these issues have been converted into ordinary stock during the half year.		
			518,199 16 8		+ Debentures, amounting to £43,055, have been exchanged for debenture stock during the half year.		
			8,101,486 0 0		8,101,486 0 0		

[illegible]

Dr.		No. 5.—NET REVENUE ACCOUNT.		Cr.	
		£	s. d.		£ s. d.
To Interest on debentures, debenture stocks, and bonds, accrued to Dec. 31, 1876		33,198	11 6	By Balance from last account	£324,003 8 11
Dividend on A 5 per cent. preference shares and stock	£16,392 1 6			Less dividend on ordinary capital for the half year to June 30, 1876	189,888 10 0
" B stock, at 4 per cent.	2,000 0 0				134,114 18 11
" C " 10 "	10,000 0 0			Revenue account (No. 4).	409,497 11 6
" D " 10 "	15,000 0 0			Dividend from the estate of Benjamin Higgs	102 16 8
" E " 10 "	8,250 0 0				
" F " 5 "	750 0 0				
" G " 7½ "	2,250 0 0				
" H " 7 "	45,500 0 0				
		100,142	1 6		
Interest on temporary loans.		207	8 5		
Commutation of annuities payable under amalgamation schemes		176,525	9 4		
Balance applicable to dividend on the ordinary stock		233,641	16 4		
		£543,715	7 1		£543,715 7 1

Dr.		No. 6.—RESERVE-FUND ACCOUNT.		Cr.	
To Balance on Dec. 31, 1876	£ 50,161 1 4	By Balance on June 30, 1876	48,598 14 5		
		Interest on amount invested,	1,562 6 11		
	£50,161 1 4		£50,161 1 4		

Dr.		No. 7.—CONTINGENCY-FUND ACCOUNT.				Cr.	
To Balance on Dec. 31, 1876	£ 50,000	s. 0	d. 0	By Balance on June 30, 1876.	£ 50,000	s. 0 d. 0	

Dr.		No. 8.—INSURANCE-FUND ACCOUNT.		Cr.	
By Balance on Dec. 31, 1876.	£ 69,747 13 5	By Balance on June 30, 1876.	£ 68,659 18 11		
		Interest on amount invested.	1,087 14 6		
	£69,747 13 5		£69,747 13 5		

Dr.			No. 9.—DEPRECIATION-FUND ACCOUNT (FOR WORKS ON LEASEHOLD LANDS).		Cr.		
To Balance on Dec. 31, 1876			£	s. d.	By Balance on June 30, 1876		
			7,953	8 8.	Amount brought from revenue account for the half year		
					Interest on amount invested		
			£7,953	8 8			
					£7,953 8 8		

No. 10.—STATEMENT OF COALS USED, &c.					
Description of Coal.	In Store, June 30, 1876.	Received during Half Year.	Carbonized during Half Year.	Used during Half Year.	In Store, Dec. 31, 1876.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common	71,030	524,296	475,032	165	120,129
Cannel	11,772	33,857	29,067	..	16,562

No. 11.—STATEMENT OF RESIDUAL PRODUCTS.					
	In Store, June 30, 1876.	Made during Half Year.	Used in Manufacture during Half Year.	Sold during Half Year.	In Store, Dec. 31, 1876.
Coke—chaldrons	7,778	482,452	140,645	318,043	31,542
Breeze—ditto	1,501	45,978	..	43,974	3,505
Tar—gallons	580,516	5,123,764	..	4,481,488	1,224,792
Ammoniacal liquor—butts of 108 gallons.	4,751	135,585	..	128,662	11,674

No. 12.—STATEMENT OF GAS MADE, SOLD, &c.								
Description of Gas.	Quantity Made (part measured).	QUANTITY SOLD.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	4,823,807	286,763	4,169,393	4,456,156	60,562	4,516,718	307,089	30,951
Cannel	287,519	19,609	*239,644	259,253	1,026	260,279	27,240	3,371

* This includes the quantity sold in bulk.

Dr.			GENERAL BALANCE-SHEET, on Dec. 31, 1876.		Cr.		
To Capital—			£	s. d.	By Cash at bankers		
Balance at credit thereof (Account No. 3)			518,199	16 8	Amount invested—		
Net revenue—					Reserve-fund		
Balance at credit thereof (Account No. 5)			233,641	16 4	Contingency-fund		
Reserve-fund account—					Insurance-fund		
Balance at credit thereof (Account No. 6)			50,161	1 4	Depreciation-fund		
Contingency-fund account—					Stores on hand, viz.—		
Balance at credit thereof (Account No. 7)			50,000	0 0	Coals		
Insurance-fund account—					Coke		
Balance at credit thereof (Account No. 8)			69,747	13 5	Tar and ammoniacal liquor		
Depreciation-fund account—					Sundry stores.		
Balance at credit thereof (Account No. 9)			7,953	8 8	Accounts due to the company, viz.—		
Debiture interest for amount due to Dec. 31, 1876			24,790	4 11	Gas and meter rental—		
Bond interest for amount due to Dec. 31, 1876			6,500	0 0	Quarter ending Dec. 31, 1876.		
Preference dividends for amount due to Dec. 31, 1876.			100,142	1 6	Arrears outstanding		
Unclaimed dividends			5,771	15 1			
Sundry tradesmen and others, for amount due for coals, stores, and sundries			146,358	11 2	Coke and other residual products		
Benevolent-fund			1,526	16 0	Sundry accounts		
					Retiring allowances		
			1,214,793	5 1			
					£1,214,793 5 1		

YORK UNITED GAS COMPANY.

The Half-Yearly Meeting of Shareholders was held on the 1st inst.—Alderman WEATHERLY in the chair.
The SECRETARY (Mr. C. Sellers) read the following report of the directors:—

Your directors have to report that during the past half year the business of the company in all departments has been unusually active. The remodelling of a large portion of the retorts, commenced last spring, was satisfactorily completed in autumn. This important work has necessarily added to the expenses of the past half year, but the benefits of such special charges in lessening future repairs will be felt in years to come.

In the gas department, on account of the prevailing darkness of the weather, the increase in consumption has been above the average. But, on the other hand, the unusual mildness of the winter, coupled with continued depression in trade, has so checked the demand for coke that your directors in December last resolved to lower the price to 10s. per ton, a reduction which six months since they did not contemplate.

With the view, however, of bringing the worth of coke for domestic fuel more prominently before the public, your directors have deemed it wise that the company should have its own horse and lurry, so as to be enabled to give prompt attention to all orders sent to the company's office. This arrangement has given great satisfaction.

In their last report your directors thought it possible they might have been in a position at this meeting to have announced another reduction in the price of gas, but considering the reductions within the last six months in the price of coke, and the great difference in revenue which the present exceptionally low price will make, if it continues, upon the current half year, they feel sure that a reduction in gas will not at present be expected.

Your directors have further to report that, since the last meeting of the shareholders, two vacancies have occurred at their board. The first took place last August, through the death of their esteemed colleague, Mr. David Hill, whose seat at the board has been supplied, pursuant to the company's Act, by appointing Mr. Sheriff Bulmer, an appointment which the directors believe will be received with satisfaction by the shareholders. The other vacancy has occurred more recently, through the death of their esteemed co-director, Mr. Alderman Steward.

The last issue of new shares of the company being now paid up, and entitled to the same dividend as the old shares, your directors recommend that the usual dividend of 5s. per share be declared upon all the shares of the company, and paid on and after the 6th inst., free from income-tax.

The CHAIRMAN, in moving the adoption of the report, said he thought, after taking into consideration the details of their business during the half year, the shareholders would agree with him the report was a satisfactory one. The directors could have wished, as the report implied, that it had been more satisfactory; that was to say, they would have been glad if their finances had enabled them to have made a reduction in the price of gas; but, like other people, they must bow to circumstances. The sale of coke, as they all knew, was one of their main sources of income. Had the price of coke been maintained at the sum it fetched six months ago, the directors could that morning have announced a reduction in the price of gas. Bearing upon that question, a friend of his, who was a consumer of both gas and coke, remarked that he was not sorry they had had to reduce the price of coke, because the price of gas was sufficiently low, and it was time that the coke consumers had a turn. He (the chairman) thought there was some truth in that, for the price of gas in York was very reasonable, and,

in fact, there were very few towns in the kingdom where it was sold at so cheap a rate; and, in reference to coke, he thought it might be fairly stated that the consumers of that article were now, as his friend said, "getting a turn," for the company had never sold it at a lower rate. The report told them that they had been unusually busy during the past half year. Although the weather had been exceedingly mild it had also been exceedingly dull and damp, and in consequence they had manufactured more gas during this winter than they had done before. As their business increased they would be constantly called upon to meet it, and it was not only necessary that they should provide for their actual business, but it was also necessary to anticipate business with proper foresight, as on that, the success of a business like theirs greatly depended. Since the last half-yearly meeting two of their old and valued friends had passed away—Mr. David Hill and Alderman Steward. He need scarcely say that whilst his brother directors and himself all most deeply deplored their loss, they at the same time could not say too much of their personal worth, and their great business abilities; and in that feeling and expression of sympathy he was sure the shareholders would fully concur.

Mr. J. F. TAYLOR seconded the adoption of the report.

Mr. W. W. HARGROVE said he thought the report would prove satisfactory, not only to themselves, but also to the general body of shareholders. All who were connected with large establishments must know by experience the importance and necessity, and he might say the economy, of not only keeping up all their appliances in a complete state of efficiency, but of availing themselves from time to time of the improvements of the age. The remodelling of the retorts, therefore, and their adaptation to present requirements, must be viewed as an act of wise policy on the part of the directors, notwithstanding that the expenditure for the half year had been augmented thereby. He thought that none of them had any reason to complain of the price of gas, or that the conditional promise of its further reduction had been deferred. He had had the curiosity to look over some statistics with regard to the price of gas in other towns, compared with which York occupied a very favourable position. In Scarborough and Dewsbury the price charged was 4s. 6d. per 1000 cubic feet; in Liverpool it was 4s.; Worcester, 3s. 6d.; Halifax, Huddersfield, Leeds, Bradford, and Manchester, 3s. 4d.; Birmingham, 3s. 3d.; Nottingham, 3s. 2d.; York, Sheffield, Darlington, and Newcastle, 3s. So that out of fifteen of the largest and most important towns the rate in eleven was higher than in York, and in none less. He was also struck the other day, in glancing at the report of a meeting at Middlesbrough, where Mr. Dunning, who was an influential member of the Town Council, in defending the illuminating power of their own gas, stated that a friend of his, who had been a great traveller through England, had informed him that the three best illuminated towns in England were Plymouth, Middlesbrough, and York. With testimony such as this, whether in reference to price or illuminating power, he (Mr. Hargrove) thought they had no reason to be dissatisfied. They ought also to remember the peculiar and difficult position in which the directors were placed. Not only had they to provide a satisfactory

dividend for the shareholders, but they had also to manufacture gas of such an excellent quality, and at such a reasonable price, as would satisfy the general consumers. It appeared to him that in the present instance the directors had met all those requirements, and therefore they could not do less than unanimously adopt the report.

Mr. PHILLIPS asked if the gas-pipes had been examined to ascertain whether they were sufficiently strong to bear any increased pressure. Although he asked the question, he expected the reply would be favourable.

The CHAIRMAN asked Mr. Phillips if he had any reason to believe that any of the pipes had been broken. He had not heard of any, and that spoke volumes that the pipes were sufficiently strong to bear all the pressure required.

Mr. PHILLIPS expressed his entire approval of the report of the directors, knowing that they would declare a dividend that would be honestly earned, that the works in all departments were in a satisfactory state, and that the accounts would bear investigation. He had every confidence in the directors, and considered that they were the persons who should have the management of the works. A few years ago a great declamation was made against independent companies having the charge of gas-works, and for those works being managed by corporations, who, it was argued, would more efficiently manage them for the benefit of the ratepayers. The Corporation of Leeds had for some years had the management of the gas-works there, and there was now a great stir made because they could not put any pressure on the pipes, lest there should be an explosion and a blow up. There had also been complaints about the leakage of the pipes at Leeds, and it was stated to amount to 12,000 feet of gas per mile, which he considered was very considerable. A special meeting of that corporation had been called—and what for, did they think? To consider the necessity of increasing the illuminating power of their gas. The fact was that, although they had gas at Leeds, they were always in darkness.

Mr. R. H. FELTOE, in alluding to complaints respecting the illuminating power of the gas, speaking from personal experience, stated that where such complaints arose, the insufficient light was caused through the services from the mains to the houses not being large enough to supply the number of lights used. He endorsed the remarks of the previous speaker relative to the excellent illuminating power of their gas.

The motion was then put and carried, and the dividend recommended in the report was declared.

Mr. J. R. HILL moved a vote of thanks to the Chairman and Board of Directors for their efficient management of the affairs of the company. When they considered, on the one hand, the very largely increased expenditure, and, on the other hand, the small receipts from the sale of coke, they must say that the state of affairs showed that there had been in the management of the company great care and wisdom exercised. He congratulated the directors and shareholders upon the addition to the board caused by the recent appointment of the City Sheriff.

Mr. H. PRESTON having seconded, the vote of thanks was unanimously passed.

The CHAIRMAN returned thanks, and the meeting then terminated.

YORK NEW WATER-WORKS COMPANY.

The Half-Yearly Meeting of Shareholders was held on the 1st inst.—Mr. J. F. TAYLOR in the chair.

The directors report (read by Mr. J. P. WOOD) was as follows:—

The shareholders will be gratified to observe that the revenue of the company continues steadily to advance, and the directors feel that the time has arrived when they are justified in recommending an increase in the dividend.

The directors have the satisfaction to report that they have extended the mains of the company through the village of Acomb, and also made further extensions in the village of Fulford; and, in addition to the great advantage which the supply of water will be to the inhabitants, they have confidence that the step they have taken will prove remunerative to the company.

The works in connexion with the duplicate trunk main from the reservoir at Severus Hill to the city are now in progress, and the directors are making the necessary arrangements with the view of erecting the proposed additional pumping-station.

The shareholders will no doubt have observed that notice was given of an intended application to Parliament for an Act to supply the city of York with water from near Lastingham, in the North Riding of this county. The directors, knowing that this company fully meets the requirements of York and its neighbourhood by furnishing an ample supply of wholesome water, and that the success of such an application would be most detrimental to the interests of the company, were taking the necessary proceedings to vigorously oppose the same; when, in consequence of the scheme not receiving any support from the citizens, the Bill was abandoned.

The directors recommend that a dividend of 8s. per share on the ordinary shares for the past half year, being at the rate of 8s. per cent. per annum, be declared, and that a dividend of 6d. per share on the preference shares from the 1st of October to the 31st of December last, being at the rate of 4s. per cent. per annum, be also declared, and that the same respectively be paid as tax on and without deduction for income, after Feb. 6, 1877.

The directors regret to have to report that Mr. Thomas Ellis, in consequence of impaired health, has resigned his appointment as a director of the company. They have elected in his place Mr. John Wilson, of this city, builder, and late an auditor of the company. The directors also regret that Mr. Thomas Turner, in consequence of the state of his health, has resigned his seat at the board. They have elected Mr. Joseph Terry, of this city, alderman, a director in his place.

The following directors—viz., Mr. William Sotheran, Mr. Ralph Davison, and Mr. Alderman Terry, retire by rotation, and are eligible for re-election. In consequence of the vacancy in the office of one of the auditors by the resignation of Mr. John Wilson, another auditor will have to be elected, and the directors beg to suggest Mr. John Brown, of High Ousegate, York, druggist, as a suitable person to fill that office.

The CHAIRMAN, in moving the adoption of the report, said that the directors had entered into a new phase of labour in consequence of the powers obtained by the new Act of Parliament which they obtained last session. The amount of responsibility, anxiety, and labour which was entailed upon them by that Act was different to the ordinary course of their action before that Act was obtained. As the new Act gave them power to raise new capital, to employ that capital, and to carry out new works, they must feel that a considerable addition was made to their work. The directors, however, felt that they had not obtained the Act a day too soon. He might say that had they obtained it a year or two ago, perhaps they might have been better able to compete with the requirements of the city than they were now. Having obtained the Act, they were now, to the best of their ability, putting its powers into operation. Referring to the new auxiliary main from the reservoir to the city, he said they had got a right market for the pipes, and the contract they had made was a very satisfactory one. The main was now being laid, and when it was completed it would give them greater power to meet the requirements of the city. The company had extended their mains to Acomb and Fulford, and they had reason to believe that they would have to make other extensions to suburban districts, but these it was believed would be as remunerative as the extensions already made. It was some satisfaction to the citizens to know that they were not living in a city that was decaying, but in a city the trade of which was flourishing and prosperous. They had a right to congratulate themselves that York was a prosperous and increasing city, for as it increased in size, and in the number of its inhabitants, additional water would be required. They might also congratulate themselves as shareholders that the company were increasing and extending every half year. Speaking of the Ebor Water Bill, he said that it was evident, from the way it was received, that it was not a scheme which would commend itself to the attention of the citizens, and as it had

failed perhaps they had better let it fade from memory. It had had, however, one good effect upon the directors. It had led them to examine their position more closely than they had hitherto done, and ascertain the quality of the water they supplied to the inhabitants of York, and he said with all confidence that the analyses they obtained from several analysts—they did not confine themselves to one or two—proved that the water they supplied was good and wholesome. The directors recommended that the dividend be increased from 7 to 8 per cent. He might remind them that in 1869 the half-yearly dividend paid by the company was £1800, while in 1874 it was raised to £2800, not so much by an increase in the per centage of the dividend, but by the creation of new capital, and by having the mortgage debt converted into capital and partaking of the dividend at the same rate as the original capital of the company. From 1874 to the present time there had been no increase, but he did not think the shareholders would be surprised that they were in a position to pay more than they were able to pay three years ago. Looking at the accounts, they considered they were only doing an act of justice to the shareholders in paying to them what the company had justly and honestly earned. The directors therefore confidently recommended that the dividend be increased to 8 per cent. Had they had the slightest fear or suspicion that they should have to go back to a dividend of 7 per cent. they would not have come before the shareholders with that recommendation; but they, however, believed that the dividend of 8 per cent. could be maintained under ordinary circumstances, and unless anything happened beyond the ken of the board. Since the report was printed the directors had considered one or two important matters. The first of these was that they had purchased from Mr. Barstow the land which was scheduled in the Act of Parliament, and which adjoined their works, for the purpose of erecting upon it a new engine-house, and for providing space for constructing filtering-beds, subsiding-tanks, and whatever might be required in future by the company. Mr. Barstow was an unwilling seller, and they were buyers under an Act of Parliament, but that gentleman had met them in a very fair and honourable spirit, although he did tell them he would attend that meeting to inform the shareholders that they (the directors) had dealt hardly with him, and had driven a hard bargain. Mr. Barstow, however, was not present; but the directors were satisfied, taking all the circumstances into account, that the land had been obtained on terms satisfactory to the shareholders. Mr. Hawksley, their engineer, had issued the advertisement for the erection of the new works, and they hoped they would be in a position immediately to proceed with the erection of those works. Bye-laws had been sanctioned, and the plumbers of the city had signified their intention to work according to the regulations contained in them.

Mr. J. L. FOSTER seconded the motion.

Mr. W. C. ANDERSON alluded to the correspondence which had appeared in the newspapers alleging that the water supplied to the city was impure, remarking that it was a great pity that it had appeared, as the water supplied to York was superior to that supplied to the majority of towns. The persons who had brought forward the subject must have done it inconsiderately, for in many respects it had been detrimental to the town. It had come to his own knowledge that persons who had intended coming to York to reside had, after seeing those letters, kept away, and no doubt other persons would know of similar instances; therefore a serious injury had been done to the city. As regarded Lastingham and Kirbymoorside, it was true that there was beautiful water in many springs; but it happened about two years ago that three specimens of water were sent to him from that neighbourhood by a person who wished to build a handsome dwelling there, and who wanted to know if the water was good. Two of those waters were proved, after careful analysis by a very experienced analyst, to be not fit for drinking purposes. There were many such instances on the high moors, where the water was so filled with mineral and other contamination as to be unfit for ordinary use. Referring to the dividend, he remarked that, considering the proposed large increase of their works, he would have preferred that the augmentation of the dividend had been deferred for some time, but he did not think the directors would have proposed it unless they believed they could continue it.

Mr. R. H. FELTOE said that in the last Act of Parliament the York Corporation had power to take samples of their water for analysis. He asked if any samples had been taken, and what was the result. He also expressed his satisfaction at the creation of a capital account, and in reference to the Water Bill already mentioned, he remarked that he never expected it would succeed, but still it must have caused an anxious time for the directors, who had strained every nerve to protect the interests of the company.

Mr. WOOD having read the section of the Act of Parliament referring to the powers of the York Corporation to extract and analyze the company's water,

The CHAIRMAN said that during the half year the corporation had taken samples of water, and the report of the analyses which had been forwarded to the company was to the effect that it was wholesome and pleasant drinking water.

The dividend as mentioned in the report was formerly declared, and Messrs. Sotheran, Davison, and Terry were re-elected directors, and Mr. J. BROWN was elected auditor.

A vote of thanks to the chairman and directors terminated the meeting.

CAMBRIDGE UNIVERSITY AND TOWN GAS COMPANY.

The Half-Yearly Meeting of the Shareholders of this Company was held at the Offices in Sidney Street, on Thursday, Jan. 25—Dr. PHELPS, the chairman, presiding.

The CHAIRMAN said that, before proceeding with the ordinary business of the day, he must ask for an expression of sympathy and regret for the loss they had sustained by the death of their friend, Mr. Charles Edward Brown. Although for some time past he had been unable to take any active part in the affairs of the company, yet he was a thorough man of business, and they would feel his loss very much. He had now to propose the adoption of the reports, which had been printed and circulated, and that they be entered on the minutes. He had not much to say about them except to congratulate the shareholders on the very excellent and sound condition of the concern. He had no necessity to refer to them, except to the report of the manager, from which they would learn that the consumption had increased to such an extent that it was necessary there should be an extension of the works. All would be glad to hear that the requisite funds should be contributed for that purpose. He had no doubt the company would go on and flourish. He moved the adoption of the following reports:—

Directors Report.

The directors herewith submit to the shareholders a statement of accounts for the half year ending Christmas, 1876, which accounts have been duly audited.

The directors recommend a dividend for the half year after the rate of 10 per cent. per annum on the consolidated stock, and after the rate of 7 per cent. per annum on the amount paid up on the new shares, payable on the 1st of February next, free of income-tax.

In view of extensive renewals and additions necessary to be made, a further call of £2 per share will shortly be made on the new shares.

The directors have to express their sincere regret that a vacancy has occurred in their number by the death of their much lamented colleague, Mr. Charles Edward Brown, who

for many years was a valued member of the board. They have elected in his place Mr. John Death. By this election the office of auditor of the company's accounts becomes vacant, and it will the duty of the shareholders at the half-yearly meeting to elect another auditor.

Manager's Report.

The increased demand for gas has taxed the capacity of your present producing power to its utmost limits, and although the supply has been fully maintained, it would not be prudent to allow the next winter to approach without making provision for expected further increase of consumption.

More retorts and a larger station-meter must be provided.

The additional steam-boiler ordered by you has been fixed, and is now in use. This places your exhausting apparatus in perfect condition.

The old main on the Lensfield Road has been taken up, and a 10-inch main laid, which, with the 6-inch main on Trumpington Road, has fully met the requirements of the Brookland district.

The illuminating power of the gas has, with very slight exceptions, been kept up to the required standard. The pressure and purity have been at all times fully maintained.

The following is the balance-sheet for the half year ending Christmas, 1876:—

Dr.	Capital Account.				Cr.
Stock	£37,440	0	0	Expenditure on capital ac-	
New shares	13,104	0	0	count	£59,391 15 10
Loans	9,300	0	0	Extensions to Christmas,	
Balance	327	4	8	1876	779 8 10
	£60,171	4	8		£60,171 4 8

Profit and Loss for the Half Year ending Christmas, 1876.

Manufacture	£7,635 15 11	Sale of gas and meter-rents	£10,093 4 9
Distribution	938 1 3	Sale of fittings	943 2 2
Fittings	507 5 3	Sale of coke	1,902 1 3
Miscellaneous	1,803 6 11	Sale of tar	917 2 3
Balance	2,971 1 1		
	£13,855 10 5		£13,855 10 5

General Balance.

Revenue account	£2,971 1 1	Owing to the company for gas, &c.	£13,115 15 9
Banker's balance	2,713 3 0	Stock	£3,021 17 8
Floating assets	10,766 12 9	Capital account	327 4 8
Unpaid dividends	3 11 9		
Balance of wages account	10 9 6		
	£16,464 18 1		£16,464 18 1

Mr. S. PEED seconded the proposition, which was unanimously carried.

Dr. PHELPS moved the dividends as recommended in the report.

Dr. DROSIER seconded this, and it was carried.

Mr. REDFARN proposed Mr. Clayton as auditor, in the place of Mr. Death, and trusted it would only be a stepping-stone to further advancement in the company.

Mr. S. PEED seconded the resolution, which was carried.

Mr. CLAYTON returned thanks.

Dr. DROSIER proposed, Mr. DIMMOCK seconded, and Dr. FAWCETT supported a vote of thanks to the chairman, which was unanimously carried.

Dr. PHELPS briefly responded, and the proceedings terminated.

CAMBRIDGE WATER-WORKS COMPANY.

The Half-Yearly Meeting of this Company was held on Friday, Jan. 26 —ELLIOT SMITH, Esq., in the absence of the Provost of King's College, presided.

The following are the reports, which, with the balance-sheet, had been printed and circulated, and were taken as read:—

Directors Report.

Your directors herewith transmit the statement of accounts for the past half year. They recommend that a dividend on the consolidated stock, and on the first, second, and final calls upon the new £2 shares, for the half year ending Jan. 6, 1877, at the rate of £10 per cent. per annum, be paid on the 1st of March next, free of income-tax. To assist in the payment of this dividend, the sum of £38 9s. 10d. will be appropriated from the suspense account.

All the calls on these shares being paid, it is proposed to convert them into stock. The directors refer the shareholders to the engineer and manager's report, which shows the progress of the company's business and the extension of the works.

A call of 10s. per share will be made on the new shares created at the meeting held in May last, payable on the 6th of April next.

The directors regret the loss of their late auditor, Mr. C. E. Brown, whose successor remains to be elected by you at the ensuing meeting.

In consequence of this vacancy, they have of unavoidable necessity to submit to you the accounts unconfirmed by the usual audit.

The retiring directors are the Rev. Dr. Okes and the Rev. Dr. Pulling, who are eligible for re-election.

Manager's Report.

During the past half year, water from the company's works has been laid on to 104 premises, the increased rental derivable from which is £113 per annum. The total number of premises now supplied is 6738.

The new works in progress at the company's pumping-station are well advanced, and the additions to the distributing mains in the town are nearly complete.

The general condition of the company's works is satisfactory.

Dr.	General Balance, Jan. 6, 1877.				Cr.
Revenue account	£2,399	0	1	Banker's balance	£1,524 15 4
Capital account	333	17	3	Manager's balance	57 8 9
Unpaid dividend	35	8	3	Water-rates	1,622 6 8
Suspense account and sale of unallotted shares	876	6	1	Water account (sundries)	308 15 7
Accounts owing by the company	1,387	1	0	Fitting accounts	645 19 11
				Stock in hand	324 2 9
				Rents (ordinary)	31 15 0
				Transfer fees	2 15 0
				Rents (Cherryhinton estate)	79 17 8
				Improvementcommissioners interest	20 12 0
				Ditto (stand-post account)	413 4 0
	£5,031	12	8		£5,031 12 8

The CHAIRMAN, after expressing his regret that the Provost of Kings College, though happily better, was not able to be present, and also expressing the regret they must all feel at the loss of Mr. C. E. Brown, one of their auditors, congratulated the shareholders upon the condition of their affairs, and proposed that the report be received and adopted.

This was unanimously agreed to, as also was a further resolution from the chair, as to the declaration of the dividend recommended by the report.

It was resolved to convert the new shares into capital stock.

Dr. Okes and Dr. Pulling were then re-elected directors.

Mr. W. CLAYTON proposed, and Mr. COLLYER seconded, the election of Alderman Deck as auditor, in the place of the late Mr. C. E. Brown.

Mr. EADEN proposed, and Mr. S. PEED seconded, the election of Mr. Nutter.

On a division being taken, there were found to be 275 votes for Mr. Deck, and 221 for Mr. Nutter.

The CHAIRMAN declared Mr. Deck elected.

The usual votes of thanks to the chairman and to the directors terminated the proceedings.

WORCESTER GAS COMPANY.—The ordinary half-yearly meeting of shareholders was held at the company's offices on Tuesday last. The usual formal business was transacted, namely, receiving the report of the directors and declaring a dividend of 5 per cent. for the half year.

NORWICH WATER-WORKS COMPANY.

The Half-Yearly Meeting of Shareholders was held on Wednesday last —Mr. H. S. PATTESON in the chair.

The SECRETARY (Mr. R. Cooper) read the following report of the directors:—

The accounts of capital and revenue for the half year ending the 29th of September last, now read, have been carefully investigated by the auditors, who have certified to their correctness in the usual manner.

After payment of working expenses, debenture interest, and dividend on the preference shares, and including the balance from the previous half year, there remains a sum sufficient to pay a dividend on the ordinary charges at the rate of 6 per cent. per annum, deducting income-tax, leaving a balance of £378 0s. 2d. to the credit of the next half year's account. The directors have, therefore, declared a dividend at that rate, which will be paid to the shareholders on the 2nd of February.

The directors have great pleasure in announcing this increased dividend for the last half year, and have every confidence that the same rate will be maintained.

The directors who retire by rotation are Messrs. H. S. Patteson, S. Grimmer, and R. Fitch, who, being eligible, offer themselves for re-election.

The company's works are in a very effective condition, and the business is quite satisfactory.

The CHAIRMAN, in moving the adoption of the report, said he had only to congratulate the shareholders upon the very satisfactory condition of the company and of their works. The shareholders were, no doubt, glad that the directors were enabled this half year to declare a dividend of 6 per cent., and to leave, within a few pounds, the same balance as at the corresponding period of last year. Besides this, the directors had been able to lay by £200 towards the sum they were reserving for putting in new boilers. The rates had been increasing satisfactorily, for they were more by £200 or £300 than at the corresponding period of 1876. That morning he accompanied Mr. Hawksley, the company's engineer, over the works at Lakenham and Heigham, and he was pleased to see their beautiful condition. In the covered reservoir, built six years ago, there were 14 feet of water, and, on getting accustomed to the light, he could see every brick, for there was no sediment of any kind.

Mr. BACON seconded the motion, which was unanimously adopted.

The retiring directors and auditor were re-elected.

Mr. HAWKLEY stated that since he last addressed the shareholders nothing had happened in the engineering department of the company's works which bore in the slightest degree an unfavourable aspect. The works were in a state of the highest efficiency, there was perfect order in every department, and the water was undoubtedly excellent. He did not know what he could say further to assure the meeting of the soundness of this undertaking from an engineering point of view. Having looked at the accounts, he could state that the company were now, and appeared likely prospectively to be more so, in the very best financial position.

Mr. BACON moved that the thanks of the directors and shareholders be given to Mr. Ayris for maintaining the efficiency of the works.

Mr. PYMAR, in seconding the motion, said that the company were much indebted to Mr. Ayris for so assiduously looking after the works.

Mr. GRIMMER testified to the energy Mr. Ayris at all times displayed, and said that some years ago, before Mr. Ayris took these works in hand, he received no dividend; but since Mr. Ayris had been manager, the dividend had been gradually increasing from 1 to 6 per cent.

The motion having been adopted,

Mr. AYRIS thanked both the directors and the shareholders for the confidence they placed in him, and said that he was glad to meet them now that a dividend of 6 per cent. had been declared—the maximum dividend they could receive, and which he hoped the shareholders would receive for many years to come.

After some conversation on an inquiry respecting the payment of back dividends and the publication of the accounts,

A vote of thanks was given to the chairman and directors, with which the business terminated.

WIMBLEDON WATER SUPPLY.—The Local Board of Wimbledon, which is supplied by the Southwark and Vauxhall Water Company, are taking steps to secure a water supply of their own, from artesian wells. Mr. Homersham, C.E., has been consulted, and has given a decided opinion that a pure and ample supply could be obtained, from wells to be sunk at Wallington, for about £55,000.

RICHMOND WATER SUPPLY.—At the meeting of the Richmond Select Vestry on Tuesday last, Mr. E. Hertslet moved that the reading of the minutes of the Water Supply Committee should be deferred until the next meeting, on the ground that, if then read, too much information would be given to their opponents, the Southwark and Vauxhall Water Company. He said that the officials of the company were on the alert to take advantage of the difficulties of the vestry, and alleged that they had thrown money into the trenches in the streets, in order to betray the labourers employed by the vestry from their allegiance. Mr. Maxwell opposed the motion, and reminded Mr. Hertslet that even if it was as he said, the power to bribe would remain with the water company, whether the minutes were read or not read. He knew as a fact that the greatest possible misery prevailed right and left, and he believed there would be, at the proper time, a deputation representing the poor cottagers of the town left day after day without water. Some of them had to go up to Mount Ararat, a distance of nearly half a mile, to get water. This matter was very serious. They had already drawn from the Local Government Board £22,000; they had as yet paid over £19,176; they owed £1040 more, which they were bound to pay without hesitation, and, as a real matter of fact, they had at this moment only a small balance of something less than £7500 in hand after the cheques of the day were paid, with which to carry on and complete the entire water supply of the town. In such a matter there should be no secrecy, unless it could be shown that secrecy would be to the advantage of the ratepayers. What was wanted, to give peace and security to the town, was knowledge. There were a variety of statements as to the sources of supply. He knew nothing about it himself, but he heard that the well, for which £500 had been paid yielded nothing to the town at present. It could not benefit Mr. Rumble, the engineer of the water company, or anybody else, that the truth should be known. As a matter of fact, the promises made to him (Mr. Maxwell) personally, with regard to the water supply, were broken. He knew it well, having in his house very serious illness, for which baths were prescribed. He appealed to the water company, and they certainly behaved most courteously and kindly to him, and he felt thankful to them for it. About 80 families, tenants of his, were none of them supplied, and in Marchmont Gardens the supply was ridiculously insignificant. Some of the servants who had to drudge to get the water were giving notice right and left. The chairman said the short supply in some cases was owing to the fact that some people bribed the watermen to favour their own tenants. He himself had suffered from the want of water, but he believed that the committee were doing their very best, and he, for one, was willing to put up with the inconvenience. The motion to defer reading the minutes was agreed to by a large majority. It is stated in a local paper that the vestry are progressing with their work as fast as possible. Out of 2200 houses the pipes have been connected at 1895. There is a large supply of water in the reservoir, and the vestry have obtained the consent of the proper authorities to take water from springs in Richmond Park. These springs are of excellent quality, and the supply is abundant.

LEEDS CORPORATION GAS SUPPLY.

Mr. HENRY WOODALL, the gas engineer of the Corporation, has just presented the following report to the Gas Committee:—

Mr. Chairman and Gentlemen,—In accordance with your instructions, I have pleasure in submitting the following report on the question of improving the quality of the gas.

As you are aware, the corporation are at present under parliamentary obligation to supply gas having a minimum illuminating power equal to 16 candles; the candles burning at the rate of 120 grains, and the gas at the rate of 5 feet per hour.

The questions now to be considered are as to the desirability of improving upon this prescribed standard; to what extent, and at what cost, can the improvements be effected?

In the first place, then, I have to remark that even between experienced operators, and with the most improved apparatus, it frequently happens that variations occur to the extent of half a candle in experimenting upon the same gas. It may, therefore, be fairly questioned whether it is possible with the unassisted eye to estimate the quality within one candle, even when observing the light emitted from the same burner from day to day. But if the quality is to be judged upon a variety of burners, the difficulty becomes far greater, one burner giving as much as 200 per cent. more light from a given quantity of gas than another. Again, it must be remembered that 16 candles is the minimum quality, and that it is impracticable always to manufacture gas (especially where a proportion of canal is required) within a range of less than one candle, so that gas may be 16 candles one day, and in excess of 17 candles on the day following.

Bearing these facts in mind, it will be evident that to be appreciable to the public the standard of illuminating power must be increased by not less than 2 candles.

Now, as to the cost; and, in submitting the following estimate, I have to remark that it closely coincides with a calculation I made twelve months ago, when prices of coal, canal, coke, and other residuals, varied considerably as compared with those now current. On the former occasion I found the cost to be 1'6d. per candle per 1000 feet, as against 1'4d. to-day.

Common Coal estimated to produce 10,000 Feet of 14-Candle Gas, costing 9s. 2d. per Ton. Canal estimated to produce 10,000 Feet of 21-Candle Gas, costing 16s. per Ton.

10,000 feet of coal gas	=	480 lbs. of sperm.
10,000 feet of canal	=	720 " "
10,000 feet of 16-candle gas	=	548 " "
10,000 feet of 18-candle gas	=	617 " "
Difference between the value of 16 and 18 candle gas	=	69 " "

Coal costing per ton	s. d.	9 2	Canal costing per ton	s. d.	16 0
Yields—			Yields—		
Coke, 6½ chald. at 4d.	2 2		Coke, 6 chald. at 3d.	1 6	
Tar, 11 gals. at 2'7d.	2 6		Tar, 10 gals. at 2'7d.	2 3	
Liquor, 28 gals. at '76d.	1 9		Liquor, 20 gals. at '76d.	1 3	
		6 5			5 0
Cost of coal to produce light = 480 lbs. of sperm	2 9		Cost of canal to produce light = 720 lbs. sperm	11 0	
			Deduct for 480 lbs. sperm	2 9	

Cost of difference between product of canal and coal = 240 lbs. = '4d. per lb. 8 3
Difference between value of 16 and 18 candle gas = 69 lbs.
69 lbs. at '4d. per lb. = 28'29d. for 10,000 feet, or 2'82d. per 1000 feet for 2 candles.

The present price of gas is 3s. 3d. per 1000 feet, subject to discounts to large consumers, and a concession on the quantity supplied to public lamps, reducing our income per 1000 feet sold to 3s. 1d.

But any increase in the illuminating power would have to be over all the gas manufactured, and not merely over the quantity sold. It is necessary, therefore, that the calculation should be made on the greater bulk. Our income from gas, calculated on the quantity made during the year ending June, 1876, was 3s. per 1000 feet. Since that date, the price has been reduced to consumers by 6d., or say 5d., per 1000 feet over all gas manufactured, making the net income at the present date but 2s. 7d.; or, supposing our gas to be equal to 17 candles (which is nearer the fact than 16), then the price now paid is at the rate of 1'8d. per candle per 1000 feet made.

Looked at from this standpoint only, there would be a clear gain to the public by increasing the quality equal to the difference between 1'8d. and 1'4d. per candle, or '8 of a penny per 1000 feet for 2 candles.

But it is necessary to inquire further, over what portion of the gas supply would an increase in the illuminating power of the gas be appreciable or valuable. In order to acquire data on this point, I took account yesterday of the gas manufactured between the hours of 9 a.m. and 3 p.m., that is during those hours when gas is least required as an illuminant; and I also had observations made, at all the gasholder stations, of the increase or decrease in stocks.

It transpired that during those hours we sent out 1,107,000 feet, or just 21 per cent. of the total delivery during 24 hours. It must be admitted that the morning was dull, and that for half an hour extremely so; but the 6 hours, as compared with the weather of the past two months, were a fair average. Now, this quantity only included the leakage pertaining to 6 hours out of the 24; to it, therefore, must be added that of the remaining 18 hours, and estimating at 10 per cent. on the winter months, as against 16 per cent. on the year round, we have a further addition of 420,000 cubic feet; added to this there is a *pro ratâ* consumption for all manufacturing, heating, cooking, and miscellaneous purposes during the remaining 6 working hours of the day; and again, the numerous lights in bed-rooms and passages during the night, also 400,000 feet to public lamps. Looking at the matter as dispassionately as I can, I feel persuaded that the quantity of gas consumed, upon which the suggested improvement would be appreciated, would not exceed one-third of the quantity made. If such is the case, then the 1'4d. per 1000 would have to be paid over 10,000 feet, while only beneficial over 3300 feet; or, in other words, 4'23d. would have to be expended to yield an advantage of 1'8d. I have not by any means exhausted the question, but will only throw out a few suggestions upon the case.

The supply of canal is very limited as compared with that of coal, and any increase in the quality of gas must rapidly enhance the value of the former. Coke is not commanding the relative price that it used to do, and if it is not to become an absolute drug in many localities, its quality must be kept up by limiting the admixture of that from canal. Gas is yet but in its infancy, and must inevitably be in increasing demand for many purposes other than lighting, and it is essential, therefore, to the manufacturer, as well as to the householder, that the price should be kept down to the lowest limit consistent with the reasonable requirements of the public.

Beyond all, however, I submit that it is unreasonable to increase the quality of gas by 2 candles, at a cost of not less than £10,000 a year, to improve the average light from, say, 10 to 12 candles (in thousands of instances it would only be from 6 candles to 8), when, by the expenditure of a few pence any person may derive the full value of 16 candles, or treble the advantage.

PROTEST OF THE CANADIAN GAS COMPANIES AGAINST THE STRINGENCY OF THEIR GAS ACT.

[From the *American Gaslight Journal*.]

Last year a few representatives of Canadian Gas Companies met Mr. Brunel, Commissioner of Inland Revenue, at Ottawa, to protest against the very stringent conditions of the Sales of Gas Act, as regards sulphur other than sulphuretted hydrogen, and against the exorbitant fees fixed for officially testing gas-meters.

After a most careful hearing, the commissioner requested that the views of the deputation be reduced to writing, and presented to him for further consideration. The following is the text of the protest submitted, which will be found of considerable interest to our readers as regards the sulphur bugbear. The authorities quoted are certainly of high standing, and should carry conviction—

To A. Brunel, Esq., Commissioner, Inland Revenue Department, Ottawa.

Dear Sir,—When certain of the undersigned, as a deputation representing the gas companies of the Dominion, had the pleasure of waiting on you at Ottawa recently, to urge the abrogation, or, at any rate, the relaxation of the exceedingly stringent Orders in Council of the 12th of February last, in respect of the amount of sulphur other than sulphuretted hydrogen, and ammonia, permissible in the gas to be supplied hereafter in the Dominion, and also to protest against the exorbitant scale of fees fixed for officially testing gas-meters; while receiving the deputation very courteously, and patiently hearing all the objections made, you asked that the objections might be put in writing. We, therefore, hereby beg to comply with your request.

Sulphur.—We respectfully submit that the sulphur remaining in gas freed from sulphuretted hydrogen, while very difficult and expensive to remove, is so infinitesimal as to be without any perceptibly injurious effects, and that its presence is, indeed, so innocuous as never to be objected to, or even suspected, by the consumer. Dr. Versmann has shown that three lucifer matches burnt in the course of an evening produce as much sulphurous acid as the whole evening's consumption of gas in a room. Dr. Odling, Fullerian Professor of Chemistry at the Royal Institution, London, in a lecture delivered in June, 1868, shows conclusively of how little account this sulphur bugbear is. He said:

"I am altogether at issue with the public when they maintain that the sulphur of gas produces by its combustion oil of vitriol, or that the amount of sulphur ordinarily contained in gas is of any consequence whatever; and a little consideration will, I think, satisfy you of the soundness of this position. We will assume that coal gas contains, not 20, but 40 grains of sulphur in 100 cubic feet—a quantity, at any rate, greatly exceeding the reality. Now, making another extravagant assumption—viz., that the whole of these 40 grains of sulphur would be completely burnt, and, in reality, they would be burnt very incompletely—they would furnish by their combustion 80 grains of sulphuretted acid gas. This quantity of the produced sulphurous acid would occupy, at ordinary temperatures, about 1-15th of a cubic foot; and, since 100 cubic feet of our coal gas give 1-15th of a cubic foot of sulphurous acid, 1500 cubic feet of coal gas would be required to furnish one cubic foot of the acid, even upon the extravagant assumption we have purposely made. But the combustion of 1500 feet of coal gas would produce something besides sulphurous acid. It would produce at least 1000 cubic feet of carbonic acid, and, in addition to its dilution with other gases and vapours, we should have our sulphurous acid diluted by 1000 times its volume of carbonic acid. Now, if we get at the proportion of carbonic acid in the atmosphere of a room highly illuminated with gas, and take the thousandth part of that proportion, we shall be able to form some notion of the amount of sulphurous acid present. You will remember that the amount of carbonic acid furnished by the breath of one individual is equal to that furnished by two 3-feet gas burners, and that the maximum amount of carbonic acid found in the atmosphere of a crowded theatre was 0'32 per cent. Now if, in addition to our previous unreasonable supposition, we further suppose that an atmosphere contains 0'2 per cent. of carbonic acid, furnished by gas combustion, you will see that the whole matter becomes a *reductio ad absurdum*, that we might actually have one half-millionth part of sulphurous acid present in the air of a gas-lighted room."

Dr. Schilling also says, in his *Journal für Gasbeleuchtung* for 1869: "Twenty grains of sulphur in 100 cubic feet of gas are entirely unobjectionable. Under the most favourable circumstances, with no ventilation whatever, it would give the atmosphere of a room only one part of sulphurous acid in 500,000 parts of air."

It will be thus seen that, even as a chemical fact, any supposed injurious effects of the presence of sulphur in the gas wholly vanish. In England, where the necessary skill and the requisite appliances are readily obtainable, the sulphur compounds other than sulphuretted hydrogen are entirely disregarded outside of London and two or three other large cities. We, therefore, submit that restricting the sulphur to the limits imposed in London, where, with all their advantages, keeping it within such limits has been the exception rather than the rule, in a country like Canada, subject to such extreme variations of climate, is vexatious and unnecessary, and we hope the Orders in Council in respect thereto will be wholly reversed or largely modified.

Ammonia.—If, as has been shown, stringent regulations in respect of sulphur in the gas are uncalled for, they are as surely equally so in the case of ammonia. A small quantity of ammonia in the gas is of itself not only unobjectionable, but is rather an advantage in the combustion of gas, in combining as an alkali with the aforesaid sulphur compounds, and so neutralizing their supposed injurious effects by the probable formation of a trace of the harmless product sulphate of ammonia. Like sulphur, it is disregarded in English gas legislation, except in London and a few other places. In such of the States of America where restrictions are imposed, we understand the limit to be five grains in 100 cubic feet of gas, and we respectfully suggest that a like proportion be the minimum in Canada.

Fees for Testing Meters.—Notwithstanding your replies to the serious objections urged on this question by members of the deputation at the interview with you, it is still hoped that you will be able to see your way to a reconsideration, and the recommendation of a considerable reduction in the published scale. The excess over the official prices charged in England, in the usual sized meters, is more than 300 per cent. The exorbitant charges will be a very serious and constant tax on gas companies. In the case, for instance, of the New City Gas Company of Montreal it will, including labour in unfixing and refixing meters, amount to at least 2000 dollars per annum, and proportionately so with other companies. It is, therefore, hoped that such alterations will be made in the proposed arrangements as will effect a considerable reduction in this serious outlay.

NEW GAS AND WATER COMPANIES.—The Daventry Water-Works Company were registered on the 18th ult., for taking over, improving, and carrying on the Daventry Water-Works, situate in the parish of Daventry, Northampton, with a capital of £3000, in £10 shares. The Bargoed Gas and Water Company were registered on the 22nd ult., for the construction of the necessary works for supplying gas and water to the inhabitants of the village of Bargoed, parish of Gelligaer, county of Glamorgan, and its vicinity. The capital is £20,000, in £10 shares.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

Consequent upon the more pacific appearance of Eastern politics this week, there has been somewhat more spirit shown by buyers, and a resultant slight improvement in the amount of business done.

Pig iron is tolerably steady all round, and the leading houses are now pretty well sold forward, especially in foundry brands. Agents for the North Yorkshire producers now quote the following prices at works:—No. 1 foundry, 49s.; No. 2 foundry, 49s. 6d.; No. 3 foundry, 46s.; No. 4 foundry, 45s.; No. 4 forge, grey, 44s. 6d.; No. 5 forge, mottled, 44s.; No. 6 forge, white, 43s.; refined metal, 62s. 6d.; Kentledge, 50s.; and cinder pig, 40s.; all per ton, net. Messrs. Stevenson, Jaques, and Co.'s (Middlesbrough) "Acklam" brands of pig are—No. 1, 49s.; No. 3, 47s.; No. 4 foundry, 46s.; and forge, 46s., in trucks. Other northern pigs are similarly priced.

North Lincolnshire brands continue firm, although the production of that locality is on the point of being augmented by the starting of four additional furnaces—two by the Redbourne Hill Company, and two by the new Appleby Iron Company. "Redbourne" No. 1 is now held at about 60s.; No. 2, 56s.; No. 3, 54s.; No. 4 foundry, 54s.; No. 4 forge, 51s.; M & W, 50s. per ton. Derbyshire and South Yorkshire brands are steady at late rates.

I understand that several good pipe orders have been placed in this vicinity within the past few days, one leading concern having received such an encouraging quota that a number of extra men have been put on, in those departments. Generally speaking, however, there is not much change to note in the state of the manufactured iron trade, there being very little work in hand at the iron forges, although there certainly appears to be a change for the better in the Bessemer trade.

The Wingerworth Coal and Iron Company, Derbyshire, are said to have decided to suspend the working of their ironstone mines and collieries for the present, owing to the depression of trade.

At several of the leading South Yorkshire collieries men are being discharged, and at others wages are being lowered. Trade in coal, in fact, rules so quiet that at hardly any of the local and district pits do the working days reach three weekly. Under such circumstances, and with the existing glut of the market, it is almost superfluous to remark that prices are so easy that patient and persistent buyers are enabled to have matters pretty much their own way. Steam coal is perhaps the exception, and even that is not "on a dead level" at the list rates.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is no improvement to report in the condition of either the coal or iron trades of this district, the depression in both branches of industry being, if possible, more marked than ever. The relapse of the coal trade from the inflation which existed two years ago has been more complete than any one could have anticipated, and colliery proprietors are now in a worse position than during the period of depression which immediately preceded the great rise in values in 1873 and 1874. For some classes of coal lower prices have now to be taken than those ruling in 1870-1, whilst the permanent cost of production has since been increased fully 1s. per ton, by the restrictions of the Mines Regulation Act. Wages are also higher, and the men work shorter hours. Very much the same thing has taken place in the iron trade, and makers complain that it is impossible to produce the iron at the prices which are now offered.

All classes of coal continue abundant in the market, and colliery proprietors, although nominally they have made no change in their list rates, are unable to maintain late prices. Large quantities of round coal have been thrown upon the market by the exceptional mildness of the season, and stocks are accumulating, the present production being considerably in excess of the demand. Common coal is also difficult to sell, and for large export orders very low prices are being taken, common coal, at the High Level, Liverpool, being offered at 7s. per ton. Common engine coal also continues a drug, and slack is being delivered at the chemical works at a price which does not leave more than about 2s. 3d. per ton at the pit. The average prices at the pit mouth in the Wigan district range about 10s. 6d. to 11s. per ton for good Arley, 8s. 6d. to 9s. for Pemberton four-feet, 6s. 6d. to 7s. 6d. for common coal, 5s. 6d. for burgy, and 2s. 6d. to 3s. 6d. per ton for slack.

In the iron trade local makes are still being kept out of the market by the low price at which sales of north country iron are being pushed here by merchants who have evidently large stocks on hand, upon which they are compelled to realize. Finished iron is also quiet; and manufacturers who have orders on their books find it difficult to obtain the specifications from merchants. Quotations remain at about £6 15s. to £7 per ton for bars delivered into the Manchester district.

The long-deferred award on the Oldham colliers dispute has at length been given. The men some months back made an application for an advance of 2d. in the 1s., which was the amount of a reduction which had been made a short time previously; but the arbitrator has decided that the wages shall neither be increased nor reduced.

The Lancashire coal merchants, at a numerously attended meeting held at Manchester on Tuesday last, decided to form an Association for the protection of their interests.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England does not improve as the year progresses. It has fallen back into quite a dull state, and the prospects of much good spring trade are very moderate indeed. The house coal trade is doing very badly. In the early part of the winter the south country merchants laid in pretty heavy stocks, and as the season has been remarkably open and mild they have not got quit of them as they would have liked, and they have not been able to put any fresh orders in the market of any value since the new year. The quotations are comparatively low. They are little more than 11s. 6d. per ton for best qualities, and from 1s. to 1s. 6d. per ton lower for second sorts. The shipments of best gas coals from the Tyne Dock are a moderate average. They are mostly taken off by steamers. There is not much demand for small coasters in this trade. The prospects of second-class gas coals were not so good last week as the week before. The iron trade did not look so strong, and the second-class gas collieries of the county of Durham will be, and are, a good deal governed by the state of things in the iron trade of the North of England. The steam coal trade of Northumberland continues in a very poor way. The collieries are working short time throughout. The pitmen are badly employed, and their wages are miserably enough at present.

Coal freights generally are lower. There was actually no demand for sailing coasting vessels last week. Rates to the east coast and the Channel ports were extremely flat. They ranged from 4s. 8d. to 4s. 9d. per ton for steamers to load coals for London. There is very little business opening for the Baltic, and outward trade to the Mediterranean is falling off. There are very good shipments of coke to Spain and Africa.

The timber trade is duller than it was. House-building is falling off in all the large towns of the North of England. The principal deliveries of

timber at present are for the collieries; but a large amount of timber may be expected in the coal ports as soon as the Baltic reopens. A better business is transacted from Spain and Africa in Esparto grass, copper, and iron ore. The general manufacturing trade of the Tyne and Wear is comparatively dull. The principal manufacturing houses have their agents and travellers upon the Continent looking up business for the year; but foreign merchants show an indisposition to enter upon contracts for forward delivery.

The manufacturing iron trade has been checked; the uncertainty which surrounds everything connected with the Eastern Question keeps all speculation back, and business gives strong indications of falling into the same dull, inanimate state which characterized it during the whole of last year.

The wages of workmen are lower a good deal than they were in the time of excessive prosperity in the districts; but they are still very much in excess of what they ought to be, considering what a profitless affair the coal trade and manufacturing business of the North of England was to the coalowners and manufacturers last year.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Mr. J. Falconer King's report of his analysis of the gas supplied to the City of Edinburgh on the 18th of January showed that the illuminating power of that furnished by the Edinburgh Company, expressed in standard candles, was 29.91, and that of the Leith Company 30.24.

A slander case of some interest has been raised in the Court of Session, which may be mentioned here, as it has arisen in connexion with the gas affairs of Forfar. The alleged slander complained of took place in the course of a newspaper correspondence with reference to the cost of gas in that town. Both of the parties, Lowson and Rutherford, were members of the Town Council of Forfar, and the pursuer, Lowson, who is a coal merchant, was convener of the Corporation Gas Committee. He was accused in one of the letters written by the defender, in respect of his influence in the Gas Committee, of accepting gratuities, commissions, or "backsheesh," from some or all of the contractors who supplied, or offered to supply, the gas coal to the corporation, given in order to obtain his influence for the acceptance of their offers, or at least connived at the acceptance of gratuities by others. The following is the issue which has been agreed upon by the counsel for the parties, and accepted by the Court:—"Whether the said letter, or part thereof, is of and concerning the pursuer, and falsely and calumniously represents the pursuer as having accepted gratuities for using his influence, in his capacity of a member of the said Gas Committee, for procuring the acceptance of offers to supply coal to the gas-works belonging to the said burgh, or permitted others to accept gratuities for the said purpose, to the loss, injury, and damage of the pursuer?"

The complaints about bad gas have now reached the town of Kilmarnock, where the supply is in the hands of the corporation. One indignant rumblor writes to say that somebody is to blame. He does not say whether or not he is to blame himself for not having his burners in a proper condition. He goes on to say: "Let the right man look out, for positively we must sell out again if our corporation cannot do better for us than this."

On the evening of Thursday last, the populous weaving and mining village of Dregghorn, near Kilmarnock, was lighted for the first time with coal gas, the event being celebrated by a public dinner at the "Crown" Hotel. The new works have been designed by, and constructed under the superintendence of, Mr. S. Dalziel, manager of the Kilmarnock Corporation Gas-Works.

An attempt at keeping down the gas account has just been detected at Aberdeen, and due punishment awarded. At the Aberdeen Police Court on Thursday—Baillies Smith and Macdonald on the bench—William Wishart, engine-fitter, residing in St. Andrew Street, pleaded guilty to having fraudulently prevented the index of the gas-meter in his house from registering the quantity of gas consumed. He had undone the couplings of the meter, and attached an india-rubber tube to the pipe, and had not allowed the gas to pass through the meter so that it could have been registered on the index. Baillie Smith, in passing sentence, said accused had put his ingenuity to a very disgraceful purpose—that of defrauding not only the Gas Commissioners, but the public of the city. There was a meanness about it, as it had been done with the intention of making his gas account as small as he possibly could without suspicion. He had, however, been suspected, and the gas officials had found the tube attached to the pipe. As it was the first offence, and he hoped it would be the last, the accused would have to pay a fine of 40s., with the alternative of 20 days imprisonment.

The Town Council of Hamilton had the subject of the gas accounts under consideration at their usual monthly meeting, last Thursday. A minute from the Gas Committee recommended payment of accounts, amounting £915 17s. 8½d., of which nearly £700 had been incurred for pipes that had been laid down in Almada Street, Quarry Street, and Union Street. Several members of the council complained of the dilatoriness displayed in the preparation of the balance-sheet, and in the course of the conversation it was stated that the last balance was reported to a meeting of council in June, 1874. The discussion dropped, on the understanding that the financial statement would be forthcoming at next meeting.

Dr. Wallace, in reporting on the quality of Glasgow gas during the week ending the 27th of January, gives the lowest minimum illuminating power at 24.74 candles, the lowest average at 25.99 candles; the lowest maximum at 26.04 candles, and the highest at 28.20 candles. The question of the illuminating power of the gas having been under the statutory minimum several times during the last month or two was lately under the consideration of the magistrates, and a communication from them was brought under the notice of a recent meeting of the Sub-Committee on Works. Mr. Foulis stated that the recent low illuminating power had been caused, to a large extent, by the coals having been delivered wet, and it being necessary to use the same at once, in consequence of the storage accommodation at the works being inadequate, and the stock of coals nearly exhausted. Thereafter the chairman, and Councillors Dron, Finlay, and Mathieson were appointed a sub-committee to consider the whole question of providing additional coal storage, and to report.

At last Thursday's meeting of the Town Council of Glasgow, a conversation arose in regard to alleged incivility on the part of the clerical officials at the corporation gas office. Speaking upon the subject, Treasurer Osborne said that there was no doubt but conduct of the kind complained of was very high-handed and discourteous, not only to consumers, but to the public, who were the masters of the officials. He thought that the Gas Committee should draw the attention of the responsible officials to such conduct.

At a recent meeting of the Sub-Committee on Works, Mr. Foulis read a report by him, drawing attention to the great loss of gas arising from leakage in the pipes laid throughout the city, stating that the apparent cause of this leakage was excessive pressure, and pointing out how this over-pressure might be obviated, or at least diminished, by dividing the city into districts and putting down governors in each district, in the manner indicated on the plans also submitted. After some conversation on the subject, the meeting appointed Messrs. Miller, Finlay, and Smith

a sub-committee to consider the whole matter, and report, Mr. Finlay to be convener.

Forfar is still in the "throes" upon the water question, but there is now really a prospect that something will be done, or, at all events, promised, by the local authority to amend the condition of things which has so long prevailed, and brought disgrace and disrepute upon the town.

The "first sod" in connexion with the Bruntisland Water-Works was cut last Wednesday. It is expected that the water will be introduced into the town by Midsummer, 1878. Mr. John Sang, C.E., Kirkcaldy, has been appointed to superintend the works throughout.

The contractors for the Cupar Water-Works have lately put in a claim for extras to the amount of fully £3000, and a claim from the Earl of Glasgow, who has property in the line of works, is also under consideration.

Nothing new of any special importance has to be reported regarding the iron and coal trades. The price of pig iron has fallen again about 1½d. per ton.

GAS EXPLOSION AT BARNSELY.—On the 29th ult. an explosion of gas occurred at a house in Shambles Street, Barnsley. While some men were putting in a larger meter, the gas by some means became ignited, and exploded, blowing a large pane of plate-glass out of one of the windows, and doing other damage. One of the workmen was injured.

BROADSTAIRS WATER COMPANY.—The annual meeting took place on Tuesday, the 30th ult. The affairs were stated to be in a satisfactory condition; a dividend of 3½ per cent. was declared (making 6 per cent. for the year), and £559 were carried forward. On the authority of Dr. Frankland, the water was said to be of excellent quality, now that the new works are in operation. At a subsequent extraordinary meeting, it was resolved to raise £1500 new capital for the purposes of extension.

DARLINGTON CORPORATION GAS-WORKS.—At the meeting of the Darlington Council on the 1st inst., the manager of the gas-works reported that he had put regulators on to the public lamps, which had reduced the waste of gas. The quarter after the regulators had been fixed the unaccounted-for gas was reduced from 23 to 14 per cent. The Mayor, Mr. Morrell, and other gentlemen, spoke of the lighting of the streets being defective; but this Alderman Kitching said was due to the distance between the lamps, which should be closer together.

COLNE GAS COMPANY.—On the 30th ult., a meeting was held at Colne of ratepayers and owners of property, to consider the question of the Colne Local Board opposing a Bill, now before Parliament, of the Colne Gas Company, for an extension of their powers. It was stated that the local board had offered to pay the company over £32,000 for the works, the capital of which only amounted to £13,500, but that negotiations had fallen through, because the gas company wanted to be paid costs, in addition to that amount. After a good deal of lively discussion, it was resolved that money be taken out of the district rate to oppose the Bill.

MANCHESTER DISTRICT ASSOCIATION OF GAS ENGINEERS.—The 29th quarterly meeting of the members of this Association took place on Thursday last, at Stafford—Mr. John Storer, the president, in the chair. During the day a visit was made to the Stafford Gas-Works, with which the company expressed themselves satisfied, and Mr. Hunter, of the Salford Gas-Works, stated that for efficiency and capacity they were equal to any in the kingdom. The principal topic of conversation during the afternoon was the approaching purchase of the gas-works by the Town Council. The meeting separated soon after six o'clock.

MANCHESTER WATER-WORKS.—The finishing touch has been given to the gigantic works in the valley of Longdendale, by which Manchester is supplied with water. These works have been in course of construction about 28 years, and have cost no less a sum than £2,500,000. The area of the reservoirs already constructed is 603½ statute acres, and they have an aggregate capacity of 4598 million gallons. Five other reservoirs, for which an Act of Parliament was obtained in 1875, are about to be commenced at Denton and Audenshaw, and these will occupy an additional 372 acres, and will have a storeage capacity of 1860 million gallons.

SALE OF GAS SHARES.—At a sale by auction at Ipswich, a week or two ago, four old £10 shares in the Ipswich Gaslight and Coke Company, upon which a dividend of 10 per cent. has been paid for many years, were sold at £23 per share. At the same time, 15 new £10 shares in the company, upon which a dividend of 7½ per cent. has been paid for many years, were sold, four at £15 15s. each, and 11 at £16 each. A sale of shares in the Malton Gas Company took place last week—fourteen £10 shares, fully paid up, realized £20 2s. 6d. per share; fourteen £7 shares, fully paid up, realized £14 5s. per share; and eleven £3 shares, £1 paid up, fetched £3 10s. each.

STEALING GAS AT ATHERTON.—At the Leigh Petty Sessions, on the 29th ult., a collier, named James Richards, of Atherton, was charged with connecting a gas-pipe to the meter on his premises without the consent of the local board. He was also charged with obstructing a board officer, Chas. Whittle, who went to examine the meter. Defendant refused to pay a deposit of 5s. required by the board from all fresh consumers, and in consequence of that the gas was cut off on the 20th ult., when the meter stood at 031. On Whittle and another servant of the board, named Manley, visiting the house afterwards, they found that the meter stood at 036, showing that 500 feet of gas had passed through the pipe since its disconnection by the board. Defendant kicked Manley out of the house. He was fined 40s. and costs in each case.

LONGWOOD PUBLIC LIGHTING.—At the meeting of the Longwood Local Board, on Wednesday last, it was resolved—"That the offer of the Colne Valley Gas Company, Limited, to supply the public lamps (where the said company's mains are already laid) at 10s. per lamp per annum be and is hereby accepted, subject to such company indemnifying this board for any sum that this board may have to pay to the Longwood Gas Company for any breach of contract to which this board may become liable; also subject to such first-mentioned company (in case of the connexions with the mains belonging to the said first-mentioned company being from any cause cut off) being at the expense of the re-connexions with the mains of the Longwood Gas Company; and also subject to the first-mentioned company indemnifying this board from all costs and expenses which this board may be put to (in litigation or otherwise) by the said Longwood Gas Company."

MALVERN LINK GAS COMPANY.—The half-yearly meeting was held on the 1st inst.—Mr. T. Holland in the chair. The statement of the accounts for the half year showed a revenue of £973 4s. 11d., and an expenditure of £737 1s. 10d., leaving a profit of £236 3s. 1d., to which was added the balance from last year—namely, £18 2s. 9d., leaving a sum divisible of £254 5s. 10d. Mr. Haynes proposed that the dividend declared be £8 per cent., and Mr. Jones proposed that it be £7 per cent. Four voted for each proposition, when the chairman gave his casting vote in favour of £7 per cent., which was therefore declared carried. The following were elected directors:—Mr. A. Brown, Mr. Cook, and Mr. L. Bird. Mr. A.R. Warde was re-elected auditor. It was determined to advertise for the

supply of coal to the gas-works for the future. An increase of £25 per annum was granted to the secretary of the company, Mr. Underwood, in consideration of the extra duties undertaken by him in the collection of the debts due to the company.

FATAL GAS EXPLOSION AT DEWSBURY.—On Saturday, the 27th ult., an inquest was held at Dewsbury upon the body of John Smith, labourer at the Dewsbury Corporation Gas-Works, who was killed on Friday. Evidence was given by the two foremen, a labourer, and Mr. Craven, the engineer of the works, showing that on the previous morning, at twenty minutes to eight o'clock an explosion took place in the purifying-shed, blowing the building up, and committing serious damage to premises near. At the time of the accident the deceased was engaged stemming a joint in the engine-house, which was totally destroyed. Smith was afterwards found under the rubbish quite dead. The witnesses said they had not the slightest idea as to the cause of the accident, that a few minutes before the explosion they had been in the purifying-shed, and there appeared to be no escape of gas. Mr. Craven added that managers of various gas-works had been down, but no one had been able to form any opinion as to the cause of the explosion. The town clerk, Mr. Jesse Smith, said the corporation deeply regretted the occurrence, and were sorry that there was no clue as to the cause, for if there had been it might have, perhaps, enabled them to avoid a similar catastrophe in the future. A verdict of "Accidental death" was returned.

GLASGOW WATER SUPPLY.—At the meeting of the Corporation Water Committee on the 22nd ult., Mr. Gale, the engineer, in his quarterly report, stated that during the past year 20 inspectors had been regularly employed in the house-to-house examination of the water-fittings, and the number of taps and other apparatus inspected was 350,270. Of these, 27,101 were found out of repair and wasting water, and 27,917 imperfect taps were inspected a second time, to find if repairs had been executed. The number of inspections made on complaints lodged at the office or information received was 10,825, and a second inspection was made of these cases to the number of 9398. Of the 10,825 complaints made of waste of water, 3629 were found to be caused by burst lead service-pipes, or an average of about 12 a day. This was exclusive of the operations in the Great Western Road experimental district.

WELL-SINKING EXTRAORDINARY.—A local paper states that Hugmore Lane, near Wrexham, is the scene of a natural phenomenon of a singular character. Recently, Mr. Charles Edwards, of Hugmore Farm, commenced to sink a well within a couple of yards of his house. After sinking through the surface soil he got into a solid bed of clay, through which he sank over 10 yards, and while the man was still at work the water burst in about 4 yards above his head, and he had to escape as rapidly as possible. The well filled in a very short time, and then ran over in a regular stream, bringing with it a large quantity of quicksand. Every effort has been made to stop it, but hitherto without avail. The removal of the sand has caused a subsidence of the ground on which the house and part of the outbuildings stand, rendering them uninhabitable, and they will have to be rebuilt. A large staff of men have been engaged in filling the well, the material used being large stones embedded in hydraulic lime; but this has proved of no avail, and the torrent still rushes on.

QUALITY OF THE NEWCASTLE-ON-TYNE GAS.—Mr. John Pattinson reports the following as the results of his examinations of the quality of the gas supplied to this borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Company.—					Week ending Jan. 27.					
Date—1877.	Illuminating Power in Sperm Candles.			Grains of Sulphur in 100 Cubic Feet of Gas.			Sulphuretted Hydrogen.			
Jan. 23	.	.	.	13.8	.	.	.	7.95	.	Nil.
„ 26	.	.	.	12.5	.	.	.	6.59	.	Nil.
„ 27	.	.	.	14.9	.	.	.	—	.	Nil.

A Sugg-Letheby standard Argand burner is used in testing. According to Act of Parliament the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas. On inquiry at the gas-works, it was found that a joint had been broken in the hydraulic main, thus accounting for the unusually low illuminating power of the gas this week. The broken joint was discovered and repaired on the 26th Jan. The gas at the date of report was again up to the usual quality.

Week ending Feb. 3.				
Date—1877.	Illuminating Power in Sperm Candles.	Grains of Sulphur in 100 Cubic Feet of Gas.	Sulphuretted Hydrogen.	
Jan. 30 . . .	14.3 . . .	6.09 . . .	Nil.	
Feb. 2 . . .	14.0 . . .	6.83 . . .	Nil.	

BARTON DISTRICT LOCAL BOARD GAS SUPPLY.—At the meeting of the board on the 29th ult., the clerk reported that, in accordance with the resolution of the board on the 9th ult., he had written to the town clerk of Salford, stating that the Barton Local Board had never ceased to be dissatisfied with the defective supply of gas, drawing attention to the report of the Salford Gas Committee respecting the alterations and extensions necessary in their gas-works, to enable them to provide for the proper supply of the borough and outlying districts, and referring to the evidence given on behalf of the Corporation in opposition to the Bill introduced by the Board some eighteen months since, for the purpose of obtaining power to supply the district with gas. His letter then went on to say that, on comparing the evidence mentioned, with the report of the Gas Committee, the Board felt more than ever justified in the action they took in endeavouring to obtain an Act empowering them to supply their own district, and could not refrain from expressing their conviction that had the real facts of the case been disclosed to the parliamentary committee the Board would have obtained their Bill. It was clear that the assertions made to the committee did not accord with the actual facts. It was admitted that without incurring an expenditure of £160,000 the Corporation could not supply the gas required for the borough and district, and he therefore intimated the Board's intention to take the necessary steps to obtain powers to supply their own district with gas. They wished, however, to come to an amicable arrangement, and desired to know whether the Gas Committee would grant them an interview. In reply he had received a communication from the town clerk, to the effect that the committee would be willing to receive a deputation upon a day named. After some discussion, it was resolved that a committee of six gentlemen should be appointed to meet the Salford Gas Committee.

SWINDON WATER-WORKS COMPANY, LIMITED.—The report of the directors, submitted to the shareholders at their meeting yesterday, was as follows:—"The satisfactory character of the statement of accounts now laid before you requires but few remarks this year. The gradual accession of business which the rapid growth of the town naturally brings to this company shows what an important feature in the extension of this town, and the increase of the neighbouring villages of Gorse Hill, and Even Swindon, your water-works hold. The number of attachments to the mains for the supply of water to houses, &c., stands at 2272, being an increase of 372, of which number 124 are supplied from the new main at Gorse Hill. The number of orders for attachment now in hand is 84. During the latter

part of the year your directors considered that the company would be benefited by an increase of capital; they, therefore, with the consent of the shareholders, offered 5000 new £1 shares to the present holders of stock in proportion to their holdings. These shares were immediately taken up, and a much larger number applied for than it was possible to allot. A call of 7s. 6d. has been made on these shares. The net earnings of the undertaking this year are £1653 9s. Your directors recommend out of this sum a dividend (on the share capital of £15,000) of £7 10s. per cent. per annum, free of income-tax, which will amount to £1125; that the sum of £250 be placed to the credit of the Chancery suit account, and the balance of £278 9s. be placed to the contingent-fund account. During the year your directors have had to regret the loss, by death, of the very efficient services of the late Mr. R. Reynolds. He served the company with zeal and ability, and your directors have filled up the vacancy by appointing his son, Mr. W. Reynolds. Messrs. Wearing, Kinneir, and Mason will retire by rotation, but are eligible for re-election."

HULL CORPORATION WATER SUPPLY.—At the meeting of the Water-Works Committee on the 22nd ult., the engineer (Mr. Maxwell) reported that during the previous fortnight the quantity of water pumped from Springhead was 8,635,712 gallons; ditto at Stoneferry, 64,935,906 gallons; total, 14 days supply, 73,571,618 gallons. Average daily, 5,255,155 gallons. Coal consumed, 101 tons 12 cwt.; ditto per million gallons, 27·61 cwt.; cost of ditto, 15s. 2d. Ten days previously the second of the new bores was connected into the general system. They had now five bores at Springhead; average distance apart about 75 feet. The area of the two new bores was about equal to that of the three old bores, and they were sunk to a greater depth. He had estimated the cost of these bores, including adits, sluice-valves, and all fittings, at £2497 10s.; it really would be about £2340, and the bores were 100 feet deeper than originally contemplated. The committee, at their meeting on the 1st ult., instructed him to test the present available supply at Springhead. He had done so, and now reported as follows:—On the 12th ult., from 9 a.m. to 3 p.m., he put all three engines at work, keeping the wells down to the sucking point. The valve in the adit, between the old and new shafts, was shut down. By the old engines pumping from the old bores the yield was at the rate per day of 3,484,800 gallons. By the Woodhouse pumping from the new bores the yield was at the rate per day of 3,553,200 gallons; thus giving a yield per day of 7,038,000 gallons. Were this quantity available throughout the year he would not hesitate to say that the water supply from Springhead was amply sufficient for the next ten years. But at this season, and for the next few months, the springs were at their best. Seven million gallons per day now did not mean more—probably less—than six millions in the autumn and early winter months. Practically, they had no means for storage, but depended on their supply from day to day. So, as the strength of a chain was its weakest link, the measure of the water supply was the capability of the springs when at their lowest yield. Again, the rainfall of last year had been very considerably above the average, and further, they could not practically, at their regular work, pump from the wells so low as in the above experiment. Supposing they could now count on six million gallons, how long were they safe with that as a supply? They were at present, even in this winter season, supplying 5½ million gallons per day. He found from the reports that for the three years ending 1868 the daily supply was 3·6 million gallons; three years ending 1871, 4 million gallons; three years ending 1874, 4·5 million gallons; and for 1876, 5 million gallons. Hence the supply had, heretofore, increased half a million per day every three years. They would, at the same rate of increase, reach 6 million gallons per day in five years hence, certainly by the summer of 1882. But in such an important element in the health, comfort, and general prosperity of the inhabitants it would hardly be wise to run too fine. There had to be taken into consideration, first, the probability of the town increasing at a faster rate than in recent years; second, the probability of an occasional dry season; third, the event of a miscalculation in the time required to execute a scheme for increased supply. Taking all points into consideration, he submitted that it would now (even when the supply was greater than it had ever been previously), be advisable to set in earnest to the question of further supply, so that plans for the same might be matured during the ensuing summer. The report was ordered to be specially circulated among the members.

NEWPORT (MON.) GAS-WORKS BENEFIT SOCIETY.—The annual dinner and entertainment in connexion with this society took place on the 22nd ult., at the Royal Albert Hall. The chair was occupied by Mr. Caning, the engineer and manager of the works, the vice-chair being filled by Mr. John Whitefield, the secretary of the club. Nearly a hundred persons, comprising officers and men in the service of the company, with their wives and a few guests, sat down to an excellent repast, after which several toasts were given, interspersed with an excellent selection of songs and instrumental music. In responding to the toast—"Success to the Newport Gas-Works Sick and Benefit Society," the chairman remarked that when they met a year ago it was his pleasing duty to announce that the first trial of their club had been successful. It was then only an experiment; but the twelve months trial of it had been a very great success. The club had been the means of doing a great amount of good. He found, from looking over the returns, that something like 12 per cent. of the members had received sick pay, while only 2 per cent. out of the number had died. The club, he believed, with the exception of a few whom he might count on one hand, included all the working men employed at the gas-works. He thought, when he looked at the figures, that the employment most of them followed was not that unhealthy and obnoxious employment that people were sometimes pleased to call it. In June last they divided amongst themselves the profits, with pleasing results to most concerned. He was happy to say, from information which he possessed, that the balance at present at the bank showed that they would not have less at the coming year. The secretary read the balance-sheet for the half year ending Dec. 30. It showed the receipts for the six months to be £26 8s. 4d.; expenditure in sick payments and funerals, £7 19s. 5d.; balance at the bank, £11 5s. 6d.; amount in hands of the treasurer, £7 8s. 6d.; total balance in hand, £18 8s. 11d.; received this year, £3 3s., making a total of £21 11s. He said that the receipts for the first year were £46 12s. 6d., after paying for books, rules, cards, &c., in getting up the society, and all sick pay and funerals, and members that left the works receiving back half the money they contributed. At their annual meeting in the summer they shared amongst their members as dividend, so that they saw the society helped its members in every way. It helped them when they were sick, and their fellow-workmen visited them, and thus were made friendly and united in their sympathy for each other. It also helped them when they were leaving the employ of the company, for they have returned to them half their contributions to the society. Help was also given in the greatest time of need—death—when not only were the funds given towards burying the dead, but, through the kindness of their manager, workmen were allowed to go as bearers. He impressed upon the members the desirability of co-operating together if they wanted to be honest and industrious workmen. Let them have done with drunkenness, and bear in mind the motto, "United we stand; divided we fall."

Register of New Patents.

869.—**HALLSWORTH, S., Armley, and BAILES, R., Woodhouse Carr, near Leeds,** "Improvements in purifying illuminating coal gas and in the preparation of the means employed therefor." Patent dated March 1, 1876.

This invention consists in the preparation and use of the residue that remains after iron pyrites are burnt in the manufacture of sulphuric acid. Also in the use of oxide of iron refuse that remains after the spent oxide obtained from gas-works has been burnt in furnaces.

To about two parts by measure of sifted or ground residue of burnt iron pyrites, or of burnt oxide of iron refuse, is added from about one to one and a quarter parts of sawdust or other equivalent, and the whole slightly moistened with water, and well mixed together. The material should be so moistened with water that, when pressed in the hand, it will ball together without wetting.

The compound is placed in the ordinary purifiers, and allowed to remain in them until it ceases to purify the gas, when it is taken out and spread upon the floor, and allowed to revivify and cool. It is slightly moistened with water each time before being used again. By this means it can be used over and over again, until it becomes so mixed with sulphur as to be too heavy for use.

876.—**BLEWITT, R. J., Upper Norwood, Surrey,** "Improvements in the method of obtaining gas for illuminating purposes, and of obtaining and applying the products of coal by distillation of the same." Provisional protection only obtained. Dated March 1, 1876.

[We give the provisional specification in this case in the applicant's own words.—Ed. J. G. L.]

Having discovered that the present system of obtaining gas for illuminating purposes and for the distillation of coal is founded on erroneous principles, I discard it altogether, and proceed as follows:—

By means of a hood, bottomless cage, or air-tight chamber, I collect the gas naturally emanating from coal, and by any kind of aperture, with tube and stopcock, let it out at once into a gasholder, from whence it may be conveyed to its intended destination in pipes of iron or bamboo (if I shall think fit to adopt the latter mode of conveyance according to the manner of the Chinese). In order to render the gas innocuous in a coal mine, I extract the same by means of a bore-hole and tube on the principle of that used for an artesian well, the tube to be two inches in diameter, and extending from the deepest part of the coal intended to be worked to such a height above the surface of the ground as may be possible or desirable. The gas may then be passed into a gasholder, and conveyed in pipes as before mentioned.

From the hold of a ship I extract the gas by a smaller bore-hole and tube through the deck, and by means of pipes convey it to any part of the ship for warmth, light, cooking, or signalling. Availing myself of the well-known effect of chlorine gas upon the olefant gas, I propose, when I think fit, to convert the latter into an ethereal oily fluid, which when ignited burns with a red light, and to use such fluid in a lamp or any similar contrivance.

I propose to obtain and increase the quantity of cyanogen and ammonia by promoting the separation of the nitrogen from oxygen in atmospheric air, and the decomposition of the hydrogen and oxygen in water, and by the decomposition of such elements. Instead of converting the sulphur usually contained in coal as iron pyrites or sulphuret of calcium into hydro-sulphuric acid gas, I extract the former by promoting and awaiting its decomposition and natural re-arrangement in strata, as described in a work on gas published by Mr. S. Hughes; and as to the latter I convert it by means of chloride of sodium, obtainable by the boiling and evaporation of sea-salt into sulphuret of sodium, one of the principal ingredients for producing an artificial lapis-lazuli or ultramarine. As the sulphur separated from the iron pyrites will be in a state of great purity, I dispose of it as a marketable commodity, and the iron or magnetic waste of iron also.

As to all the products arising from the distillations of coal, I produce them in the usual manner, but with far less expense, and without any of the offensive odours which accompany the present system.

934.—**WHEELER, H., Birmingham, and PEARSON, J., Handsworth,** "Improvements in direct-acting steam-pumps." Provisional protection only obtained. Dated March 4, 1876.

This invention consists in improvements in mechanism for actuating the slide-valves of direct-acting steam-pumps.

According to one modification these parts are constructed in the following manner:—In the steam-chest are formed two small cylinders, their axes being in the same line and parallel to the axis of the steam cylinder. The cover ends of these small cylinders, through which the piston-rods pass, are turned towards each other. The piston-rods at their ends carry tappets, which are jointed to the rods. The ends of the tappets when in their normal position are below the level of a projection on the slide-valve, and as the pistons advance their tappets bear against and carry forward the slide-valve in one or other direction. From the outside of the steam-chest screw-stops pass inside, and projections on the tappets strike against these stops when the small pistons have advanced to a greater or less distance, and by lifting their ends, disengage them from the slide-valve. The precise point in the strokes of the small pistons at which the tappets are liberated from the slide-valve is determined by the distance to which the screw-stops are advanced. On the return motions of the pistons of the small cylinders the tappets are restored to their normal position by striking against the covers of the small cylinders. Ports communicating between the steam cylinder and the small cylinders admit steam from the former into the latter at the required times, and also effect the exhaust of the small cylinders. The cover end of each small cylinder is in communication with the exhaust-pipe of the steam cylinder. By the motion of the piston of the steam cylinder the small cylinders are supplied with steam, and exhausted at the required times for the proper working of the slide-valve of the steam cylinder.

According to another modification, the small cylinders are arranged with their axes at right angles to that of the steam cylinder, and parallel with one another. The ends of the piston-rods of the small cylinders carry inclines, which act respectively on arms having motion in a line parallel with the axis of the steam cylinder, and which, on their advance motion, strike against and carry forward the slide-valve. The arms are carried by springs by which their return motion is effected.

APPLICATIONS FOR LETTERS PATENT.

413.—**HUNT, B., Lincoln's Inn, London,** "Improvements in pipe-joints." A communication. (Complete specification.) Jan. 31, 1877.

422.—**KIRKHAM, T. N., Westminster, HULETT, D., High Holborn, and CHANDLER, S., jun., and J., Newington Causeway, London,** "Improvements in apparatus for the purification of gas." (Complete specification.) Feb. 1, 1877.

424.—**AVERY, C., Islington, London,** "A new or improved rotary engine, applicable also for use as a liquid-meter and as a pump." Feb. 1, 1877.

431.—**POPE, J., Folkestone,** "Improvements in taps or cocks, which improvements are also applicable to regulating the flow of water to water-closets and other like receptacles." Feb. 1, 1877.

- 341.—COTTERELL, F. J., Birmingham, "An improvement or improvements in sliding gaseliers or gas chandeliers." Jan. 26, 1877.
 349.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in pumps." A communication. Jan. 26, 1877.
 351.—HARRISON, C. W., Mansion House Chambers, London, "Improvements in apparatus for charging or impregnating atmospheric air with inflammable vapours." Jan. 27, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3880.—GREEN, H., Preston, Lancs, "Improvements in coal gas scrubbers and apparatus for distributing liquid for other purposes." Oct. 7, 1876.
 4540.—DEWRANCE, J., Borough, London, and MALLINSON, J., Welwyn, Herts, "Improvements in cocks." Nov. 22, 1876.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

- 283.—SCOTT, H. Y. D., and SPENCE, J. B., "Improvements in the treatment of sewage and ammoniacal liquids." Jan. 22, 1874.

- 322.—CLARK, A. M., "An improved process for eliminating the soluble principles contained in gases and vapours." Jan. 24, 1874.
 342.—LAKE, W. R., "An improved apparatus for maintaining a constant level of water in wet gas-meters, and for separating from vapour liquid held in suspension in the same." Jan. 27, 1874.
 348.—WHITTINGHAM, J., "Improved apparatus for manufacturing gas for illumination." Jan. 27, 1874.
 350.—CLARK, A. M., "Improved machinery for cutting and screw-threading pipes." Jan. 27, 1874.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

- 3741.—WALKER, S., and HOLT, E., "Improvements in steam pumping-engines." Dec. 24, 1869.
 80.—CHAMEROY, E. A., "Improvements in means and apparatus for gauging or regulating the flow of water or other liquids." Jan. 11, 1870.
 113.—THORNELOE, G., "A new flexible valve for regulating the flow of fluids in pipes, also used in apparatus for the manufacture of gas." Jan. 13, 1870.

Share List of Metropolitan Gas and Water Companies.

(Corrected by Mr. F. N. GOLDING, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Div. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Div. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Div. p. Cent. p. Ann.	Latest Quotations.
10000	20	Anglo-Romano	20 0 0	9 0 0	20-22	5900	10	Hong Kong (Lim.)	10 8 0	10 0 0	163-175	9000	4	United General	4 0 0	2 10 0	3-3½
5000	20	Bahia (Limited)	20 0 0	2 0 0	14-16	56000	50	Imprl. Continental London	43 15 0	9 10 0	95-97	1500	10	Wandsw. & Putney	10 0 0	10 0 0	19-20
1000	20	Do., do., redeem.	20 0 0	2 0 0	25-27	2500000	Sk.	Do., 1st pref.	100 0 0	10 0 0	215-218	1500	10	Do.,	10 0 0	7 10 0	11-12
1500	20	Do., 2nd pref.	20 0 0	7 10 0	21-22	1500000	Sk.	Do., 2nd pref.	100 0 0	6 0 0	140-145	2957	10	Do.,	10 0 0	7 0 0	..
40000	5	Bombay (Limited)	5 0 0	7 10 0	73-74	14450	Sk.	Do., 3rd pref.	100 0 0	6 0 0	..	993	10	Do.,	3 0 0	7 0 0	..
10000	5	Do., fourth issue.	4 0 0	7 0 0	53-54	4350	Sk.	Do., A shares	12 10 0	6 0 0	33-34	15000	5	West Ham	5 0 0	10 0 0	8-8½
10000	20	British (Limited)	20 0 0	10 0 0	41-43	7622	25	Do., Debent. stk.	100 0 0	5 1/2 & 6 1/2	..	10000	5	Do., new shares	2 10 0	10 0 0	3-4
7500	20	Cagliari (Limited)	20 0 0	5 0 0	16-17	26805 1/2	All	Do., preference	5 0 0	7 10 0	5-5½						
5500000	Sk.	Commercial	100 0 0	10 0 0	215-218	15000	5	Do., Mauritius (Limited)	2 0 0	..	1-1						
70000	100	Do., 7 per cent.	100 0 0	..	150-155	15000	5	Monte Video (Lim.)	20 0 0	8 0 0	19-19½						
20000	20	Continental Union.	20 0 0	6 0 0	22½-23½	6000	5	Nietheroy, Brazil (Limited)	10 0 0	3 10 0	81-83	12000	100	Chelsea	100 0 0	6 0 0	148-150
10000	20	Do., new	12 10 0	6 0 0	13-24pm	29000	5	Oriental (Calcutta).	5 0 0	9 10 0	21-24	1500000	100	East London	100 0 0	6 0 0	148-150
10000	20	Do., preference	20 0 0	7 0 0	26-28	25000	5	Do., new shares	3 0 0	9 10 0	21-24	8000	50	Grand Junction	50 0 0	5 0 0	73-75
75000	Sk.	Crystal Palace District	100 0 0	10 0 0	215-220	8000	10	Ottoman (Limited)	5 0 0	3 0 0	21-3	5840	25	Do., 3 shares	25 0 0	5 0 0	36½-37½
125000	Sk.	Do., 7 per cent.	100 0 0	7 0 0	150-155	30000	5	Para (Limited)	10 0 0	7 0 0	5-5½	2160	25	Do., new ditto; max. div., ½ p.c.	25 0 0	5 0 0	32-34
50000	Sk.	Do., preference	100 0 0	6 0 0	135-140	30000	5	Phenix	20 0 0	10 0 0	42-44						
23406	10	European (Limited)	10 0 0	10 0 0	18½-19½	10000	5	Do., new	60 0 0	7 10 0	100-105	547960	100	Kent	100 0 0	8 0 0	175-185
12000	10	Do., new shares	7 10 0	10 0 0	7-8pm.	17500	20	Do., capitalized	100 0 0	5 0 0	107-110	970	100	Lambeth	100 0 0	6 5 0	148-150
35406	10	Do., new shares	5 0 0	10 0 0	5-6pm.	27000	20	Do., new, 1876	17-18pm	..	..	1161	100	Do.,	100 0 0	6 5 0	148-150
379770 1/2	Sk.	Gaslight & Coke A.	100 0 0	10 0 0	219-221	360000 1/2	100	Rio de Janeiro (L.)	20 0 0	10 0 0	33-35	4475	100	New River	100 0 0	7 0 0	185-195
1000000	Sk.	Do. B.	100 0 0	4 0 0	86-90	144000 1/2	Sk.	Singapore (Limited)	5 0 0	7 10 0	53-54	400000	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	101-103
30000	10	Do. 5 per cent. pref. conv., 3rd issue.	all	5 0 0	20½-21	36000	20	Do., preference	5 0 0	7 10 0	53-64	3036	100	Southwark & Vauxh.	100 0 0	4 0 0	112-4 xd
50000	10	Do. do., 4th do.	6 0 0	5 0 0	8½-9½pm	7359	5	Shanghai	32 10 0	12 0 0	30-32	1296	100	Do., pref. stock	100 0 0	5 0 0	112-114
50000	10	Do. do., 5th do.	2 0 0	5 0 0	81-84	2000	5	South Metropolitan	50 0 0	10 0 0	110-112	..	100	Do., D shares	100 0 0	4 0 0	108-111
290000 1/2	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	230-240	1500	32½	Do., new shares	9 0 0	10 0 0	12½-13½	..	100	Do., 4½ preference	100 0 0	4 10 0	106-108
300000 1/2	"	Do. D do. do.	100 0 0	10 0 0	230-240	4000	12½	Surrey Consumers	10 0 0	10 0 0	21-22	1600	100	Do., new ordinary . . . . .	..	4 10 0	..
165000 1/2	"	Do. E do. do.	100 0 0	10 0 0	230-240	4000	12½	Do., new	8 0 0	10 0 0	9½-10½p.	12172	61	Do., new ord. No. 1	40 0 0	4 10 0	106-108
30000 1/2	"	Do. F 5 do. do.	100 0 0	10 0 0	114-116	20000	12½										
60000 1/2	"	Do. G 7½ do. do.	100 0 0	7 10 0	165-170												
1300000 1/2	"	Do. H	100 0 0	7 0 0	153-155	15000	10										
6200	5	Georgetown, Guiana	5 0 0	5 0 0	..	10000	10										

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to Gwynne & Beale's Patent Improved Gas-Exhausters,

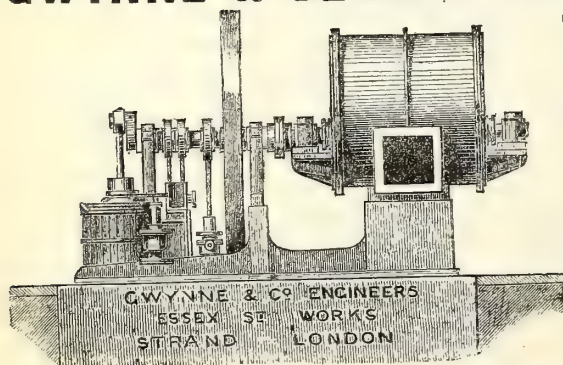


FIG. 224.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the most perfect system of action yet discovered. Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 62,500 cubic feet per hour. Gwynne & Co. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement. Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters at alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES, CAN BE HAD ON APPLICATION TO

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 cubic feet Patent Gas Exhausters, and many of all sizes.

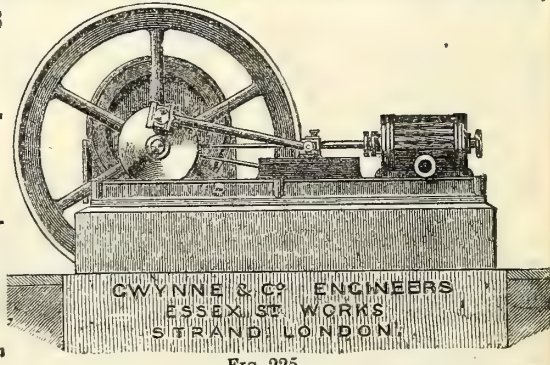


FIG. 225.

D. BRUCE PEEBLES & CO., ENGINEERS,

FOUNTAINBRIDGE WORKS, EDINBURGH, MANUFACTURERS OF WET AND DRY GAS-METERS;

Patentees and Sole Manufacturers of "PEEBLES' GAS-GOVERNORS,"

FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS, OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.

"These Lamp-Governors are so superior that they are likely to supplant all others."—Dr. Wm. Wallace, F.R.S.E., F.C.S.

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TO CORRESPONDENTS.

Several items of intelligence are unavoidably postponed, having arrived too late for insertion in this number. We shall be glad if correspondents will bear in mind that we cannot ensure space for communications which reach us on Monday morning.

W. P.—Gas, or a mixture of gas and air, cannot be ignited without the application of flame. Sometimes the gas, or a mixture of gas and air, comes in contact with a flame, and the flame “backs;” hence explosions, which are regarded as mysterious, but which have a simple origin, and are seldom dangerous.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—We hope to find room in our next for the excellent address of Mr. Wood, the president, at the meeting of the Association on the 9th inst.

RECEIVED:—Bodmin, Congleton, Eastbourne, Halifax, Kidderminster, Leicester, Macclesfield, Pontefract, Sutton-in-Ashfield.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 13, 1877.

Circular to Gas Companies.

WHILE all sections of politicians are congratulating one Earl on his accession to the House of Peers, we may be excused for, without any reference to general politics, congratulating another Earl on having obtained a step in the Peerage. Baron, now Earl, Redesdale can hardly be said to be a friend to Gas Companies; but the fact that he, more than any other man living, has assisted in moulding general gas legislation into the shape it has now assumed, seems to us to require some words in recognition of his services, the more so as we are glad to see that he

will continue to occupy the post of Chairman of Committees in the House of Lords. We hope that he may long be spared to retain the office. We have said that Lord Redesdale is not to be regarded as the friend of Gas Companies. It is to him we owe the limitation of dividends on “additional” capital, and some other restrictions. We shall not, however, quarrel with his Lordship on this score. His great merits are the perfect consistency with which he maintains the principles he has laid down, and the even balance he holds between contending parties. Six and seven per cent. dividends are, after all, no great grievances, when it is known that they can be guaranteed. In the revolutionary part of recent Metropolitan Gas Legislation, we do not know that Earl Redesdale has given any active assistance. He has never insisted on auction clauses, though he has accepted them when brought before him. He has always allowed Gas Companies to borrow to the extent of one-fourth of the capital raised, while he has given to railway companies the power to borrow to the amount of one-third of the share capital. Perhaps, then, for these and other reasons, we should more properly characterize Lord Redesdale as the friend of gas proprietors. At all events, we can now only congratulate his Lordship on arriving at a higher dignity, and wish him long life to enjoy his elevated position.

Our readers, when perusing the abstract of Gas Bills, printed in another column, will, perhaps, with ourselves, be struck with the fact that recent Metropolitan Gas Legislation seems to have had but little influence over the measures proposed. It must be remembered that these are only *Bills*, and that we shall have to wait to know what the *Acts* passed will be. To a great extent, however, the Acts must be what the Bills are, for comparatively few of the measures presented this year will have to encounter powerful opposition. Turning to the Bills themselves, we do not find a single instance in which auction clauses are proposed. There is one which will specifically enact that new shares shall first be offered to existing proprietors, and, if not taken up, shall be disposed of in any way the directors think fit; but, supposing these to be sold by auction, the premiums might be regarded as profits, and applied accordingly. Again, we find the same proportion observed between the share and loan capital proposed, and that in no case is it intended to make the issue of share and loan capital in equal proportions compulsory. Then, as to the sliding scale, we observe but one instance in which it is proposed to introduce this into Provincial Gas Legislation. The circumstances of the United General Company, in Limerick, are, however, very peculiar, and we may felicitate the Directors on the happy thought which induced them to make the proposal. It may, perhaps, go a long way in disarming opposition. Not that we consider the position of the Company in Limerick at all critical. On the contrary, we believe that the Company will maintain their standing, and before long succeed in acquiring the undertaking of the Corporation. From the opposition of the newly-projected Company, we feel satisfied that the United General have nothing to fear.

It has been recommended by a distinguished humorist, that no one should prophesy until after the event had happened. We do not prophesy; but as “coming events cast their shadows before them,” we venture to say that the gas legislation of the present session will bear but a slight trace of the influence of recent Metropolitan Legislation. Candidly speaking, we expected otherwise, but are greatly pleased to see our anticipations unrealized.

Our readers will peruse with pleasure the cheerful speech of the Governor of The Gaslight and Coke Company. That great corporation, now representing the largest gas undertaking in the world, must necessarily be looked up to as a guide to smaller concerns—that is, so far as fair comparisons can be established. The Governor, it will be seen, traversed much the same ground we did in our “Circular” last week, but gave more precise calculations than we had time to make. That the present management of the vast undertaking is an enormous success, must be patent to all, from whatever point of view it is regarded. Wherever there is a failure, it proceeds from causes which no management can control. That is the case with the price of coke, from the depreciation of which the Company now suffer, and are likely to suffer for some time to come. A revival of industry will, we trust, soon take place, but nothing besides cold weather can bring coke up to what has been considered its legitimate value. There exists, unhappily, a popular prejudice against the use of coke for domestic purposes, and hence its employment is confined to the poorer classes, and for manufacturing purposes. While coal remains comparatively cheap, coke can only command a sale at a relatively low price. We have often said that something might be done in London, as it

is done by the Paris Gas Company, to promote a more general use of coke for domestic purposes. The Chartered Company are now in a position to do all that is done by the Paris Gas Company. They have power to use patent inventions if they can find any good for anything; they can work up residuals; in fact, they can do anything dealing with gas and its products. Now we cannot help thinking that there is a good opening for the manufacture of artificial fuel at Beckton. There is not a spot in the world where it would sell as it might at Beckton, supposing a fuel made, adapted for consumption in steam vessels. It is in this direction, we rather think, that the Company must look for a profitable outlet for their coke and breeze. They have all the materials at hand. Only machinery is wanted, and we cannot help thinking that at Beckton there exists an exceptionally good opportunity for doing a profitable business in artificial fuel.

The explanation of the Governor respecting the commutation of annuities is very satisfactory, for the matter has been misunderstood. It is clear that the item of "Superannuation allowances, &c.," has nearly disappeared from the revenue account, and that the commutation has been effected in the most economical way possible. Something will, of course, remain to be paid annually for some years to come, inasmuch as there are, as is always the case, officers, mostly advanced in years, who prefer a pension, because they do not see their way to make a profitable investment of a commutation allowance. But we think we may take it as a fact that the pensions due from the Chartered Company are now nearly wiped out, and we believe that the unappropriated balance of the profits in the hands of the Directors could not, in the interests of the consumers, have been better employed than in effecting this desirable operation.

The scheme for making a complete anastomosis of the mains from the several manufacturing stations of the Company, recalls to us some remarks we made a fortnight ago as to the future of the testing-stations. When the combination projected is completed, which, we hope, will be done with the least delay possible, it is clear that the gas must be tested at the station where it is made. Objections will, of course, be urged against this by the local authorities on several grounds; but, if the Company are to remain liable to a penalty for any defect in gas made at a particular station, it is clear that the gas from that station must be examined before it can possibly become mixed with gas from other works.

We have before alluded to the Bill promoted by the Company to remove the sulphur difficulty, which was sanctioned by the proprietors at the meeting made special for the purpose. The measure will be opposed, and should the question be fully entered upon, we must suppose that the sulphur business will be settled, one way or the other, for all time—"a consummation devoutly to be wished."

We are glad to see that our repeated advice has been, so far, taken, that a large number of unincorporated Gas Companies are this year applying either for Acts of Incorporation or for Provisional Orders which, when confirmed, will come to about the same things. How advisable it is that a Gas Company should be provided with statutory authority, in some shape or another, is shown in the case of the Bishop Auckland Company, who are, as our readers will see, promoting a Bill. They will see also, by a report in another column, that the Local Board of Bishop Auckland, taking advantage of the fact that the Company have no statutory powers, are applying to the Local Government Board, under the Public Health Act, for a Provisional Order, which, if granted, will enable them to set up competing gas-works. There are allegations of *mala fides* made against the Company, of which we know nothing. They may be true or not. All we wish to point out here is the relative advantages to the gas consumers offered by the Gas Company and the Local Board. The former propose to supply fourteen-candle gas, at the maximum price of 5s. per 1000 feet; the latter offer twelve-candle gas for 6s. per 1000. Need anything more be said? Except this, by way of general remark. Is it not extraordinary that in Durham, and our readers will see other towns, actually in, or close by coal-fields, gas should be dearer than in small towns in Surrey and Sussex? There are, we know, in some mining districts, particular reasons for a high price of gas. In others, like Bishop Auckland, there is, so far as we know, no reason why gas should be dear, except that coke will be nearly valueless.

We have received the annual report of the West of Scotland Association of Gas Managers for 1876-77. It is a compilation which reflects the highest credit on the Committee of the Association. We have, more than once, described the scope of the work, which aims at giving precise information relative to the gas supply of Scotland. We are sorry to see that the columns showing the details are not filled up to the extent we could

wish; but, as it is, the report is of great value, seeing that it contains returns, more or less complete, from 259 Scottish gas undertakings. We shall return to it, after giving an attentive study to the contents.

The gas accounts of the Corporation of Leeds for the past year have been issued, and those of the Corporation of Birmingham will, we expect, be published this week. There are some interesting points in connexion with these latter, to which we shall refer when we have them before us. To-day we need only say that the undertaking has been worked to great advantage.

The dispute between the gas consumers and the Corporation of Wigan has waxed very fierce; but we are glad to see that there is a chance of its soon being settled. The Town Council, in accordance with the wishes of the consumers, have decided to call in an independent engineer to give his advice and opinion on the irritating question of increased bills for gas. The names of Mr. King (Liverpool), Mr. Paterson (Warrington), and Mr. George Livesey were mentioned to the Council, and we need only say, that the opinion of either one of these gentlemen should command the respect of the Wigan community. In the meantime, an able report by Mr. Hawkins, the Manager of the Corporation Works, seems to indicate clearly the origin, or rather cause, of the complaints. It appears that, in past times, no proper periodical inspection of meters was made in Wigan. A meter was fixed, and then expected, like Tennyson's brook, to "go on for ever." But it did not, and, as a matter of fact, one was discovered which had not registered a foot of the gas passed through it during six years. In such a case, the inspector would, of course, have to exercise more or less imagination when making out the gas bill. That the registration of the meters against the Corporation must have been enormous, may be inferred from the fact that, the loss by what, by a figure of speech, is called "leakage," amounted, in 1875, to 32 per cent. of the gas made. Under present management, however, a more complete system of meter inspection has been inaugurated, and this would seem to have had something to do with the increased bills. At all events, loss by leakage appears to have been considerably diminished during the past six months, in part, no doubt, owing to a very proper enlargement of the mains. In our experience, we have found very few of the exaggerated registrations of meters to be sustained by inquiry and examination. In a majority of instances, meters register against the gas supplier. No doubt one principal cause of the complaints is that pointed out by Mr. Hawkins—viz., the bad burners and fittings in use in Wigan and, as we mentioned last week, in Leeds. Apart from these considerations, however, a knowledge of human nature has taught us that a great number of men take no notice of their expenditure. Lots of people will tell you that they have no knowledge how their money goes, and no idea what becomes of their wine and spirits, the simple fact being that they have spent the one and drunk the other. It is much the same with regard to gas. No notice is taken of consumption until the inevitable bill comes in, and then follows an unreasonable uproar like that now raised in Wigan.

The undertaking of the Penrith Gas Company will soon pass into the hands of the Local Board, who have applied for a Provisional Order, which the Gas Company do not oppose.

The Corporation of Worcester and the Gas Company are at the present moment at loggerheads, for reasons which the information before us does not enable us fully to comprehend. It seems, however, to be a question as to the propriety of the present charge for public lights, and we rather think that a small concession on the part of the Company would make matters smooth. There are, of course, the usual threats of competing works and a compulsory purchase, but these the Company may laugh at.

GAS BILLS FOR 1877.

The following twelve Bills are to authorize the incorporation of, and to confer statutory powers on, Gas Companies, all of whom, with two exceptions, have works in operation.

The *Bishop Auckland District Gas Bill* is to incorporate the Bishop Auckland Gas Company, formed in 1846, with a nominal capital of £13,960, of which £8376 has been paid up. This Bill asks power to raise additional capital to the amount of £66,040, the dividends on which are to be limited as usual. As the Company have at present no mortgage debt, the usual borrowing power is prayed for in respect of both original and new capital. Gas of fourteen-candle power, tested by Sugg's "London" Argand, No. 1, is to be supplied, at a maximum charge of 5s. per 1000 feet. No conditions of purity are proposed beyond those which are imposed by the general Act of 1871.

The *Carshalton Gas Bill* is, first of all, to incorporate the

Carshalton Gas and Coke Company, Limited, formed in 1857, with a nominal capital of £50,000, all of which has been subscribed, and £27,500 paid up. The Bill asks power to raise additional capital to the amount of £50,000, and as the Company have at present no debt, the usual borrowing power is sought in respect of both old and new capital. The Bill proposes a supply of thirteen-candle gas, tested by Sugg's "London" Argand, No. 1, at a charge not exceeding 6s. per 1000 feet. The Bill further seeks power to transfer the undertaking to, or amalgamate it with, that of the Croydon Commercial Gas Company, on terms and conditions which seem to have been arranged, but which are not set forth in the Bill. Necessarily the Croydon Company, if the amalgamation be effected, will take over all the powers conferred by this Bill, if it should pass.

The *Christchurch Gas Bill* is to incorporate the Christchurch Gas Company, Limited, formed last year, with a nominal capital of £50,000, one-half of which has been subscribed and fully paid up. Power is sought by this Bill to raise additional capital to the amount of £25,000, the dividends on which will be limited as usual. The Company have no mortgage debt, and they only seek the usual borrowing power on the original capital already raised, and to a like extent on the additional. The Bill proposes to supply fourteen-candle gas, at a charge not to exceed 7s. per 1000 feet.

The *Coatbridge Gas Bill* is to incorporate the Coatbridge Gaslight Company, formed in 1843. The present capital of the Company is £7590, raised in three pound shares, all fully paid. The Company have also expended on the undertaking £10,120 and upwards out of profits applicable to dividend. These two sums the Bill proposes shall be converted into consolidated stock, and distributed among existing proprietors, at the rate of seven pounds for each three pound share. It is also proposed to raise additional capital to the amount of £32,290, by ten pound shares, of course, and with the usual limitations as to dividends. The usual borrowing powers are sought in respect of original stock and additional capital. Twenty-candle gas is to be supplied (Coatbridge is in the county of Lanark), tested by a union jet burner. The price is not to exceed 6s. 8d. per 1000 feet.

The *Colne Gas Bill* is to incorporate the Colne (Lancashire) Gas Company. The Company, or "Society," as it is called, was formed in 1838, and the members have spent £15,000 on the undertaking. This Bill proposes to allot the original capital among those who are the actual proprietors of it, and then seeks power to raise an additional £15,000, the dividends on which are to be limited as usual. The usual borrowing powers are sought. It is proposed to supply fourteen-candle gas, at a price not to exceed 5s. 6d. per 1000 feet.

The *Epsom and Ewell Gas Bill* is to incorporate the Epsom and Ewell Gas Company, Limited, constituted in 1839, under a deed of settlement, and now having a paid-up capital of £24,000, and a mortgage debt of £4800. It is proposed in this Bill to raise additional capital to the amount of £30,000, with the usual limitations as to dividend, and to exercise the usual borrowing power. Fourteen-candle gas is to be supplied, at a price not to exceed, within the parishes of Epsom, Ewell, and Banstead, 6s. 6d. per 1000, and not more than 7s. beyond such limits.

The *Limerick Gas Bill*, one of the exceptions alluded to above, is to incorporate a new Company, with power to acquire the gas undertakings of the United General Company and the Corporation of Limerick. The most important statement in the preamble is that neither of the gas undertakings in the City of Limerick is subject to statutory regulations. The capital proposed for the new Company is £70,000, carrying the usual borrowing powers. No terms of purchase have been agreed upon with either the Corporation or the United General Company. The new Company propose to supply fourteen-candle gas, at a price not exceeding 5s. 6d. per 1000 feet.

The *Londonderry Gas Bill* is to incorporate the Londonderry Gaslight Company, formed in 1829. The present nominal capital is £36,000, which is deemed fully paid up. This Bill seeks authority to raise £24,000 of new capital, with the usual restrictions as to dividends. As the Company have no mortgage debt, borrowing power to the usual extent is sought in respect of both old and new capital. It is proposed to supply fourteen-candle gas, at a price not to exceed 6s. per 1000 feet.

The *North Dock Ward (Dublin) Gas Bill* is another measure to incorporate a new Company, with power to manufacture and supply gas within an insignificant portion of the City of Dublin. The capital proposed for the Company is £32,000, in respect of which the usual borrowing power is sought, but no money is to be borrowed until the whole amount of capital is subscribed, and one-half paid up. The Bill proposes a supply of sixteen-candle gas, tested by Sugg's "London" Argand, No. 1, at a price not

exceeding 3s. 6d. per 1000 feet. It also asks that two years may elapse before the Company are compelled to institute a testing-station at their works.

The *Sittingbourne Gas Bill* is to incorporate the Sittingbourne District Gas Company, formed to take over the undertaking started in 1846 by Mr. George Smeed. The consideration is to be settled by agreement or arbitration. The capital proposed for the Company is £30,000, carrying, of course, the usual borrowing power. Gas of fourteen-candle power is to be supplied, at a price not to exceed 6s. per 1000 feet.

The *Southend Gas Bill* is to incorporate the Southend Gas Company, originally formed in 1854, with a nominal capital of £10,000, of which £9000 has been subscribed and fully paid up. The Bill seeks authority to raise another £10,000, and to exercise the usual borrowing power. Gas of fourteen-candle power is to be supplied, at a price not exceeding 6s. per 1000 feet.

The *Tudhoe and Sunderland Bridge Gas Bill* is to incorporate a Gas Company of the same name, which is formed to take over the gas undertaking of the Weardale Iron and Coal Company, which now supplies Tudhoe. The capital of the Company is to be £28,000, one-half of which is to be deemed stock fully paid up, and is to be vested in the proprietors of the Weardale Iron and Coal Company, and the other half is to be raised as usual by the issue of £10 shares. There is a provision that these shares may be divided into preferred and deferred half shares, with the usual consequences. The usual borrowing power is sought in respect of both capital stock and new capital. It is proposed to supply gas of twelve-candle power, at a price not to exceed 5s. per 1000 feet.

It is hardly necessary to state that in all the Bills above mentioned, which are promoted to incorporate companies already in existence, the necessary provisions are made for the transference of the undertaking to the newly constituted Company, with all liabilities. In many cases it is proposed that borrowed money shall be converted into stock, at a low rate of dividend. In all it is proposed that money received on deposit shall be entitled to interest at the rate of five per cent. Whenever not mentioned, it must be understood that the test burner is Sugg's "London" Argand, No. 1.

The following Bills are promoted by Gas Companies already incorporated, to obtain further powers:—

The *Alliance and Dublin Gas (Bray Supply) Bill* is to enable the Company to acquire some additional lands on which to erect new works. No further capital is asked for.

The *Ashton under Lyne Gas Bill* is to enable the Ashton Gas Company, with a present paid-up capital of £47,700, to raise £50,000 in addition, with the usual borrowing power in respect of it. The dividends on the new capital are, of course, to be limited to the now universal rates. The general Act being incorporated, the proposed illuminating power is fourteen candles, Sugg's "London" Argand, No. 1, being the test burner.

The *Bristol United Gas Company's Bill* is merely to enable the Company to make some re-arrangement of the roadway in the neighbourhood of the works.

The *Croydon Commercial Gas and Coke Company's Bill* is to authorize the Company, whose present share and loan capital amounts to £149,100, nearly the whole of which has been expended, to raise further capital to the extent of £120,000, and to borrow in the usual proportion. All past mortgage debts have been converted into capital; if any further conversions be made, this Bill fixes the rate of dividend payable on the stock at five per cent. The Bill contains sections to authorize the purchase of, or amalgamation with, the Carshalton Gas Company. If such purchase or amalgamation be effected, the united Company will be known as The Croydon and Carshalton Gas Company.

The object of the *Crystal Palace District Gas Bill* has already been mentioned in our "Circular," as also that of *The Gaslight and Coke Company's Bill*.

The *Leicester Gas Bill* is promoted by the Leicester Gas Company, first of all to obtain an extension of their limits of supply, and then authority to raise further capital. The present capital of the Company is £220,000, raised in three several sums, under the authority of three separate Acts of Parliament, which conferred the usual borrowing powers in respect of the capital authorized. The debt of the Company, however, appears to be exactly £1000. By this Bill power is sought to raise further capital, not exceeding £250,000, carrying, of course, the usual borrowing power. The Bill is, further, to authorize the purchase of over thirty-three acres of land, and the construction of works thereon for the purposes of the Company.

The *Louth Gas Bill* has already been noticed in our "Circular," and need only be briefly alluded to here. The Bill is to repeal the original Act of the Company, passed in the early

days of gas lighting, to re-incorporate the Company, to give power to capitalize expended profits under the name of improvement stock, and to enable the Company to raise £20,000 additional, with borrowing powers in the usual proportion. Necessarily, the Bill contains all the provisions common to modern gas legislation. Fourteen-candle gas is to be supplied, and the charge is not to exceed 5s. 10d. per 1000, a discount of fifteen per cent. being allowed for prompt payment.

The *Newport (Monmouthshire) Gas Bill* is simply to enable the Newport Gas Company to acquire land on which to erect new works. No further capital is applied for.

The *Stretford Gas Bill* is to authorize the Stretford Gas Company, incorporated in 1862, with a nominal capital of £39,000, of which £38,000 has been raised and expended, to enlarge their existing works. For this purpose the Bill asks power to raise additional capital to the amount of £61,000, by the issue of *five pound* shares. This capital is to carry the ordinary borrowing power, the dividends on it being limited as usual.

The *Thanet Gas Bill* has been referred to and described in our "Circular." It is to authorize the capitalization of expended profits, to give power to raise additional capital to the amount of £32,000, and to confer borrowing powers in respect of the original capital, the improvement stock, and, of course, the additional capital. Gas of fourteen-candle power is to be supplied, and the price is not to exceed 5s. 6d. per 1000 feet.

The *United General Gaslight Company (Limerick Undertaking) Bill* is to dissolve the original Company and re-incorporate them with extended powers. The preamble recites the history of the Company from their formation in 1830, under letters patent, with a nominal capital of £500,000, and power to make and sell gas, and deal in stocks and shares, down to the Act of 1866, which left them with only the Limerick undertaking, and a nominal capital of £36,000. This Bill is to enable the reconstructed Company to raise a further sum of £24,000, with power to borrow to the usual extent in respect of both original and new capital. Gas of fourteen-candle power is to be supplied. The dividends are to be regulated by a sliding scale, as provided for in the recent Metropolis Gas Acts, the initial price at Limerick being 5s. per 1000 feet. The Bill is also to enable the Company to acquire the gas undertaking of the Corporation of Limerick, and in the event of the purchase being effected, to authorize the Company to raise further capital to the amount required to pay the purchase-money.

The *Wakefield Gas Bill* is to empower the Wakefield Gas Company, having at present a paid-up capital of £80,000, to raise additional capital to the amount of £75,000, carrying the usual borrowing power. All the money the Company have had power to borrow under their previous Acts has been raised by the issue of shares; but, of course, a clause in this Bill will prevent a repetition of this proceeding. Gas of 14-candle power is to be supplied, and the bill proposes that, after the expiration of two years, the Company shall be compelled to maintain the pressure now usually prescribed. The dividends on the new capital are, of course, limited to the usual rates.

The *Waterford Gas Bill* is to enable the City of Waterford Gas Company, with a present declared capital of £16,000, to capitalize expended profits to the amount of £4000, and to raise additional capital to the amount of £16,000, with the usual borrowing power. The new shares will be denominated C shares, and the Bill proposes to limit the dividend payable on them to eight per cent. From and after the 25th of June, 1886, the Company propose to supply 14-candle gas, tested by Sugg's "London" Argand, No. 1, and they offer to fit up, within three months after the date mentioned, a room at the works, where the gas can be tested. The date mentioned is that on which the agreement of the Company with Mr. George Anderson will terminate.

The *Woolwich, Plumstead, and Charlton Gas Consumers Bill* is to authorize the Company, having at present an expended share capital of £60,000, to raise another £60,000. As the Company raised the money they were authorized to borrow under previous Acts by the issue of shares instead of loans, this Bill is to empower them to borrow £30,000 in respect of their entire capital.

SALE OF GAS SHARES.—On the 6th inst., 24 shares (£12 10s. each, fully paid) in the Abingdon Gaslight and Coke Company were submitted to sale by auction in that town, and realized upon an average £22 10s. each.

EXPLOSION OF GAS AT BRADFORD.—On the 3rd inst., as some workmen be longing to the Corporation Gas-Works were engaged in laying mains under the footway in the Manchester Road, and were making a connexion with the service-pipe to the shop of Mr. T. W. Wade, stationer, there was a loud explosion. The window, in one large sheet of glass, was blown out, the stock was set on fire, and Mrs. Wade was burned about the neck and arms, but not seriously. The fire was quickly extinguished, and no further damage was done. The man who was connecting the pipe states that he had no light, and the cause of the explosion, which at first caused great alarm, is not clear.

Communicated Article.

ANALYSIS OF COAL GAS.

By A. W. WILKINSON, M.D.,
Chemist to the Mutual Gaslight Company, New York.

To make an analysis of coal gas by any of the well-known processes is a task of such a magnitude that few, if any, engineers of our gas-works care to undertake it; and yet how often would they be glad to know, even approximately, the composition of this mixture of gases.

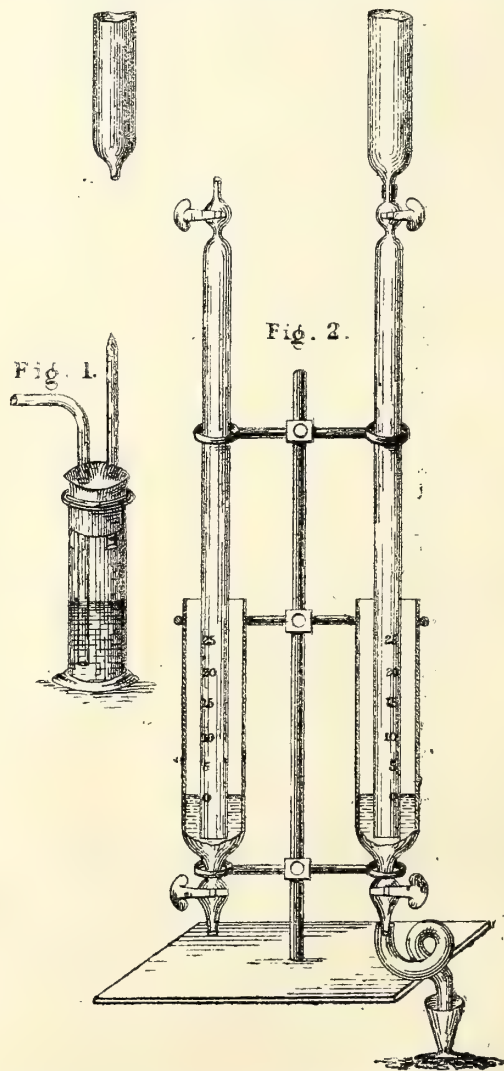
I propose in this article to give a short and ready method of a qualitative and quantitative analysis of gas—one so easy of manipulation that it will come within the reach of any one at all skilled. Although it does not claim to the greatest degree of accuracy, yet, with care, a satisfactory result may be obtained, and that, too, within a very short time; in fact, the principal gases only require a few minutes for their separation.

I give here a list of the gases found in coal gas, so that we can better keep them in mind:—

Ammonia.
Sulphuretted hydrogen.
Carbonic acid.
Air, or oxygen and nitrogen.
Bisulphide of carbon.
Olefiant gas.
Acetylene, &c.
Carbonic oxide.
Light carburetted hydrogen.
Hydrogen.

The first four of the gases in the list, although often present in well-made gas, are generally considered impurities, and, by rights, should not be there.

It is not my object to discuss this subject, but to give a sure and easy mode of detection. The usual test for ammonia (red litmus or turmeric paper) is too crude to detect its presence, even though it may be present to a considerable amount. I much prefer litmus water, which may be readily made by boiling a few cubes of the litmus in water for a minute or two, then filtering the liquid. It should have a bright blue transparent colour, not too dark; to this add a fraction of a drop of some weak acid, such as acetic or hydrochloric; this will change the colour to a wine red, and, if sufficiently diluted, will be capable of detecting the smallest trace of ammonia.



The apparatus I use for the purpose is a bottle, here depicted (fig. 1), which permits of the gas being burned after it has passed through the liquid.

A second bottle, of the same size, filled to the same extent with the reddened litmus, should be placed by its side, so that any change in colour may be noticed. If after passing a foot or two of the gas,

the colour does not change to blue, it may safely be pronounced free from ammonia.

The same apparatus (when partly filled with lime water) answers excellently well for detecting carbonic acid, the white precipitate of carbonate of lime being characteristic. Also for sulphuretted hydrogen, when partly filled with a solution of acetate of lead; the brown or black precipitate of sulphide of lead indicating this gas.

The presence of acetylene may be readily proved by partly filling the apparatus with a solution of the subchloride of copper in ammonia; the red precipitate of the acetylide of copper, which when heated explodes, shows this gas.

For a quantitative analysis, I make use of a graduated burette, with a stopcock at the tip, the tip ground to fit a funnel of an inch in diameter and four inches long. The drawing (fig. 2) gives a good idea of this instrument with the stoppered funnel to stand it in.

For convenience in working, the tube should be $2\frac{1}{2}$ feet in length, five-eighths of an inch in diameter, and divided into 100 parts. To fill this with water, place it in the funnel, secure both to the stand, as in drawing, and then pour into the funnel sufficient water to fill the tube and a little over. Having fitted a flexible tube to the tip, open the stopcock, and by exhaustion fill the tube with water, without changing its temperature by handling; when completely filled, close the stopcock, and now we are ready to introduce the gas for analysis. Care must be taken to have the gas and water, as well as the reagents we use, of the same temperature as the room.

A second tube of like size should also be filled and placed by its side. The two may now be filled to the O point, by putting on the tip an india-rubber tube, through which is flowing the gas to be examined. By opening the stopcock, the gas is allowed to enter as the water flows out, at the same time avoiding any absorption the gas might suffer by passing through water.

The second tube, filled in the same manner, serves to note any change of temperature. The funnel previously described is now placed on the tip, which permits us to introduce any absorbent we wish; by simply opening the stopcock, it will flow down and expose an enormous surface to the gas. A minute is sufficient for the absorption. A little liquid should always be left in the funnel to prevent the introduction of air.

For the absorption of ammonia, use dilute sulphuric acid; the rise of the water in the tube will in a few minutes indicate the per centage of this gas.

For sulphuretted hydrogen, a solution of arsenious acid (this may allow the previous test); the further rise of the water in the tube indicates the per centage of this gas.

For carbonic acid, use a solution of caustic potass. A small quantity of this solution will readily absorb carbonic acid, and may follow the preceding test; the rise of the water in the tube indicates the per centage of this gas.

For bisulphide of carbon, a solution of iodine in water (made by boiling iodine in distilled water), followed by a solution of caustic potass; the rise of the water in the tube indicates the per centage.

For air, use pyrogallate of potass, made by dissolving pyrogallie acid in a solution of caustic potass; this may follow the preceding test, and will absorb oxygen. As oxygen is but one-fifth of the air, we have to multiply the rise of the water in the tube by five, to give the correct amount, or we may say so much oxygen and four times its amount of nitrogen.

For olefiant and acetylene gases, and other hydrocarbons, I prefer bromine; yet Nordhausen oil of vitriol may be used. A few drops of bromine placed in the funnel with a little water on the top may be gradually introduced by turning the stopcock; as it flows down, the tube becomes filled with the vapour of bromine. This in the sunlight will in a few seconds absorb the illuminating gases; in ordinary light a few minutes are required.

The bromine should be followed by a solution of caustic potass, which will leave the tube perfectly clear, and the rise of the water will indicate the per centage of the illuminating gases.

For carbonic oxide, employ a saturated solution of the subchloride of copper in strong hydrochloric acid; this may follow the preceding test, after the tube has been thoroughly washed with water of the caustic potass previously used. This solution will quickly dissolve carbonic oxide; it should be followed by water and caustic potass, to dissolve hydrochloric acid vapours; and a further rise of water in the tube indicates the per centage of this gas.

We have now left a mixture, hydrogen and light carburetted hydrogen and the nitrogen of the air. As these gases serve only to dilute, having no light-giving qualities, it is not important to separate them. In reading the amount of absorption, fill the funnel with water so that the liquid inside of the tube stands at the same level as the water in the funnel outside.

Avoid handling the tube containing the gas; that is, take hold of the stopcock only when moving it.

If the gas has not undergone expansion or contraction in the second tube, your readings will be approximately correct.

I have found the apparatus so simple and so easily handled, and the analysis so satisfactory, that I now depend upon it entirely. Several times I have compared the results with the usual eudiometric analysis, which takes several hours and the greatest care in manipulation, and find I can produce equally good results.

My greatest difficulty has been in the choice of reagents. To find a reagent that will dissolve a single gas, leaving the other gases for those reagents which follow, has been no small task. Take, for instance, the absorption of bisulphide of carbon, the one mentioned is the only practical substance that will dissolve this compound without, at the same time, taking some of the hydrocarbons.

Again, they must follow in a certain order. If, for instance, we use bromine in testing for the amount of illuminating gas in com-

mon coal gas, containing, as it does, ammonia, carbonic acid, bisulphide of carbon, they, as well as the illuminating gas, will be absorbed, and will add to the apparent richness. This mistake has often been made.

The apparatus will be found useful in examining the coal gas in the different stages of its generation, as well as in the various steps of its purification.

Analysis of gases from other sources can be readily made with this apparatus. Those skilled will at once appreciate its application.

I hope that the process herein described may be of some little service to your numerous readers.

College of the City of New York, Jan. 22, 1877.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXVIII.

MAIN-PIPES (*continued*).

In ground whose surface is perfectly level, mains should be laid with a slight inclination, a fall of about 12 inches in 200 yards being amply sufficient. At the lowest point of the incline thus given to the line of mains, a cast-iron syphon or drip-well, fig. 46, should be

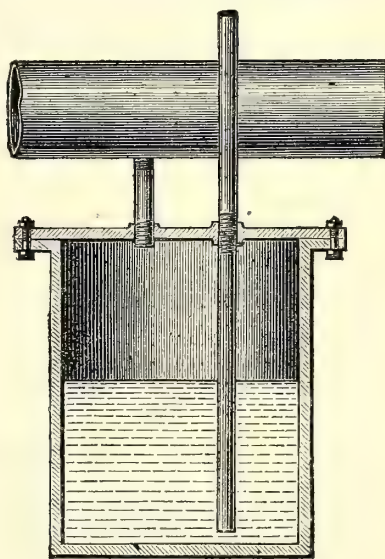


FIG. 46.

sunk at such a depth below the under side of the main that a pipe having its ends attached to the one and to the other will convey the water or other liquid contained in the mains, and due to condensation or other causes, into the drip-well, from which it is periodically removed by means of a small hand-pump attached to another pipe passing through the cover of the well, and dipping to within $1\frac{1}{2}$ inch or 2 inches of the bottom, the opposite end rising to the surface of the ground, being plugged, and protected by means of a cast-iron cover with hinged lid. For the smaller sizes of pipes up to 4 inches diameter, the drip-box or syphon-well, with two sockets cast on, as in fig. 47, is the most convenient for use. The wrought-iron pipe

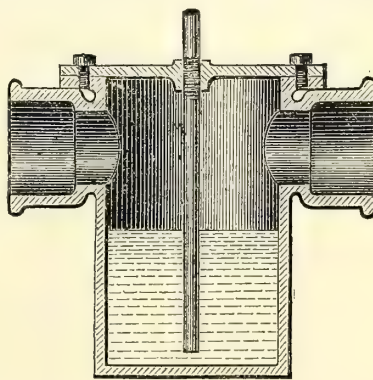


FIG. 47.

which rises to the surface of the ground, and to which the syphon-pump has to be attached, should be secured to the cover by a left-handed screw-thread. This is necessary, because the plug or cap which closes the pipe at the upper end is apt to set fast with rust in the intervals of inspection; and the force necessary to turn it when in that condition, if the thread is of the ordinary description, is often sufficient to cause the unscrewing of the pipe from the cover underneath.

All syphon-wells, when completed and ready for fixing, should invariably be proved at the gas-works, under pressure. If gas be used for that purpose, the precaution should be taken of expelling the air before applying a light to the joints. Fatal accidents have occurred by heedlessness in this respect, the gas and air having formed an explosive mixture.

The principal point requiring attention in the fixing of syphons is the placing of them level on a solid foundation, so that there may be no danger of settlement, resulting, in the first instance, in the

drawing of the connecting-pipe, and, in the second, in fracture of the main. In loose and sandy soils a good flag should be placed at the bottom of the trench or pit, and well bedded, for the cast-iron pot to rest on.

TABLES, showing the Average Cost per Yard of Laying Mains, 9 feet long each, with Turned and Bored Joints, and with Lead Joints, including the Total Expense of Material (the Pipes excepted), Excavating, Reinstating, and Maintaining the Ground for Six Months after completion. Average Depth from the Surface of the Ground to the Upper Side of the Pipes, 1 foot 9 inches.

Diameter in Inches.	2		2½		3		4		5		6		7		8	
Description of Joint.	Turned and Bored.	Lead.	Turned and Bored.	Lead.	Turned and Bored.	Lead.	Turned and Bored.	Lead.	Turned and Bored.	Lead.	Turned and Bored.	Lead.	Turned and Bored.	Lead.	Turned and Bored.	Lead.
In ordinary ballast	s. d. 0 8	s. d. 1 0	s. d. 0 9	s. d. 1 1	s. d. 0 10	s. d. 1 2	s. d. 1 3	s. d. 1 7	s. d. 1 6	s. d. 2 0	s. d. 1 7	s. d. 2 2	s. d. 1 10	s. d. 2 6	s. d. 2 1	s. d. 2 10
In roads macadamizd. with Welsh or limestone	0 11	1 3	1 0	1 5	1 2	1 6	1 7	1 11	1 9	2 4	1 11	2 6	2 2	2 10	2 5	3 2
In ordinary paved streets	1 0	1 4	1 1	1 6	1 4	1 8	1 8	2 0	2 1	2 7	2 3	2 10	2 5	3 1	2 8	3 5
In bitumenized streets	3 2	3 6	3 3	3 9	3 6	4 2	5 0	5 6	5 3	6 0	5 7	6 2	5 10	6 9	6 1	7 2
In footpaths made with sand or ashes	0 6	0 11	0 7	1 0	0 8	1 0	0 11	1 3	1 4	1 10	1 5	2 0	1 7	2 3	1 11	2 8
In footpaths flagged	0 8	1 0	0 9	1 1	0 10	1 2	1 3	1 7	1 6	2 0	1 7	2 2	1 10	2 6	2 1	2 10
In footpaths asphalted	1 10	2 2	2 0	2 4	2 2	2 8	2 7	3 0	2 10	3 4	2 11	2 6	3 2	3 10	3 5	4 3

Diameter in Inches.	9		10		11		12		13		14		15		16	
In ordinary ballast	s. d. 2 2	s. d. 3 0	s. d. 2 6	s. d. 3 6	s. d. 2 8	s. d. 3 10	s. d. 2 11	s. d. 4 2	s. d. 3 3	s. d. 4 9	s. d. 3 5	s. d. 5 2	s. d. 3 9	s. d. 5 7	s. d. 4 4	s. d. 6 5
In roads macadamizd. with Welsh or limestone	2 6	3 4	2 10	3 10	3 1	4 3	3 4	4 7	3 8	5 2	3 10	5 7	4 2	6 0	4 9	6 10
In ordinary paved streets	2 9	3 7	3 1	4 1	3 4	4 6	3 7	4 10	3 11	5 5	4 1	5 10	4 5	6 3	5 0	7 1
In bitumenized streets	6 2	7 6	6 6	8 0	6 8	8 4	7 11	9 8	8 3	10 3	8 5	10 8	9 0	11 4	9 8	12 3
In footpaths made with sand or ashes	2 0	2 10	2 4	3 4	2 6	3 8	2 9	4 0	3 0	4 7	3 3	5 0	3 7	5 5	4 2	6 3
In footpaths flagged	2 2	3 0	2 6	3 6	2 8	3 10	2 11	4 2	3 3	4 9	3 5	5 2	3 9	5 7	4 4	6 5
In footpaths asphalted	3 6	4 4	3 10	4 10	4 0	5 2	4 4	5 7	4 9	6 3	5 0	6 9	5 3	7 1	5 10	7 11

Diameter in Inches.	17		18		19		20		21		22		23		24	
In ordinary ballast	s. d. 4 8	s. d. 7 0	s. d. 5 0	s. d. 7 5	s. d. 5 8	s. d. 8 2	s. d. 6 3	s. d. 8 10	s. d. 6 8	s. d. 9 4	s. d. 7 1	s. d. 9 9	s. d. 7 4	s. d. 10 0	s. d. 7 7	s. d. 11 2
In roads macadamizd. with Welsh or limestone	5 2	7 6	5 6	7 11	6 2	8 8	6 9	9 4	7 2	9 10	7 7	10 3	7 10	10 6	8 1	11 8
In ordinary paved streets	5 4	7 8	5 8	8 1	6 4	8 10	7 0	9 7	7 5	10 1	7 10	10 6	8 1	10 9	8 4	12 0
In bitumenized streets	10 0	12 10	10 6	13 6	11 10	15 2	12 6	16 0	13 0	16 6	13 6	17 0	13 8	17 3	14 0	18 6
In footpaths made with sand or ashes	4 6	6 10	4 10	7 3	5 6	8 0	6 0	8 7	6 6	9 2	6 10	9 6	7 2	9 10	7 4	11 0
In footpaths flagged	4 8	7 0	5 0	7 5	5 8	8 2	6 3	8 10	6 8	9 4	7 1	9 9	7 4	10 0	7 7	11 2
In footpaths asphalted	6 2	8 6	6 6	9 0	7 2	9 9	7 9	10 4	8 2	10 10	8 7	11 3	8 10	11 6	9 1	13 8

From properly-laid and well-jointed mains the leakage is but small, and continues to be so, unless disturbance from subsidence or upheaval (by frost) of the ground takes place.

One of the most prolific causes of leakage with which a gas manager has, at one time or another, to contend, is the opening and undermining of the streets for sewerage purposes. In the construction of such works not carefully undertaken and carried out, the destruction they cause to the pipes is incalculable; and the effects are not confined to the period of the work being performed, but are felt for months after its completion. They are the occasion of damage to the mains and loss of gas, even when the greatest care and the best appliances are used in their execution. We have known more than one instance of a system of pipeage, in a previously satisfactory state, utterly disorganized by such operations, and it is always a wise economy, when these works are being carried out in a district, for the gas authorities to take the precaution of appointing a trustworthy person to devote his time to protecting, as far as possible, their property from damage, by endeavouring to secure the solid filling up and ramming of the soil in all places where the sewers or drains have been formed underneath or near to the line of pipes, and when the latter has been undercrossed at right angles. But even when the utmost care has been exercised, breakages and drawing of the joints will occur.

In the worst evils, however, there are compensatory circumstances; and in the course of sewerage and draining operations, opportunities are afforded for the discovery of leakages which, though not heavy in character, may have been in existence for a lengthened period. All wrought-iron service-pipes that exhibit signs of active corrosion on being uncovered under such circumstances, should be renewed, as, owing to the disturbance and exposure of the pipes for a time to the air and moisture, their oxidation would, if they were allowed to be covered in, proceed with renewed rapidity.

A very simple and effective method of discovering the vicinity of a heavy leakage is to drive a steel bar into the ground at short intervals near to the line of pipes, taking care, of course, not to injure the main. In nineteen cases out of twenty the escaping gas will issue from the hole on the withdrawal of the bar, and thus much unnecessary opening of the ground may be avoided.

(To be continued.)

PROPOSED PURCHASE OF THE EDGWORTH GAS COMPANY.—A meeting of the Bolton Gas Committee was held on Friday last, at which the chairman and the vice-chairman were authorized to negotiate with the Edgworth Gas Company for the purchase of their plant conditionally, on power being obtained by the corporation to supply that township with gas.

REDUCTIONS IN THE PRICE OF GAS.—The directors of the Kidderminster Gas Company have issued a circular, in which they state that, "following the policy adopted in January, 1876, the directors desire that the consumers shall again participate in the benefit of the success which has attended the working of the past year; they have, therefore, resolved to make a further reduction in the price of gas. From and after the 1st of January, 1877, the prices will be as follows:—Consumers under 50,000 feet per quarter, 3s. 6d. per 1000 feet (reduction, 3d.); consumers above 50,000 and under 250,000 feet, on such quarter, 3s. 5d. per 1000 feet (reduction, 2d.); consumers above 250,000 feet on such quarter, 3s. 3d. per 1000 feet (reduction, 2d.)."

The cost of laying mains will vary somewhat in different places, hence it is impossible to state a price that will apply in all cases. The following tables, however, may be taken as giving about the average cost throughout the country:—

Correspondence.

STREET-LAMP LIGHTING.

SIR,—The local board of the town in which I reside are now engaged in laying water-pipes, and they have determined at the same time to lay down a new main expressly for the supply of gas to the public lamps. The whole of this gas will be registered through one meter. I believe the gas company approve of the scheme.

I should be glad to know whether this method has been adopted in any other place, and, if so, with what success. I reserve further remarks on the scheme.

W. M. A.

LOSS OF METERS, ETC., BY FIRE.

SIR,—Will you favour me by allowing me to request some of your readers to kindly inform me—What is the usage in other companies in cases where meters, fittings, or stoves, let on hire, are destroyed by fire on the premises of the consumer who has them in use? My company have recently lost several meters in that way, and I am uncertain whether we shall be likely to succeed in proceeding for the recovery of the value from the persons who rented them of the company, and in whose charge they were at the time they were destroyed. Have any similar cases been legally decided, and, if so, with what result?

SECRETARY.

SPONGY IRON WATER FILTRATION.

SIR,—In your number of the 6th inst., I see a reference to my method of purifying water by means of spongy (metallic) iron. Allow me one remark. Dr. Frankland certainly recommended animal charcoal as long as it was—notwithstanding its well-known objectionable properties—the best filtering medium known. I think I may even say, that when, as one of the Commissioners on Rivers Pollution, his attention was drawn to spongy iron, he made the first experiments with considerable distrust; but when he satisfied himself, conclusively, of the purifying value of that material, he could not but acknowledge its superiority.

If the writer of the article desires information about spongy iron, and will favour me with a call, I shall, with pleasure, give him every explanation, and place all means at his disposal to satisfy himself about its merits as a purifying medium for water.

GUSTAV BISCHOF.

Analytical Laboratory, 4, Hart Street, Bloomsbury, London, W.C., Feb. 9, 1877.

[We have never come across any recantation by Dr. Frankland of his opinion as to the purifying action of animal charcoal. Our correspondent has probably forgotten that about two years ago he promised to send us a specimen of his spongy iron and filter for experiment.—Ed. J. G. L.]

A HINT TO JOINT-STOCK GAS COMPANIES.

SIR,—As many companies registered under the Act of 1862 have not kept up their registration by sending to the Registrar "once at least in every year," a list of the names, addresses, and occupations of all their shareholders, and have thus become liable to heavy penalties at the instance of any common informer, I shall feel obliged if you will allow me to say that where companies have not an agent in town to whom they can entrust this matter, I shall be happy to undertake it for them, and give any information that may be required.

W. LIVESLEY.

Gas and Water Companies Association, 6, Victoria Street, Westminster Abbey, S.W., Feb. 9, 1877.

PROPOSED CATALOGUE OF GAS COMPANIES.

SIR,—I send herewith a copy of a circular and specimen of the lists referred to therein, which I have recently sent, at the instance of the Association, to all the companies named in the list.

In reply, I have received much information that I should have been glad to acknowledge in each case; but as that is impracticable, I shall feel obliged if you kindly permit me to do so generally through your JOURNAL.

It is, of course, intended that both the details and results shall be at the service of the companies when complete.

W. LIVESEY.

Gas and Water Companies Association, 6, Victoria Street,
Westminster Abbey, S.W., Feb. 9, 1877.

[ENCLOSURE.]

5 & 6, Victoria Street, Westminster, Dec. 5, 1876.

Sir,—The committee of this Association, being of opinion that the large amount of capital invested in the different gas undertakings in the United Kingdom, and the great quantity of coals used for gas purposes, are but little understood, and that if these facts could be ascertained the large interests involved in the "manufacture of gas" would be better appreciated, and that as there are no official records from which the information can be procured, the committee would be doing good service to the companies to have it ascertained, they have decided to make special application to the manager of each separate undertaking, whether in the hands of a local authority or a company, for the information necessary for the purpose, and to have it worked out.

To do this effectually it was found necessary, as a preliminary step, to prepare a list of all the gas undertakings in operation at the present time; and this has been done with great care from the best official sources of information that could be obtained—viz., the indices of all the local and personal Acts passed by Parliament in the present century, and the annual returns presented to Parliament by the Registrar of Joint-Stock Companies of all the companies registered under the Companies Acts of 1844 and 1862.

From the first of these sources the names of all the companies and local authorities to whom statutory powers for the supply of gas have been granted have been taken; and from the second the names of all the companies that have been registered as gas companies, or gas and water companies, except such as have subsequently obtained statutory powers.

The first gas Act granted to a company is The Gaslight and Coke Company's Act (now the Chartered), 1810, and the first Act to a corporation, the Manchester Act, 1824.

The names of the companies having statutory powers will, it is hoped, be found tolerably correct; but the names of the local authorities may probably require amendment, inasmuch as it has been assumed that whenever a local authority have obtained parliamentary power either to purchase any existing works, or to construct others, they have exercised that power, and that in all cases where the local authority have the supply in their own hands they are under statutory regulations; but it is now supposed that there are some exceptions to this.

In addition to the foregoing, there are many other undertakings belonging either to companies not registered or to private individuals, of which the committee have no means of obtaining reliable information, such information as the lists contain having been taken from the JOURNAL OF GAS LIGHTING.

The lists were, in the first instance, arranged in alphabetical order throughout, with the intention of sending a complete list to the manager of each undertaking, and asking him to furnish the information required in his own case, and, at the same time, to look over the list and make any correction that might appear to him necessary or desirable; but, on further consideration it was found that this would not only be much too costly as a preliminary proceeding, but would require more time and attention from the respective managers than they might be able to give to it; and that, if done at all, under such circumstances it would, in all probability, be done but very imperfectly.

The lists have therefore been re-arranged and placed in alphabetical order in counties, each county by itself, as being more within the local knowledge of the different managers, and, consequently, less trouble for them to correct, as well as less costly to the Association.

I now send you two copies of the list as complete as we have been able to make it for your own county, and respectfully request, on behalf of the Association, that you will kindly give your aid in forwarding the object they have in view, by looking over the list and making any correction or supplying any omission that may occur to you, and filling up the particulars of your own case in one copy, and returning it to me as addressed at the back, retaining the other copy for your own use.

I am, Sir, yours very faithfully,

W. LIVESEY, Secretary.

To the Manager of the Gas-Works at —

N.B. The lists will be published when completed.

The following is a summary of the number of companies in England, Scotland, and Ireland, as the list at present stands, viz.:—

	Local Authorities.	Companies with Parly. Powers.	Other Companies.	Totals.
England	102	304	835	1241
Scotland	18	4	234	256
*Ireland	14	3	88	105
	134	311	1157	1602

* This is doubtless very defective.

RICHMOND WATER SUPPLY.—It is reported that the difficulty experienced by the vestry in obtaining water from the old artesian well in the lower road has been overcome. Last Thursday morning one of the workmen descended the well to a depth of nearly 200 feet, where the boring commences, and having probed the pipe to a depth of about 40 feet, succeeded in clearing some obstruction, the consequence being that the water came rushing up in such volumes as to drown all the pumping apparatus, and cause the man making the experiment to beat a hasty retreat. The water ran rapidly to within 20 feet of the surface, or nearly 100 feet above the highest pump. As there is no prospect of recovering the submerged pumps, a new one of greater power has been obtained for fixing nearer the surface. The well proper is 7 feet in diameter and 200 feet deep, and the boring about 200 feet below that. The supply from this source alone is now estimated at from 250,000 to 300,000 gallons per 48 hours, giving 20 gallons per diem for every inhabitant, besides which there are private wells in use, at premises where water has never been laid on, sufficient to supply 5000 people at least. As the vestry have secured the use of the old artesian well for six months, there is little fear of the supply again running short before the completion of the new artesian well belonging to the vestry, which is progressing favourably.—Standard.

Parliamentary Intelligence.

HOUSE OF COMMONS.

THURSDAY, FEB. 8, 1877.

On the motion of Mr. EDWARD STANHOPE, a copy was ordered of "Report by the Board of Trade upon all the Railway, Canal, Tramway, and Water Bills of Session 1877."

Mr. ALEXANDER BROWN gave notice that, on going into committee of supply, on Friday the 16th of February, he would call attention to the state of the water supply for domestic purposes in the villages and rural parts of the country; and move—"That in the opinion of this House it is desirable to confer upon the local authorities further powers in order to remedy the existing evils."

FRIDAY, FEB. 9.

The Examiners report that, in the cases of the petitions for the Bromsgrove, Droitwich, and Redditch Water, and the Dublin Improvement Acts Amendment Bills, the Standing Orders have not been complied with, were referred to the Select Committee on Standing Orders.

STOREAGE AND CONVEYANCE OF WATER.

Mr. WHALLEY asked the President of the Local Government Board whether it was his intention to introduce a Bill for affording facilities for the storage and conveyance of water, pursuant to the recommendation of the Commission in their sixth report on the Pollution of Rivers and Domestic Water Supply.

Mr. SCLATER-BOOTH: I presume the recommendation to which the honourable gentleman alludes is "that the owners of land should be permitted to include the cost of village water supply among those expenses which they are now enabled to charge on their estates, with consent of the Improvement Commissioners." Taken by itself, this would hardly be for me to initiate, but, taken in connexion with another well-known recommendation of the Sanitary Commission, it would become of considerable importance. Having regard, however, to the amendments in the law which were effected by the Public Health Act of 1875, I am not prepared at this moment to introduce any Bill having the limited object suggested by the honourable gentleman.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION

SATURDAY, FEB. 10.

(Before Vice-Chancellor BACON.)

In re THE NEW GAS GENERATOR COMPANY, LIMITED.

In this case a petition had been presented by Henry Wilson, the administrator of a deceased shareholder, named Vender, the holder of 100 £10 shares, on which £5 had been paid, asking for a compulsory order to wind up the company. The petitioner also claimed to be a creditor of the company.

Mr. HEMMING, Q.C. (with him Mr. OSWALD), said the company were registered on the 16th of May, 1872, and had for their object the production of gas of a very good kind. The capital of the company was to consist of £25,000, divided into 2500 shares of £10 each. No part of the capital was allotted to the public, the seven persons who signed the Memorandum of Association for 750 shares being the only subscribers. The company had never commenced business, the objects for which they were started had failed, and the company had suspended payment. The original office was closed, and no other place had been registered as the office. The petitioner, who was the legal personal representative of Mr. Vender, one of the subscribers, now found himself in the position of being the administrator of a shareholder of 100 shares, upon which he was liable to pay £500, and he wished to be free from the liability, and to know what his position was. When the company were started the arrangement was that if a sufficient number of applications for shares were not received, no allotment would be made, and the deposit money returned. A sufficient number of applications was not received, the deposits were returned, and the only persons who remained were the seven subscribers to the memorandum. The suggestion on the other side would, no doubt, be that because there were so few members the Court would not interfere by way of a compulsory order to wind up, but if a voluntary winding up would be cheaper, the petitioner had not the slightest objection to that course being taken. The petitioner's debt was disputed by the company, who stated that the money was advanced upon the understanding that he should not be repaid. If the company chose at any future time to go on with the business, the petitioner would be liable to pay the £500 remaining uncalled, and from this liability he wished to be freed by a winding-up order. In support of his argument for a compulsory order to wind up, the learned counsel quoted the authority of the *London and County Coal Company* (3rd Equity Cases), *Saunders's Patent Association* (12th Equity), and the *Tuma Cocori Mining Company* (17th Equity).

Mr. KAY, Q.C. (Mr. WHITEHORNE with him), said he appeared on behalf of Frederick and Henry Porter, two of the subscribers to the memorandum, to oppose the petition. He submitted that the present was one of those cases which the Court always regarded with the greatest possible suspicion, because no one knew better than his lordship that such petitions were presented only for the purpose of creating costs. Shortly stated, the facts were as follows:—The company were registered, there being seven subscribers to the memorandum, but the articles provided that no allotment of shares should be made unless 2000 shares at least should be applied for, and a deposit of £2 per share paid thereon. This number of shares was not applied for, and therefore, in pursuance of the articles, no allotment was made, not even to the subscribers to the memorandum, the deposits were returned, and the company never commenced business nor incurred any liability; so that it was a mere name of a company, and had been treated from the beginning as an entirely defunct company. The evidence proved that there was not the shadow of a pretence for saying that Mr. Vender was a creditor of the company, and that he had never in his lifetime made any claim against the company. The cases of *Ex parte Mullins* (3rd De Gex and Smale), the *Natal Company* (1st Hemming and Miller), *Ex parte Wise* (1st Drewery), *The Sea and River Marine Insurance Company* (2nd Equity), clearly proved that an order to wind-up could not be made.

The VICE-CHANCELLOR asked whether the petitioner wished to support the petition in his character of creditor.

Mr. HEMMING said he would rather go upon both points—shareholder and creditor.

Mr. KAY referred to the evidence at some length, in order to prove that the company were never indebted to Mr. Vender.

Mr. WILLIAM BARBER, who appeared for the holder of 100 shares, and for the company, also objected to a winding-up order being made.

The VICE-CHANCELLOR, in delivering judgment, said: The petition was put upon two grounds—first, that the company had not done any business whatever since the year 1873, that they had never commenced business, that the objects for which the company were formed had failed, that the

company had suspended their business for more than a whole year, that the registered office could not be found, and that the company were unable to pay their debts. That was the first ground on which the petition was sought to be supported. The second ground was that the petitioner was a creditor of the company, and the case had been argued on both grounds. The first, which was directed towards the discretion of the Court, was one of general public importance. When the Court was called upon to exercise its equitable authority, it should be satisfied that there was some reasonable ground for its interference, some reason for incurring the costs which were a certain consequence of making the order asked for, and a prospect of some good being done to some one. If the Court were satisfied in these respects, it would make the order asked for. But what necessity existed in the present case? It was undisputed that the company had entirely come to an end, the shares were not allotted, the subscribers who agreed to take shares had had their deposits returned to them, the contracts with the vendors had been given up, no business had been carried on, and no business could by any possibility be carried on; and the petitioner, with an affectation to which he could not listen, and which could not be serious, said that he was under some liability, for that the persons forming the company might hereafter issue shares, and that he, in his character of administrator of Mr. Vender, might be exposed to liability. It was not possible. The company—whether wound up or not did not signify—had entered into a contract to buy patents to carry on gas manufacture; they had rescinded that contract, had no business, no assets, and, moreover, owed no debts, yet it was said that the petitioner came trembling to the Court asking for protection against the danger to which he was exposed. It was impossible to entertain such a case. The authorities might be ransacked, but no case could be found in which the Court had, under circumstances at all approaching the present, made an order to wind-up unless there had been some fraud in the matter which the winding-up might succeed in detecting. In the authorities which had been referred to, fraud was alleged, and the Courts had—to use the words of one of the judges—“extinguished the wretched thing.” But, in the present case, the “wretched thing” had extinguished itself, and the order asked for to wind up, if made, could have no other result than to put costs into the solicitors pockets. The other ground on which the order was asked—namely, the alleged debt—was as much extinguished as the first ground. The petitioner found a letter which accompanied a cheque from Mr. Vender, and some entry in a book of Mr. Vender's, and therefore he concluded that he had a claim as creditor against the company. But it was proved by the secretary of the company that Mr. Vender had never paid, on account of the company, a single shilling, that he had never lent any money to the company, that he never claimed to be a creditor, and, further, that the expenses of formation were paid by some other person. There was no ground on which the petitioner could be called a creditor of the company, and that he was aware of that fact his lordship could not entertain the slightest doubt. Being of that opinion, it was his duty to dismiss, with costs, the petition, which had been presented solely for the purpose of creating costs and prolonging a litigation which never ought to have been instituted.

Mr. KAY asked to be allowed to take judgment against the debt, in order to prevent further proceedings on that point.

The VICE-CHANCELLOR said he could not do that; he dismissed the petition because the debt had not been proved.

EDGWARE PETTY SESSIONS.—WEDNESDAY, JAN. 31.

(Before Serjeant Cox, Chairman, and Messrs. FORTNUM and HOLMES.)

CONVICTION UNDER THE CONSPIRACY AND PROTECTION OF PROPERTY ACT.

William Page, a stoker, in the employ of the North Middlesex Gas Company, was charged with wilfully and maliciously breaking his contract of service, knowing that the probable consequence would be to deprive the inhabitants of Hendon of light on the 21st ult.

Mr. William Porteus said he was secretary and manager of the North Middlesex Gas Company, at Hendon. The defendant had worked for him about two years under a weekly engagement. On Saturday, the 20th ult., when he paid him his wages, he told him he should stop 4s. to ensure his coming to work the following morning. Defendant said: “I shall not submit to that. If you don't pay me in full I shall give you a week's notice.” Witness then paid him the 4s., doubting whether he would come, and said, “Now, you understand I shall expect you to come to-morrow.” Defendant replied, “If I don't come you know what you can do; you can summon me.” It was a very serious matter for the company that the men acted in this way, as they supplied three railway stations and 15 churches with gaslight. Defendant had previously induced two night-men to leave their work, but by persuasion they had the good sense to return to it. Defendant did not come to work on the Sunday or the two following days. In consequence of his not coming on the Sunday witness had to take a lad from the yard and pay him double. He had to employ inferior labour, and calculated that in consequence he made less gas by 20,000 feet.

Defendant said he was not working under agreement, and that he was laid up three days from a pain in his back.

In reply to a question by the CHAIRMAN, Mr. Porteus said he did not wish for imprisonment, nor indeed a heavy fine; all he desired was that such an example might be made as would deter the other workmen from acting similarly. He did not wish for any costs.

The BENCH said Mr. Porteus had acted very liberally and kindly to defendant, and this they hoped would prove a warning to him. They also wished it to be known that if any other man was brought before them for a similar offence, he would be sent to prison without the option of a fine.

Defendant was fined £1, and 9s. 6d. costs.

WORSHIP STREET POLICE COURT.—FRIDAY, FEB. 9.

(Before Mr. BUSHBY.)

CARRIAGE OF COAL TAR NAPHTHA.

Mr. T. Wood, chemist and oil merchant, of 4A, Leather Lane, Holborn, appeared to a summons charged with sending inflammable matter—namely, two casks of coal tar naphtha—by the Great Eastern Railway without marking on the outside of the casks the nature of their contents, and without giving the necessary notice to the railway officials.

Mr. E. Moore, solicitor to the Great Eastern Railway, said that on the 18th of January last the defendant himself brought to the Great Eastern Railway two casks, which he declared to contain mineral oils. The officials of the company suspecting that they did not contain mineral oils, took samples of the contents, which, on being analyzed, proved to be coal tar naphtha, a highly dangerous substance, giving off an inflammable vapour at less than 20° Fahr. The Act of Parliament empowered railway companies to refuse to carry any substance that gave off an inflammable vapour at less than 150°, and although some other companies would carry it, the Great Eastern had always taken advantage of the Act, and refused to have anything to do with it. The penalty for making the false declaration was £20. The defendant pleaded guilty.

Dr. Redwood, analytical chemist, having given evidence as to the inflammable nature of coal tar naphtha,

Mr. BUSHBY said he could see no extenuating circumstances in the case to induce him to mitigate the penalty, the peril to the public was so great. The defendant must therefore pay £20, and £5 7s. costs.

The money was at once paid.

Miscellaneous News.

THE GASLIGHT AND COKE COMPANY.

The Half-Yearly Ordinary General Meeting of Proprietors was held at the Company's Office, Horseferry Road, Westminster, on Friday last—the Hon. RICHARD HOWE BROWNE (the Governor) presiding.

The SECRETARY (Mr. J. Orwell Phillips) read the advertisement convening the meeting, and the minutes of the last general and special meetings, which were approved.

The report of the directors and statement of accounts, which have already been published in the JOURNAL (pp. 155, 197, 198, 199), were taken as read.

The GOVERNOR: Ladies and gentlemen, in moving the adoption of the report and statement of accounts, which you have been good enough to take as read, I might almost confine the few remarks which I intend to make to the first paragraph of that report, which conveys to the proprietors the pleasing information that the company, in every branch of its manufacture and management over which the directors have any control whatever, is improving. I may state, in illustration of that fact, that we have improved in the quantity of gas manufactured per ton of coals to a very large extent during the last half year, as compared with the corresponding period of the year 1875. During the year 1875 the gas made per ton of coal was 9900 cubic feet, whereas in the year now under consideration it was 10,149 cubic feet. This is an amount per ton of coal carbonized which I believe has never been equalled in any London company; and I am sure you will agree with me that it reflects the greatest possible credit upon our engineers, and upon all concerned in the carbonizing department that such a result has been obtained. As to the quantity of gas sold per ton of coal during the last year, the report I have to make to you is still more satisfactory, and I believe it exceeds any figures that have ever been put before the public. The gas sold during the year 1875 was at the rate of 9020 cubic feet per ton of coal carbonized, which in itself was an enormous amount to realize; but in the year 1876 we have been absolutely paid for 9363 feet of gas per ton. This is a most satisfactory state of things, and shows a very rapid improvement in this department of our affairs. The general increase in the consumption of gas during the year has been 6 per cent., or within 5 decimals of 6 per cent. We have never looked for more than about 5 per cent. ordinarily all over our districts. Of course, in some districts the increase has been considerably more, such as in the new districts of Kensington and Highgate, where a large amount of building has been going on. Taking an average over the whole area supplied by the company, it cannot be regarded otherwise than as highly satisfactory that we can report an increase of about 6 per cent. And there is another point to which I may very fairly allude as a matter for congratulation, and that is, that over our enormous area, comprising upwards of 1270 miles of mains, our leakage—or, at least, our “unaccounted-for gas,” for it is not all leakage, as we suffer a great deal in other respects through gas being used without being paid for—taking, however, everything into consideration, the leakage on our mains and services only amounts to 6·37 per cent. I very well recollect the day when we used to consider 15 or 16 per cent. a very satisfactory state for our leakage account; and, therefore, the improved state of things now existing shows, I think, the very great attention which has been paid to the supervision of our mains and fittings throughout every portion of our vast district. We adopt a system which we have found to work admirably. We have each street periodically under inspection, so that every main and every service comes under the supervision of the inspectors at certain intervals, say of about three years at the utmost. We adopt the same system also with regard to our meters, and in this way we consider that we have saved enormously in leakage. Turning to other points embraced in the first paragraph in the report, I must refer to one or two matters which are not quite so satisfactory. First of all, I will take the deficiency in the sale of coke. Our great enemy during the last half year has been, of course, the weather. I do not suppose any gentleman present can call to recollection a period in which the autumn and the winter have been so extremely mild as during the last half year. I believe I may say that we have not had a single day's frost, and not a single day's fog—which is a state of things we generally look forward to as a source of additional revenue. We have been unaided by these two allies almost all through the period under consideration. I have been in London every week, and I do not think I have once seen a regular London fog. Again, the wear and tear at Beckton has increased. That station has been at work during the last eight years, and it now requires the usual renewals, replacements, and repairs that every other station of the company requires, and will henceforward find its place in the general wear and tear account. Hitherto there has been very little to do at Beckton; and I must say, in justice to the gentlemen who have had the conduct and control of those works, that they have been constructed and carried on in a manner which has necessitated very little extra expense indeed. The next point I refer to is the announcement made in the report, that we have reduced the price of gas from the 1st of January last to 3s. 6d. per 1000 cubic feet. That was a very bold step to take, many people will say; but I think we were justified in taking it by the state of our finances, and by the future prospects of the company. I assure you the directors went into the nicest possible calculations as to the result of the reduction, and I hope when we next meet you, we shall have to report favourably upon the matter. We must, however, bear in mind that we have had many elements working against us since we made the reduction. We have had coke at an absurdly low price, and a continuance of such weather as has rendered the use of gas almost unnecessary for heating purposes. I have no doubt, notwithstanding, in my own mind, that either this half year or the next the result of the step we have taken will prove most satisfactory to the proprietary. There is another thing which has militated against us, and which every gentleman connected with business has had experience of, and that is the very great dullness and depreciation in trade generally. There is not a tradesman or merchant in the City of London who will not readily testify that, during the whole of last year, owing to “wars and rumours of wars,” the trade of the Metropolis was, to a certain extent, paralyzed. There is little or no trade going on in some of the districts of London, which used to be the centres of activity and industry, and we consequently suffer from it. These are circumstances over which, of course, we have no control. In all other matters referred to in the report, which we have been able to influence and control, everything has gone on most satisfactorily. Then, gentlemen, it is stated in the report that we have under consideration the digest of a very large and comprehensive scheme for the connexion of all our stations by large trunk mains. We have not determined, as yet, the exact position of those mains, nor have we gone further than to refer the subject to a committee of our own engineers—most able men, and competent to advise us in

reference to it. We are convinced in our own minds that such a course will tend to economy in the distribution of our gas, and make us independent of any accident which might happen at any one of our stations. The expenditure will necessarily be large, but we believe it will be conducive to the good and safe working of the company generally. We have made several alterations, I may say, since we have joined the Imperial and Independent Companies, in the supervision of our districts, as far as the inspectors are concerned. We have made some radical, and, I believe, most useful and important alterations in the supervision of our districts, changing inspectors from one district to another, and appointing persons to take charge of districts in their own neighbourhood, so as to consult their convenience, and to ensure that every portion of the large area we supply is well looked after. I think that already we have found great advantages accruing from this step, and I trust in future the benefits of it will be found to increase. The next point I will allude to—and I will touch upon it very slightly, because it was dealt with in the last report—is the commutation of the pensions of the officers of the different amalgamated companies. Some of these pensions, however, were not necessitated by the amalgamations, but were pensions for long services rendered. The subject was considered most attentively by the court of directors, and, after the maturest deliberation, we thought the best plan would be to commute those pensions, and thus wipe them off from the books of the company, thereby effecting a saving of about £14,000 or £15,000 a year from the present time. I shall very naturally be asked how we did this, and therefore, to anticipate any discussion upon the subject, I may tell you now (I did not do so at the last meeting, because then the arrangements were not completed) that we applied the unappropriated profits of previous years, which, under our Acts of Parliament, we could not employ otherwise, in commuting these pensions by payments in cash, and so making an investment of the money which, during the next eleven or twelve years, will return us a small amount of interest. Instead of carrying it forward as a balance of profit, for this purpose, as you will see by the accounts, we have taken a part of our surplus fund, which amounted last half year to £184,000, and have supplemented that by about £40,000 from the earnings of the half year under consideration, and have thus wiped off entirely the pensions, which amounted to nearly £15,000 a year. We think that this arrangement, while it has satisfied all the annuitants and pensioners, is the best possible that could have been effected for the shareholders. Then again, since our last meeting, we have carried out and perfected what we foreshadowed in our last report—that is, the formation of a kind of indemnity and insurance fund amongst our own *employés*, from the secretary downwards, as a provision in case of any infidelity or fraud, and to supply the place of those companies which have hitherto done our guarantee business. Without casting the slightest disparagement upon those companies, whom we now no longer employ as our insurers, I may say that we have considered it much better for the officers themselves, and for this company generally, that they should be their own insurers. And, although we have only established the fund since the first of this year, I assure you we have already obtained very satisfactory fruit from it. According to our present system, every gentleman in the service of the company looks after every one very jealously who is appointed to an office. Not that they have any voice in the matter; but if the directors should, through any inadvertence, or from being ill-advised, appoint any person to whom they have any reason to object on account of his former life, habits, and conduct, they would represent to us that he was not a fit person to be associated with them in this general indemnity-fund, and, of course, the directors would take it into consideration, and immediately remove that person from the fund. I hope the proprietors will agree entirely in the step we have taken in this matter. Now, gentlemen, I am always averse to making changes in the form of our accounts; but we have made a little alteration this time which I think you, with me, will approve of. When we took over the undertaking of the Great Central Gas Company, it will be in your recollection that we took over with them, and as a part of their dower, a defalcation-debt of some £70,000. We were obliged, by the scheme of amalgamation then adopted, to pay off that amount by annual instalments. The ingenious gentleman who betrayed the Great Central Company into this heavy loss, was, I believe, Mr. Higgs, and that person's name has appeared in our accounts as a defaulter for the last eight years. I am now happy to say that our accounts have been so far altered that this defalcation appears no longer. We have paid off the whole of the amount, and on the present occasion we have to the credit of our net revenue account, as an asset of the company, a small amount received as a dividend from the estate of Benjamin Higgs. Having referred to the defalcation which we took over from the Great Central, and which was a heavy incubus upon us, I am bound also to say that we have been perfectly satisfied with our bargain. The amalgamation of that company gave us some directors of great practical experience, and amongst them none more so than my excellent friend yonder, Mr. Bennoch. Altogether it proved a most profitable and a most convenient transaction for the Chartered Gas Company. Gentlemen, you will be anxious, very likely, to know something as to our financial position, and the probability of future calls upon our shares. I will, therefore, just state that upon the fourth issue of our capital we have still available £200,000—i. e., we can make two calls to that amount, and in all probability they will be made (though I cannot fix exactly the date) in the course of the present year; one, perhaps, may be needed in July, and the other later on. You may, however, be satisfied on this point, that the directors will not call up a single shilling that is not absolutely requisite for the carrying on of the undertaking. I told you at the last meeting that we were under contract for several very large works at the different stations. We are bound, of course, to carry out those contracts, and they will have to be paid for. They amount, at the present moment, to £321,000. We have ample funds to meet these charges, without trenching upon the fifth issue of capital, upon which we have altogether £400,000 still available, with the addition of £125,000 to be borrowed on debenture stock if we please. We have also, as you know, the capital authorized by the Act of last year, amounting to £1,000,000 in shares, and £1,000,000 in borrowed money, which I hope will not be required for a great many years to come. It may, however, be, and I will not predict that it will not, that the rapid extension of trade in our districts will render it necessary to call up that capital sooner; and if so, all I can say is, that in such a case the sooner the necessity arises the better. Since we last met you here in special meeting, at which you authorized us to raise the sum of £125,000 in debenture stock, we have carried out that operation, and I think I may say on the most favourable terms. I stated at the last meeting our views as to the rate at which that stock should be issued, and some shareholders objected to the low rate of interest we proposed, and said we should not be able to carry out our intentions. I am happy to say that every farthing of the money was subscribed at 4 per cent., and that in addition to the amount we were authorized to raise, we had applications from *bond fide* proprietors of the company for eight times the sum we asked, at the same rate. I think no greater evidence can be adduced of the confidence reposed, by those best qualified to understand the matter, in the solidity and future prosperity of this undertaking. I think, moreover, that the gas world is greatly indebted to the company for having placed gas debenture stock on such a footing. I may say that this stock, which we thus raised

at 4 per cent., now stands at a considerable premium on the Stock Exchange. Having carried out this operation, we were enabled to renew a very large amount of Imperial debentures—£146,000 at 5 per cent.—which fell due since the 1st of this month, by the same amount of debenture stock issued at 4 per cent., thereby effecting a considerable saving; and, being debenture stock it is a perpetual saving. Debentures are payable at certain times; debenture stock is stock of the company, rating at the interest at which it is issued as long as the company exist. Gentlemen, you are well aware that this company have always adopted the principle of giving to every new invention, and every new material that comes to England, a fair trial, to see what it may be worth for the purpose of our manufacture, and I will now give you an illustration of this. We have been lately trying a new Australian cannal, a most extraordinary mineral, and which, so far as we have examined it, has proved extremely satisfactory. It is a species of shale, and we have found, by putting one of our stations—that at Pimlico—entirely upon this material for a period of one month, that the results are of the most encouraging kind. We believe, from what we see at present, that the importation of it is likely, in future years, to influence considerably the price which is being paid for the cannal used by the company, and which costs such an enormous sum of money. The Boghead and Lesmahagow cannals hitherto at our disposal are extremely costly, and we hope that this new material may prove highly serviceable to us in their place. I am not going to give you any exact results now, for I do not think we are in a position to express any very confident judgment from the short experience we have had as yet. I can only say that, so far as we have at present gone, there is every prospect of a considerable saving being effected by its use. We are very sparing of cannal, because of the great expense it involves, and because, also, of the high illuminating power we are now getting out of common coal; but if the price of this new material should prove moderate, and within our means, there is no doubt that, from the small quantity required, and the small space required for its storage, it will be a great convenience and advantage to us. It is a stuff which no weather affects at all; it may be left out in the open air quite as well as placed under a covered store, without being deteriorated. I hope that by the next meeting we shall have ascertained the exact cost of freight. We already know what we can procure the material for at Sydney, but we do not yet know what it will cost to bring it over. Now, gentlemen, I dare say you have read a great deal of correspondence lately in the newspapers about officers and *employés* of gas companies receiving commissions from those who supply goods to the companies. I am not at all in the habit of reading anonymous letters of the kind—indeed, I have not the time to do it; and I will say further that I attach very little importance to any letter or document to which the writer is ashamed to affix his name. I treat such things in general as waste paper, and throw them aside. But there has appeared in what is usually called “the leading journal,” a letter from a correspondent signing himself “A Commission Abolitionist,” to which my attention has been directed. Now, I do not stand here to vindicate the whole of the gas community against the practice which it is alleged is going on; I only stand here to exonerate the officers and *employés* of this company, and I say distinctly that to my knowledge such a practice has never obtained here. I have taken the greatest possible care, and made every inquiry that I possibly could, to ascertain the facts of the case, and I am very pleased to be able to say that I have satisfied myself entirely that the practice has no existence here, and that it has not existed here. And, gentlemen, I will give you the reason why I am satisfied that it could never prevail in this company. I do not know how things are carried on in other companies, as I do not belong to any other gas company in London than the Chartered, but in this company it is next to impossible that any contractor, coalowner, or ironmaster who supplies goods could offer bribes to an officer with any security whatever that it would be the slightest service to him. And I tell you why. Every tender for whatever we require is brought into the court-room open, and initiated by a director, before any one else sees it; therefore, the person who might offer a bribe would have no assurance whatever that influence could be used to get him the contract. On the contrary, in our coal contracts we invariably abide by the results of our experience of various kinds of coal in the preceding year. If we find that a coal is particularly good, we are willing to give a good price for it; if we find it not profitable to the company, we immediately set it aside. This is always done by the vote of the court, and therefore any person attempting to corrupt a servant of the company by bribing would do so at his own risk, and with no certainty that he would obtain a contract at all. I objected to the letter I have referred to when I first read it, because the writer stated that he himself belonged to a firm which had made a very large business by the system of “commissions,” and this “Abolitionist” further intimated that he was carrying on the system still, although on a modified scale. This individual, therefore, is evidently himself bribing people to commit robbery, to cheat their masters, for, on his own confession, he is continuing the practice which he condemns. His letter refers principally to the *employés* of gas companies, or I should not have noticed it; and I can only express my wonder and astonishment that such a communication should ever have been allowed to appear in the columns of *The Times*. Gentlemen, presently we shall have to make this meeting special for the consideration of a Bill which the directors have determined to introduce into Parliament this session relative to the purification of gas, and I think that, perhaps a few words from me now, as the matter is alluded to in the report, may save a good deal of time at a future stage of our proceedings. The fact is that last session we were dictated to by the Committee to acquiesce in a provision with reference to the sulphur impurities in gas, which upon experience we find it is impossible to comply with, without creating a nuisance and inconvenience to those who surround us. Latterly, when manufacturing a great deal at Beckton, and other outlying stations, no objection was made to the process we are compelled to adopt; but, as we are under the necessity of using lime at other stations also, so as to bring our purification within the limits prescribed by the Gas Referees, we find that on removing that lime from the purifiers we cause a certain degree of annoyance to our neighbours, whereas if we could get the clause in our Act repealed, which we hope to do this session, we shall be able, by the use of the material we, in common with other companies, have used for many years—the oxide of iron—to purify our gas in a sufficient manner without inflicting a nuisance upon others. Well, now, gentlemen, I shall only add one word in conclusion, and that is with reference to the general policy that has governed this company for the last few years. I think that the high state of prosperity to which this company have now attained, has been attained—and I do not speak egotistically, nor because I desire to praise my brother directors, from whom I have received such great support—but I will say that, in my humble opinion, the status which this company has attained, and which is the highest of any company I know of, is attributable to the liberal, enlightened, and progressive policy which the board, with the consent of the proprietors at large, have followed out for the last 15 years. From the first time that my honourable friend, Mr. Beck, assumed the chair which I now occupy—from that moment a new system was inaugurated in this company. We were not satisfied with the standstill policy of former

years, which suited those who preceded us, and did avail them in those times. Even in my own recollection, I know that the changes, alterations, additions, and improvements which have been effected in the management of the Chartered Gas Company, now so happily combined with the Imperial and Independent, would have frightened our predecessors out of their senses. I recollect the time when there was a contest in this room as to the proposed extension of our gasholders, the ample provision of which is one of the great secrets of the successful working of a gas company, because we ought to have storage for gas equal to a large per centage, if not the whole, of our make day by day. I am happy to say that, through the influence of my personal friend, Mr. Beck, and others, who were then members of the board of the Chartered Company, we were able to over-ride that policy; and now we stand pre-eminent for our large gas storage, by which means great economy is effected. Then came the question of districting, which was a grand operation, bringing to a close the system of ruinous competition formerly carried on. In past days, five or six mains were laid through a district where one was amply sufficient. That system is happily abolished, and since then we have been at peace with all the world. Then followed the great question of amalgamation, which, in the early years of my friend's governorship, we carried out with five or six of the smaller companies, and which, upon his retirement, we extended by embracing the great Imperial and the Independent Companies. I say, gentlemen, it is these movements and these acts alone to which we are indebted for the high position in which we now stand, and I do trust that whoever may succeed us here will carry out, to the fullest extent, the policy which we have inaugurated, and which, if faithfully persevered in, we believe will secure the lasting prosperity of this vast undertaking. I now beg to move—"That this meeting do agree with and confirm the report of the directors, and the auditors report and statements of the accounts of the company as transmitted."

Mr. E. VAUGHAN RICHARDS, Q.C. (the deputy-governor): After the full and able statement just made by the governor, it will not be necessary for me to do more than briefly second the resolution, which I have very great pleasure in doing. There is only one remark I would make, and that is with regard to the mutual guarantee-fund. It is no new experiment, but one that had been in operation in the Imperial Company for eight years with signal success. It is one of those things that the amalgamated company have borrowed from the Imperial, just as they have borrowed many other things from them and the Independent, which they honestly believed would contribute to the increased prosperity of their undertaking. And I take this opportunity of stating that it has been done with the most perfect straightforwardness, and that we all work together with the most complete harmony in carrying on the work of the company.

After some remarks by Mr. SAYWELL,

The motion was put, and carried unanimously.

The SECRETARY brought up a minute from the court of directors, dated the 26th ult., recommending the dividends mentioned in the report.

On the motion of the GOVERNOR, a resolution in accordance therewith, and declaring the dividends so recommended, was put and carried.

The governor having retired, Mr. Richards took the chair.

Sir A. SCOTT WAUGH said: As an old proprietor of the Chartered Company, and an ancient friend of the Hon. Richard Howe Browne, who is one of the directors retiring by rotation, I have great pleasure in proposing to the meeting that he be re-elected. He has now served the company for 21 years, and during that long and eventful period he has been conspicuous for his zeal, wisdom, and undaunted resolution. The prodigious success of the company is the best criterion of the excellence of its management. Mr. Browne for a long period was the deputy-governor during the reign of our former model governor, Mr. Beck, whom he supported in every part of his administration. Without further eulogy, I move that he be re-elected to a seat at the board.

Mr. BECK: I have very great pleasure in seconding the motion. Having acted with Mr. Browne for many years, I know his qualifications well, and his entire devotion to the interests of the company.

The motion was put, and carried unanimously, and Mr. Browne resumed the presidency of the meeting.

On the motion of Sir A. SCOTT WAUGH, seconded by Mr. PRICE, the other retiring directors—Mr. Hugh Edward Adair, Mr. James Brickwell, Mr. Ulick John Burke, Mr. Robert Temple Frere, Colonel William Thomas Makins, M.P., Mr. Thomas Paine, and Mr. Benjamin Leigh Smith—were also re-elected.

The GOVERNOR: With regard to the election of auditors, I beg to report that Messrs. William Hawes and Mr. R. J. Mansell, the auditors of the late Imperial Company, and Mr. W. T. Reynolds, the auditor of the Independent Company, do not intend to offer themselves for re-election, and I have to bring up the following minute from the court of directors:—"Resolved, that it be recommended to the court of proprietors to vote to the retiring auditors each a gratuity equal to three years of their respective salaries, in pursuance of the 29th section of the Scheme for the Amalgamation of the Imperial and Independent with The Gaslight and Coke Company." I now move that the directors be authorized to pay to each of these gentlemen the gratuity in accordance with such recommendation.

Mr. E. VAUGHAN RICHARDS seconded the motion.

Mr. DOANE asked what the remuneration of these gentlemen had been.

The GOVERNOR: Two of them had £100 a year, and one £50, so that two will receive £300 each, and one £150.

The motion was put and agreed to.

On the motion of Mr. BECK, it was resolved that Mr. J. S. Barker, Mr. T. J. Briggs, and Mr. F. Farnan, be re-elected auditors of the company.

Mr. SAMUEL WARD asked what arrangement was made in reference to the retirement of auditors.

The GOVERNOR said it was arranged between the auditors themselves who should retire and who should remain.

Mr. SAMUEL WARD said he thought the appointment of auditors should be entirely with the shareholders, and it seemed to him by this arrangement the matter was taken out of their hands.

The SECRETARY said up to the present time there had been seven auditors, the representatives of the three companies last amalgamated. Three of them now retired entirely, and of the four remaining, three offered themselves for re-election. This time next year the whole of them would come forward in the same way.

The motion was put and carried.

The meeting was then made Special, for the purpose of considering the Bill about to be introduced by the company, intitled, "A Bill to repeal certain provisions of The Gaslight and Coke Company's Act, 1876, with respect to the purity of the gas supplied by that company."

The SECRETARY read the heads of the Bill, and the sections of the Act of 1876 intended to be repealed.

The GOVERNOR moved, and Mr. RICHARDS seconded, a formal resolution approving of the Bill, subject to such alterations as the directors may deem expedient.

A SHAREHOLDER asked whether the Bill was likely to be opposed.

The GOVERNOR said he thought most likely it would be by the local authorities.

The motion was put and carried.

A cordial vote of thanks was given to the Governor, Deputy-Governor, and Directors, for their able management of the affairs of the company.

The GOVERNOR acknowledged the vote.

A vote of thanks was also given to the Secretary and staff for their services.

The SECRETARY acknowledged the compliment, and the proceedings terminated.

STOCKTON AND MIDDLESBROUGH WATER-WORKS COMPANY.

The Half-Yearly Meeting of Shareholders was held at Darlington on the 6th inst.—Mr. H. PEASE in the chair.

The SECRETARY having read the notice convening the meeting,

The CHAIRMAN said the directors had not circulated any full statement in the usual form among the members, but they had laid on the table the report of the directors, which every shareholder was fully at liberty to inspect. Nothing devolved upon him at the present moment further than to say that, notwithstanding the general depression of trade in the district the company had been supplying with water for so many years, their property was still a developing property, and was still in a healthy and satisfactory state. The board were not contemplating any large new works, neither did the past history of the company require referring to, because they were very well aware of it.

Two or three SHAREHOLDERS expressed an opinion that the report ought to be read, but

The CHAIRMAN said it was always agreeable to the directors to meet the views of the proprietary; but they were in the position of trustees, and were endeavouring to execute that trust to the very best of their judgment. The directors informed them that the affairs were thoroughly sound and healthy, and the whole of the proceedings was laid before them, in which the figures were as fully published as in the newspaper. The directors were acting for the very best interests of the concern, and they asked the shareholders to read the figures for themselves, and make themselves satisfied.

Mr. HOBSON thought that, under the peculiar circumstances in which the company were placed at the present time, it would be better to accept the statement of the directors.

Mr. J. H. BOWMAN, a director, said there were very few gentlemen there who knew what treatment the directors had received. In dealing with the parties who wished to buy the works, papers which had been considered private and confidential were brought up by counsel and witnesses when before the parliamentary committee. In adopting the course which they did on the present occasion, the directors did so with the desire to prevent anything from being brought against them in the arbitration which was imminent. A very great amount of money was at stake in the arbitration they were looking forward to, and the interests of the shareholders would be best consulted by keeping their own counsel, and getting as much information as they possibly could.

Mr. GRACE said that, in the arbitration referred to, the figures would have to go before the arbitrators, or the enemies of the company, if they liked to call them that, and this being so, why not let the shareholders know now?

Mr. BOWMAN said they could know all they wished by looking for themselves.

The CHAIRMAN then moved the following resolution:—"That a dividend be declared on the original and 'A' shares at the rate of 12s. 6d. per share, and on the 'B' and 'D' shares 10s. per share, payable at the National Provincial Bank of England, Darlington, on Wednesday, Feb. 7, 1877."

Mr. A. KITCHING seconded the resolution.

Mr. GRACE said the declaration of dividend rested with the directors and not with the shareholders.

Mr. THOMPSON said the directors had declared the dividend, and the shareholders were now asked to confirm it.

The resolution was then carried.

On the motion of Mr. FOGGITT, seconded by Mr. KAY, Messrs. Henry Pease and W. Thompson were re-elected directors; and Mr. W. F. Laidler was subsequently re-elected auditor.

Mr. GRACE said, with reference to the statements he made at the last meeting, about the balance remaining in the hands of the directors after the payment of dividend, this balance should have been shown on the balance-sheet, or, if expended, the expenditure should have been shown. He tried to convey that view to the meeting, but it had been since represented to him that by alluding to that balance he had let the Corporations of Stockton and Middlesbrough know there was a balance. He would, however, remind them that whereas he named the matter in August, so long ago as March in the House of Commons, and June in the House of Lords, Mr. Bowman gave those very figures, and showed that, after paying their back dividends, they had a balance over, so that he could not have been culpable in letting the corporations know. One jocose gentleman told him that he had "let the cat out of the bag," and what he wished them to know was that when he referred to the matter, the corporations were already informed of it.

The CHAIRMAN said that no doubt Mr. Grace had endeavoured to exercise his right position as a shareholder, whatever might come of it.

A vote of thanks having been proposed to the chairman and directors, Mr. MOSSOM, in seconding, said that, considering the peculiar circumstances in which the company were placed, the shareholders were quite right in acting on their advice.

The vote having been passed, the CHAIRMAN, in reply, said the position of the directors was no bed of roses.

The meeting then terminated.

GAS EXPLOSION AT CORK.—On the 25th ult., we learn from a correspondent that a serious explosion of gas took place at the house of Mr. Samuel Hill, builder, Sunmount Terrace, near the Military Road. Happily, however, there was no loss of life, a fact which was due to the extraordinary presence of mind Mr. Hill showed in turning off the gas at the meter, he at the time having been burnt on the face and arms. The cause of the explosion, as far as can be gleaned was due to negligence in not properly turning the gas off, so as to allow an escape, also to a leakage in the jointing of the pipes between the rafters. After the lights were supposed to be turned off, the inmates retired to rest, and in the course of the night Mr. Hill perceived a smell of gas, which pervaded his bedroom. He got up and went downstairs for the purpose of stopping the leakage; but he incautiously lit a match before he succeeded in finding the meter. Instantly a fearful explosion occurred, shattering everything in the house to pieces. Although the house is a comparatively new one, in a moment it was a complete wreck, the ceiling being entirely blown off the kitchen, the windows shattered, the plaster fell from the walls, and the pictures and various articles were broken—the entire house presenting a scene of confusion. Mr. Hill had a most extraordinary escape, as he with the most wonderful presence of mind, and in the middle of the flames and debris, burned as he was, ran to the meter, turned off the gas, thus saving the house from fire. The other inmates of the house escaped unhurt, and Mr. Hill was subsequently attended by Dr. H. M'Naughton Jones, who pronounced his injuries not to be of a serious character.

GAS AFFAIRS AT BISHOP AUCKLAND.

A Meeting of the Ratepayers of Bishop Auckland was held on the 6th inst., to take into consideration the propriety of opposing the Bill about to be brought before Parliament by the Bishop Auckland Gas Company. The chair was occupied by Mr. R. Bowser, the Chairman of the Local Board, and there was a large attendance.

The CHAIRMAN, in opening the proceedings, said that after the gas company had agreed to entertain a proposition for the sale of their works, and the local board had applied to the Local Government Board for a Provisional Order to purchase, much to their surprise an advertisement appeared in the newspapers, giving notice of the intention of the gas company themselves to apply to Parliament for an Act of Incorporation. The company were an ordinary trading joint-stock company, possessing no rights or powers, and if they obtained the Act of Parliament which they sought they would then possess complete control over the gas supply, whether the local board liked it or not. Not only had the company sought to obtain these powers, but they gave the local board a backhand blow by raising all the opposition they could to the Provisional Order. The powers which the company sought to obtain, if obtained, would give the company a control over the gas supply which would be most prejudicial to the interests of the ratepayers, and, therefore, the local board took steps to oppose the Bill. Before doing so, however, they satisfied themselves that such a course would be to the interests of the ratepayers. The board considered that there was no town in the county of Durham or in England so well situated as Bishop Auckland for the supply of the raw material for making gas. They had received a number of communications from other places with regard to the price of gas, and from them they found that in Bingley the local board made a profit of £1534, which amount went to the diminution of the rates. At Bury, in Lancashire, a profit of £8953 was made; and at Rotherham, a town very similarly situated to Bishop Auckland, the price paid by consumers being 3s. and 3s. 3d. per 1000 feet, they made a profit of £4000. Coals passed through Bishop Auckland to Darlington; but still the corporation there supplied gas at 3s. per 1000 feet. It might be said that they were not able to manage the manufacture of gas; but he saw gentlemen around him who were as competent to manage such a concern as any in the kingdom. As an instance of their competency, he would refer to their management of the water-works. Out of the water-rates—and they were only some 2d. in the pound—they had made a profit of £324 7s. 8d., and if they charged the Waskerley water-rate, they would have made a profit of £1528. The question for the ratepayers was, Would they support the local board in obtaining cheaper gas, or would they support the gas company in making their monopoly perpetual? He concluded by moving that the sanction of the ratepayers be given to the opposition against the company's Bill.

Mr. J. PROUD (Chairman of the Gas Committee of the Board of Health) seconded the motion, and said that some ten or twelve years ago he advised the gas company to supply gas to Bishop Auckland at as cheap a rate as gas was supplied to any town in England, and it was because they had not accepted that advice that he opposed them now. The gas company possessed a capital of £8376, and, finding that that was too small a capital on the strength of which to ask Parliament to hand over the ratepayers to the control of a few capitalists, and that such a request would be treated as ridiculous, they said they would supply Heighington, and Shildon, and Evenwood, and St. Helen's with gas, and they proposed to increase their capital to £80,000. Was it because St. Helen's or West Auckland wanted gas that the company wished to have the privilege of supplying them? No, for they had gas already. Shildon could have its own, and if Evenwood wanted gas it would not come to Bishop Auckland, but go to St. Helen's. To show further that the company were insincere and unreal in asking this increase of capital, there was not one word in the Bill about the time when Heighington and Shildon should be supplied, and when the company got their Bill they could, and no doubt would, put their hands in their pockets and say, "We'll rest and be thankful." Again, it was not to the interest of the ratepayers of Bishop Auckland that the company should supply Heighington and Shildon, for it would rob them of the benefits they had worked for and deserved. That was the first objection. If they grumbled at the price of gas supplied by a company with a capital of £80,000, how could they expect to obtain it cheaper from a company with a capital of £80,000? That was the second objection to the Bill; and the third was that they asked a greater rate of interest than they ought to get. The fourth objection was that the company sought the right to break up the streets and channels of the town, whether the board were willing or not, without the slightest consideration. The fifth objection was that the company, in clause 55 of the Bill, said they "may from time to time supply" gas if they thought fit. Now they ought to have this "may" turned into "shall." The sixth objection was that the maximum price of 5s. per 1000 feet was too high, for though they might be restricted to a certain dividend, if they had a balance after that, and he believed they would, they would not reduce the price of the gas, but say that they believed in paying their directors and secretary handsomely. In conclusion, he said that although the company had been supplying the town with gas for 30 years, they never thought of going to Parliament till the action of the ratepayers drove them.

The motion was put and carried almost unanimously, but

Mr. R. WELBURN demanded a poll, which the chairman announced would take place.

Another resolution was then moved, expressive of the confidence the ratepayers felt in the local board, after which the proceedings were brought to a close by a hearty vote of thanks to Mr. Bowser for presiding.

MANCHESTER DISTRICT ASSOCIATION OF GAS ENGINEERS.—A paragraph appeared in our last number briefly recording a meeting of this Association on the 1st inst. The notice was condensed from a report in a Stafford newspaper, forwarded to us by post, and specially marked by the sender to call our attention to it. We are, however, called upon by authority to deny the truthfulness of the paragraph, and to say that no such meeting was held as stated.

SKELMANTHORPE GAS COMPANY, LIMITED.—The eighteenth general meeting was held, at the works, on the 1st inst.—Mr. J. Kaye presiding. The report, which was read by Mr. J. Booth, the secretary and manager, showed that the company are in a flourishing condition. The usual dividend of 5 per cent. was declared payable at once, 5 per cent. was allowed for depreciation, and a handsome surplus was placed to the reserve-fund. The retiring directors were re-elected, along with Mr. Henry Wadsworth, in place of Mr. Henry Dalton, deceased.

ILKESTON GAS SUPPLY.—At the meeting of the Ilkeston Local Board, on the 6th inst., it was proposed that a properly-qualified person should be employed to examine the works of the company, the supply of gas, and enter into the whole matter, so that the Board might be thoroughly prepared with evidence to oppose the application of the company for a Provisional Order, and also to meet any representations of the company in the event of a commissioner being sent down by the Government to make a preliminary inquiry into the matter. A lengthy discussion ensued, but it was ultimately agreed to leave the whole matter in the hands of the committee appointed as a Gas Committee at the last meeting.

NEW GASHOLDER AT THE NORWICH GAS-WORKS.

A telescope gasholder and wrought-iron tank, possessing some novel features of construction, have recently been erected, and put into operation by the Messrs. C. and W. Walker, of Donnington, at the Norwich Gas-Works.

The gasholder, in two lifts, is of the height of its own diameter, which is 70 feet, the upper and lower lifts being 35 feet deep each. The tanks 35 feet deep. As the soil upon which the tank rests is of unequal character, the tank bottom was made of wrought-iron plates, in order to be capable of sinking a little without fracture, in case of any uneven settlement in the soil beneath. Surrounding circumstances also rendered it necessary that the tank should not only be abundantly strong, to resist the pressure of water 35 feet deep from the interior, but that it should also be strongly framed, to resist any uneven thrust from the exterior—of a nature to cause distortion or collapse—in the event of its being necessary at any time to empty the tank. To provide for this, the tank on the exterior was strongly framed by rings of channel iron, connected by vertical girders, in such a manner that a thrust or pressure received at any point would be immediately resisted by the entire framing; the strain being, by the construction, received and distributed over the entire area of the framings strongly connected to the sides of the tank.

The inlet and outlet pipes, 2 feet diameter, are of wrought iron, entering and leaving in the usual manner, and the gasholder crown is fitted with Livesey's patent man-lid for enabling the interior of the pipes to be got at without emptying the gas from the crown. In the course of its erection, the tank bottom, resting on blocks with its first tier of side-plates, was first rivetted up, and then proved with water. After which, the entire bottom and one tier of the sides was lifted in one piece, and lowered on to its foundation.

For the before-mentioned reasons, also, it became necessary to construct the columns of wrought iron instead of cast iron. The columns, seven in number, were, therefore, made 2 feet 6 inches diameter, of wrought-iron plates, and in their construction, the planing-machine and the lathe were brought largely into use, and their strength and rigidity much increased thereby. The plates were planed on their edges, and curved by long rolls, the seam being invisible, when the edges were brought together, iron to iron. Each length of the column shaft thus formed was placed in the lathe and carefully turned on the ends. No rivets are visible, and when the columns are erected on the site—their outer surfaces cylindrical and smooth all over from bottom to top, without the sign of a hammer mark—they more than equal in appearance the fairest castings; in fact, no practical man could tell whether the columns were of wrought or cast iron, judging from their external appearance.

The columns were found to possess great strength, and capable of resisting the highest winds. The gasholder being in an exposed position, a middle tier of wrought-iron girders connects the columns in the middle of their height, and they are further tied together at the top with a strong tier of wrought-iron truss girders. The girder framing was subjected to several severe strains, and was found to be firm, rigid, and unyielding.

The whole of the work had been so carefully made, and erected with all rivet-holes fair and true, that, on the completion of the whole work, the tank standing its whole height, 35 feet above its foundation, out of the ground, without any exterior support, was filled with water, and found to be perfectly water-tight. As soon as the water had reached the brim, gas was admitted into the holder, which was put into service without any air testing, and was found gas-tight, rising and descending freely and truly from top to bottom.

FAVERSHAM WATER COMPANY.—The annual meeting was held on the 5th inst.—the Mayor presiding. The profits on the past year's working amounted to £645 odd, out of which it was agreed to declare a general dividend of 7 per cent., without deduction for income-tax, and to add £35 to the reserve-fund.

CARNARVON CORPORATION GAS-WORKS.—At the meeting of the Carnarvon Town Council, on the 6th inst., a report was brought up from the Gas Committee, which stated that during the three months ended Dec. 31, 1876, the consumption of gas was 417,610 cubic feet in excess of the four months ended the same period of 1875, while the leakage account had been reduced from 19 to 8½ per cent. They recommended that the contract with Mr. William Jones for the repair of the meters should be discontinued, and the manager directed to obtain the services of a competent gas-fitter to be employed under his directions. The balance-sheet for the 16 months from Aug. 25, 1875, when the works came into the hands of the council, to Dec. 31, 1876, showed a balance of profit of £676 17s. 1d., the expenditure being £3933 12s. 8d., and the receipts £4610 9s. 9d. The new exhauster was working admirably, and had greatly improved the quality of the gas. Mr. De Winton explained that for some years the whole of the profits on the works would be swallowed up in extensions; but, at the same time, the debt would be gradually extinguished and the works would be greatly increased in value. An offer had been made by Mr. Dawes on behalf of Mr. Assheton-Smith for the purchase by the corporation of the Nantlle railway embankment, which was necessary for the extension of the works. A sum of £125, or 6d. per yard for 5000 yards, was asked, and the committee, thinking such an excellent opportunity should not be allowed to pass, had made the purchase, subject to the approval of the council. The report was adopted.

THE SURREY BOURNE WATER.—On the 5th inst. hundreds of persons proceeded from Croydon in the direction of Caterham, in consequence of its being generally rumoured that the Bourne Water had begun to flow from the Surrey hills. The rumour proved to be perfectly correct. The water had overflowed the great natural reservoirs of the chalk strata, and was seen pouring in a perfect torrent towards Croydon. In many parts where the channel provided for its course is inadequate, the water has escaped into low-lying fields, which it has converted into perfect lakes. These broad sheets of water, as they mirrored the glowing sunlight, gleamed like belts of silver at the base of the Surrey hills, imparting an unusual charm to the landscape. Before Croydon was converted to the cause of sanitary reform, an overflow of the Bourne was looked upon as a calamity to the district. The "woe water," as it was called, flooded most of the houses of the old town, and after it subsided much sickness and disease usually followed. These evils have been remedied by two important works carried out by the Croydon Board of Health. In the first place, the board purchased and removed a water-mill which stood near the parish church, and which dammed the water back upon the Old Town about 11 feet. In the next place, the board constructed the Bourne culvert, which, at a depth of several feet, extends in the bed of porous gravel from the outlet of the Bourne at the river Wandle, under the Old Town, to a long distance down the Brighton road. The culvert is between 3 feet and 4 feet in diameter, and for the sake of drawing the water from the ground it is constructed chiefly of bricks without cement, so that it now not only receives the stream of the Bourne before it arrives near to the town, but effectually keeps down the water in the gravel beds, which, before these works were accomplished, were always saturated to within a few inches of the surface. The Bourne is now running at a very rapid rate, and a daily increase in the volume of water may be looked for.—*The Times*.

SOUTHAMPTON GAS COMPANY.

[From a series of papers on "The Industries of Southampton," in the *Hampshire Independent*.]

No sketch of the operations of the Southampton Gas Company would be complete without reference to the part taken by this town in the early history of gas lighting. Although gas had been used for the purposes of artificial lighting, in various manufactories in England, before the beginning of the present century, it was not till 1810 that sufficient success attended the promoters of this method of illumination to warrant their applying for an Act incorporating a gaslight company; and powers, it is recorded, were granted for that purpose two years later, in order to make a great experiment of a plan of such extraordinary novelty. These powers had been obtained only seven years when, in 1819, gas-works were erected in Southampton, at a cost of from £20,000 to £30,000, by two brothers named Barlow, who soon afterwards entered into a contract with the Board of Improvement Commissioners (answering to our present Urban Sanitary Authority) for lighting the public lamps of the town, then numbering only about 150, within half an hour after sunset, and continuing them burning till within an hour of sunrise, at 10s. (ten shillings) per lamp per year, the price charged to private consumers, for the first 20 years of the existence of the undertaking, being 15s. per 1000 cubic feet; a charge which was reduced in 1839 to 11s. prepayment and 12s. credit. In the year 1823 the works were sold to a company, by whom, four years later, they were leased to Mr. Samuel Dunn, and afterwards to his brother. Both failing to make the undertaking a financial success, the company, in 1833, resumed possession of the works. The 10s. contract with the Improvement Commissioners expiring in 1841, negotiations were opened for a renewal, which ended in the price being advanced to £4 10s. per lamp per year for 21 years, with 6s. for lighting, extinguishing, and repairs. Four years later, the Paving Commissioners desiring to extend the lighting to the district over which they had jurisdiction, a new contract was made with them at £4 per lamp, to include all charges. In 1844, the price to private consumers was reduced from 11s. to 9s., or for credit from 12s. to 10s.; in 1846, from 9s. to 8s.; and again from 8s. to 6s., just previous to an application to Parliament for incorporating a second company in the town, under the title of the "Southampton Consumers Gaslight and Coke Company." In respect to this application a local inquiry was held, under the authority of the House of Commons, by a barrister and a civil engineer. They sat in the town-hall some days, and having heard the evidence of a number of inhabitants, many of whom are still living—Alderman Tucker, Mr. J. H. Cooksey, Mr. J. R. Weston, Mr. Phippard, Mr. Joseph Hill, Mr. Taylor Dore, Mr. Fisk, Mr. J. S. Bartlett, Mr. Barling, and others—they reported against the promoters, but said they were "fully conscious that the formation of the company had been of service to Southampton, in rendering the present company more anxious to meet the wishes of the consumers, more particularly as respects the diminution in price." In 1865 another attempt was made to found an independent company, but it failed, the present company making certain concessions and obtaining increased powers, as they did again in 1876, an effort, it will be remembered, having just previously been made on the part of the corporation to purchase the works.

One of the results of the inquiry in 1847 was the appointment, as manager of the works, of Mr. James Sharp, who held that position and proved himself an eminently useful townsman, until 1867, when he retired, and was succeeded by Mr. S. W. Durkin, who had for some years assisted him in the management, and has ever since had sole charge of the works. At the time of Mr. Sharp's retirement, the establishment was undergoing reconstruction from plans by Mr. J. B. Paddon, C.E., of Brighton, and we have had the testimony of competent persons, living at a distance, that the works are now amongst the most perfect and economical in the kingdom. The coals are brought by sea and landed on the company's own wharf, on the banks of the Itchen, close alongside the works. The first process for extracting the gas from these coals is to submit them to a high heat, by placing them in retorts, which are arranged in groups, each group being heated by a suitable furnace, supplied with coke produced during the process of manufacture. The total number of retorts is at present 260, the number in actual use varying according to the demand made on the works, but averaging at this time of the year about 175 daily. The process of gas-making being continuous, these retorts are worked by day and night, three gangs of men being employed in this department, each under a working foreman, who relieve each other every eight hours. To see a retort emptied of the coke to which the coal is reduced, and charged with a fresh supply, forms to a southerner a sight second only in interest to the working of an iron foundry. The coal being placed in a semi-cylindrical scoop, is suddenly lifted into the incandescent retort by three men, who have need both to be trained to this hard work and to be expert, for a lazy or inefficient man may allow a considerable quantity of flame, which contains all the essentials of gas, to escape. The proper charge being completed, frequently in less time than it takes to write a description of the process, the retort is hermetically closed. The products instantaneously find their way up a pipe fixed on the front of the retort into what is known as the hydraulic main—a large iron tube extending the whole length of the group of retorts. This being partially filled with ammoniacal water and tar, produced during the manufacture, the gas, as it is generated, forces itself through this liquid, and, being unable to return, escapes by the only available passage to the apparatus for purifying the gas, which is assisted in its course by the exhaustion produced by a rotary pump driven by steam-power, suitable boilers and engines in duplicate being provided for this purpose. Originally gas was used in the state in which it passed from the hydraulic main, but, to cleanse it of impurities, it is now conveyed into a condenser, or series of pipes, where its temperature is reduced, and the products of condensation, tar, and ammoniacal liquor, are received into vessels prepared for the purpose. To separate the tar still held in suspension, and the ammonia which exists as gas, it is then passed into the washer or scrubber—a large vertical cylinder known among the workmen as the "Tower of Babel," wherein the gas, by a series of boards placed edgewise, is broken up into innumerable ascending streams, meeting in its upward course a continuous shower of the ammoniacal liquor before referred to, this washing process being eventually finished with clean water. Passing out of the scrubber, it enters the purifiers, a series of iron chests, charged with oxide of iron and lime, which absorb the carbonic acid and sulphuretted hydrogen contained in the gas, this being the last process through which it passes before being conveyed to the station-meter and thence to the gasholders. The station-meter is much like an ordinary house meter, only, of course, much larger, and required to register millions of feet instead of thousands. Every hour of the day and night the foreman registers the make and consumption of gas, and draws up a debtor and creditor account, showing at sight the stock which the company possess, and which is accordingly either increased or decreased as experience and circumstances require. The gas is now in a chamber connected with the gas holders, of which there are four in the company's yard, the largest holding half a million cubic feet of gas. Attached to a second chamber is an apparatus called the governor, which regulates the pressure as it passes to the arterial mains and lateral pipes supplying the company's district, and embracing eighty miles of pipe, from two inches

to sixteen inches in diameter, the last mentioned being the size in which the gas is delivered from the works.

The company's responsibility, however, does not end here; for, supposing the gas to have escaped deterioration by the retorts being a little too hot or a little too cold, if the gas happens to have been excessively condensed, a troublesome deposit, called naphthaline, settles in the mains and services, especially in the winter time, even if there are no troubles arising out of the vapour of water which gas carries in its passage from the tanks of the gasholders—to collect which vapour, as it condenses, is the object of the syphons one sees placed at intervals along the lines of gas-mains. The company being under parliamentary obligation to supply gas of a stated quality, several times a day the gas is tested, as it passes off their premises, by a photometer, placed in a perfectly dark room. This is an instrument of great beauty and simplicity. An Argand burner at one end, consuming 5 feet of gas per hour, is compared with sperm candles at the other end, so adjusted as to burn 120 grains per hour. The total of the several readings is taken, and as gas is materially affected by the temperature and barometric pressure to which it is subjected, stated adjustments are made to meet these ends, and the precise illuminating quality of the gas is thus determined. The gas having passed from the works, there remains, as the present writer has found by experience, a duty on the part of the consumer to see that the illuminating power of the article with which he is supplied is not deteriorated by improper fittings, and especially by defective burners, than which latter nothing is more common, and, perhaps, nothing less frequently suspected. Gas lighting has of late years become such a purely scientific subject that many burners have been brought out, notably those by Leoni, Brönnner, and Bray. For a steady and remarkably pure light, we have found Sugg's "London" flat-flame burner, with self-acting governor, exceptionally pleasant and effective; and, profiting by our own experience, we strongly recommend all who have cause to complain of their gas to ascertain, as a first step, that the fault is not their own, by reason of defective burners. A few shillings or even pence spent this way will be found an experiment well worth making.

It remains only to say that the consumption of coal yearly at our gas-works is from 16,000 to 17,000 tons; that the amount paid in weekly wages to men, and exclusive of the salaries of the *employés* in the more responsible positions, varies from about £200 per week in the busy season to little more than half that amount in the summer; and, as bearing upon a recent controversy in the town, that statistics published by Mr. Field, of London, show that consumers in the metropolitan districts contribute 1'05d. to the local rates on every 1000 cubic feet of gas sold, as against 4'215d. per 1000 feet on the gas sold within the town of Southampton.

SEVENOAKS WATER SUPPLY.—At the last meeting of the local board it was decided that it was desirable that the board should obtain by purchase the works of the present Sevenoaks Water-Works Company, and the clerk was instructed to communicate with the company to know upon what terms they would be willing to sell their works to the local board.

EFFECTS OF HEATED AIR ON BOOK BINDINGS.—At a conference of librarians held in Philadelphia, U.S.A., in the autumn of last year, a variety of subjects connected with the successful management of libraries were discussed, among others may be noted that of binding. All present seemed to agree that leather bindings were extremely perishable, but nothing better was suggested. The various experience elicited proves that the real cause of destruction is heated air, drying up the oil in the binding; such air, of course, rises, and so, even in a library like that of the Boston Athenæum, not lighted at all, the books in a gallery lay to pieces much sooner than those on the lower floor. One of the largest libraries in London, that of the London Institution, has conquered this difficulty by binding all its books in half buckram; the buckram can be obtained in at least four colours (a leather lettering-piece may or may not be put on), and is so very strong, neat, and cheap, that the rare use of it must be due to equally rare acquaintance with the material. Much may also be done to preserve leather bindings by lighting libraries with sunlights, which, properly constructed, are perfect ventilators.

WALSALL CORPORATION GAS-WORKS.—At the meeting of the Walsall Town Council on the 5th inst., two resolutions of the Gas Committee, the one directing a contract to be entered into with Messrs. Horsman and Co., for the construction of a gasholder-tank on the site of the new gas-works at the Pleck, for the sum of £5058, in accordance with plans, sections, and specification prepared by the gas engineer; and the other directing a contract to be entered into with Mr. Daniel Howard, for the construction and erection of a gasholder, 120 feet in diameter, for the sum of £4435, were confirmed. The Gas Committee were also authorized to enter into contracts for the erection of a retort-house and stack, and for the construction of a canal basin and railway sidings, at the new gas-works, and to take all necessary steps and proceedings in relation thereto, and to enter into all bargains and other matters connected with, or incident to, the erection of the new works. The common seal of the borough having been ordered to be affixed to a notice to the Birmingham Corporation that the council will take, over from the 1st of July next, the gas undertaking late of the Birmingham and Staffordshire Gaslight Company, the town-clerk was authorized to raise on mortgage, pursuant to a recommendation of the General Purposes Committee, a further sum of £8000 at 4 per cent., towards the cost of the new gas-works, and to direct the common seal to be affixed to a mortgage debenture for such sum.

COMPENSATION TO THE OFFICERS OF THE LATE LEEDS GASLIGHT COMPANY.—At a meeting of the Leeds Town Council on Wednesday last, the following memorial, signed by four officials of the late Leeds Gas Company, was presented:—

To the Worshipful the Mayor, Aldermen, and Burgesses of the Borough of Leeds.
Gentlemen,—An Act of Parliament was passed in the 33rd and 34th Vict., cap. 56, and called "The Leeds Corporation Gas Act, 1870," wherein by clause 5 it is provided that on payment of the purchase-money each company shall be at liberty to retain out of their general assets or contingent-fund the sum of £2500 for the purpose of providing compensation at the discretion of their respective directors for any officers or others in their employment or service. This amount (£2500) was retained by the directors on Sept. 1, 1870. On Feb. 1, 1871, £1560 was distributed by the directors among their late officials. In 1873 a deputation from the officials waited upon the directors to ask that the balance might be divided, but met with no success. In 1875 the following memorial was presented to the directors, but received no attention:—"Sir,—We, the undersigned, respectfully beg to bring under your notice the balance which remains unappropriated of the £2500 retained by the company for the purpose of providing compensation at the discretion of the directors for any officer or others in their employment or service. More than three years have elapsed since a partial distribution of £1560 was made, and we hope that you will not think us presumptuous in asking respectfully that the balance may be equitably divided in accordance with the 5th clause of the Leeds Corporation Gas Act, 1870." And now, after nearly seven years have expired, the balance, supposed to be about £1000, still remains undivided. We, the undersigned, formerly officials in the Leeds Gaslight Company, earnestly hope that the corporation will be pleased to take such steps as may be necessary to carry out the intention of the council and the Legislature.

The town-clerk said he had referred the memorialists to two of the directors of the old gas company (Mr. Oxley and Mr. Wray), and Mr. Oxley had expressed his anxiety to distribute it. Mr. Wray said that the directors were distributing part of the money now. On the motion of Alderman Tatham the memorial was referred to the Gas Committee, with instructions to report.

GAS AFFAIRS IN AMERICA.

REPORT OF THE GAS COMMISSIONERS
IN RELATION TO THE SUPPLY OF GAS TO THE
CITY OF BOSTON.

In January, 1875, the Board of Aldermen of the City of Boston passed an Order, requesting His Honour the Mayor to appoint three Commissioners to investigate and report—

1. Upon the quality and price of the gas furnished in the city, as compared with other large cities in America and Europe.
2. Whether any improvements can be made in the present methods of manufacturing gas by the different companies in the city.
3. Whether it would be expedient for the city to undertake the manufacture and supply of gas for public and private lighting.
4. Whether any further legislation is desirable to enable gas consumers or the municipal authorities to secure a prompt and impartial investigation of complaints against private companies, and an efficient remedy for any abuses of which they may be found guilty.

The commissioners appointed under this order were Messrs. Charles F. Choate, John Felt Osgood, and Edward S. Wood, and they presented their report in the month of October last. It was as follows:—

REPORT.

In order to enable ourselves to arrive at definite conclusions upon the subjects included in the above order, we have studied and shall consider in the following pages—

1. The various processes for manufacturing gas in use in this and other cities, comparing one process with the other in regard to the quality of the gas made, and so far as possible in regard to the cost of its manufacture.
2. The peculiar relations which exist between municipalities and the gas corporation or corporations located in them.
3. The state and city laws which govern or have a bearing upon the gas corporations in this city.

And for the sake of convenience this report will be divided into the following parts:—

1. General considerations.
2. Processes used in the manufacture of illuminating gas.
3. Comparison of principal gas companies and works.
4. Relations of municipalities to gas corporations.
5. Competition.
6. Conclusions.

General Considerations.

It will be remembered that the passage of the above order was the result of hearings before the Board of Aldermen on Nov. 9, 16, 30, and Dec. 7, 1874, on the petition of a company, calling itself the "Citizens Gaslight Company," for permission to lay pipes in the streets of Boston, and compete with the Boston Gaslight Company in the sale of gas to the citizens.* It was claimed by the petitioners that gas of a better quality than that now supplied could be furnished at the price of 2 dols. per 1000 cubic feet—50 cents less than that charged at that time by the Boston Gaslight Company—and that this price would be sufficient to guarantee a fair dividend to the stockholders. On the other hand, the opponents of the scheme, especially the Boston Gaslight Company, argued that coal gas could not be supplied for 2 dols. per 1000 cubic feet with a fair profit; that on no account should competition be allowed, on account of the injury done to the streets, and for the reason that competition, where the demand for the product supplied is limited, as in the case of gas, does not ensure a cheaper rate, since some arrangement is inevitably made between the competing companies, which finally results in raising instead of lowering the price—the people being obliged to pay the profit on two capitals instead of one.

It will also be remembered that at this hearing it was extremely difficult to obtain the exact cost of the manufacture of gas with all the items which go to make up that cost. Unfortunately the commissioners have met with the same difficulty, and where they have been successful in gaining the desired information, it has been given "confidentially." They are, therefore, unable to make it public in this report, although they themselves have been able to form accurate comparisons.

Sources of Information.—In order to be able to compare accurately the gas supplied to the citizens of the places mentioned in the following pages, we have availed ourselves of various sources of information.

1. Personal inspection. We have visited the gas-works in New York, Brooklyn, Philadelphia, Chicago, Detroit, Saratoga, Poughkeepsie, Boston and vicinity, Lowell, Lynn, and New London, and have in these and other places satisfied ourselves of the quality of the gas supplied, it being tested, in most instances, in regard to its illuminating power and deleterious impurities.

2. Conversation with officials of the various gas-works visited and others. We have at all times been received by them in the most cordial manner, and all information which we could reasonably expect them to impart to us has been freely given. From some of these gentlemen we have received much important information, by comparing which, though mostly of a confidential nature, with the returns of various gas companies, we have been enabled to judge more fairly whether they were working as economically as was practicable, and in many other ways also have been able to arrive at conclusions, which perhaps could not have been attained in the common course of inquiry.

3. By means of the following printed circular, which was sent to all of the principal gas companies of the United States, from many of which full returns were obtained:—

To the President of the _____ Gas Company.

Dear Sir,—The Gas Commission, appointed by His Honour the Mayor of the City of Boston, are desirous of obtaining certain information relative to the manufacture of gas, and would feel under great obligations to you in receiving answers to such of the annexed questions as you may deem proper, with the assurance from us that such as you may so mark will be considered as confidential.

- Amount of capital paid in?
Amount of bonds issued, and what interest they bear?
Capacity of the works?
Amount of gas manufactured per annum?
Amount of gas sold per annum?
Per centage of loss by leakage per annum?
Number of miles of gas-mains?
Number of benches of retorts, and average number in use?
Number of retorts to the bench?
Number of benches used for the manufacture of coal gas, and average number used?
Number of benches used for the manufacture of naphtha gas, and average number used?
Per centage of atmospheric air used in the naphtha gas?
Are the gases measured separately before being mixed in the holder?
Per centage of air in the mixed gas in the holder?
Amount of coal used per annum?
Kind of coal used for making the gas?
Kind of coal used for enriching the gas?
Amount of gas produced per lb. of coal?

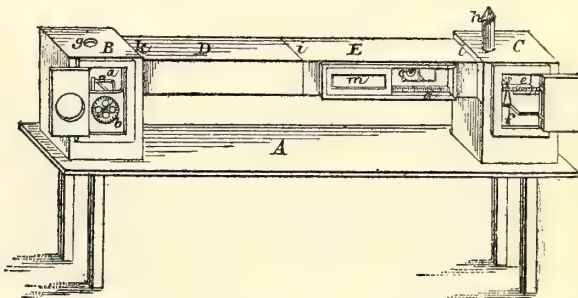
* By the courtesy of Captain Dresser, the editor of the *American Gaslight Journal*, we have received a copy of the evidence taken at the hearings referred to. It is of a highly instructive character, and we may yet have an opportunity of publishing some extracts from it.—Ed. J. G. L.

- Per centage of enriching coal used?
Is the McIlhenny dip seal used with success?
Is any other patent process used with success?
Is naphtha volatilized by fire or steam?
Is naphtha charged directly into the retorts?
Number of gallons of naphtha used per annum?
Price paid per gallon for naphtha?
Amount of gas produced from a gallon of naphtha?
Cost of gas, deducting coke and tar, in holder?
Cost delivered to the consumer?
Candle power of the gas at the works?
Candle power of the gas one mile from the works?
Specific gravity of the gas?
Number of men employed at the works?
Number of labourers employed by the company?
Annual cost of coal?
Annual cost of labour?
Annual cost of water?
Annual cost of purifying materials?
Cost of coal per cubic foot?
Cost of labour per cubic foot?
Cost of coal per ton at the works?
Cost of the enriching coal at the works?
What purifying material is used, lime or iron oxide?
What price per 1000 cubic feet is charged consumers?
What price is obtained for coke?
What price is obtained for coal tar?

4. Published reports in standard European and American gas journals. From these were obtained chiefly the accounts of the European gas companies, which are published in detail semi-annually, together with the returns of the Government inspectors, who are obliged to report periodically the result of their examinations.

It was, perhaps, unfortunate that we have been obliged by the order to examine all of the various processes for the manufacture of illuminating gas, since this necessitated the consideration of innumerable patent processes, all of which, however, with the exception of those in actual use in works of considerable size, were excluded as not being in a condition suitable for thorough examination, although the theoretical merits of most of them were carefully considered. Only those, which could be subjected to thorough examination, will be considered in the following pages.

The general method pursued in making our investigations was, in the first place, to determine the quality of the gas in those places visited by personal testing. In making the most important test—that by means of which the illuminating power is determined—we made use of a portable photometer, for which we are indebted to the kindness of Mr. C. D. Lamson, engineer of the Boston Gaslight Company, by whom it was devised, and under whose direction it was made.



This photometer consists essentially of four parts, represented by B, C, D, and E. (See diagram.) "A" merely represents the table upon which the instrument is placed, and can be extemporized by using the box in which the photometer is transported, and any ordinary table. The instrument is made of light wood, painted inside and out with a lampblack paint, containing a large amount of drying material, so as not to reflect any light. B is a box in which the photometer meter, *b*, is securely fastened. Above the meter is the burner, *a*, so arranged that the centre of the flame is directly beneath the centre of the hole, *g*, which, when the apparatus is mounted, is exactly 100 inches from the perforated tin chimney, *c*, beneath which is the standard candle; the centre of the gas and candle flames, therefore, are 100 inches apart. The door of B contains a hole through which the meter-dial can be read when the door is closed, thus preventing the entrance of any light into the chamber in which the gas-flame is burning. The box, C, contains the candle-balance, *e*, securely fastened in position. The balance used was Goodwin's balance, which permits of the weighing of the candle *in situ* while burning; the pointer, *f*, showing exactly when the 12 or 24 grains of sperm have been consumed. Firmly fastened to C, at *h*, is the hollow box, E, which contains the disc, *c*, placed in a moveable frame, the pointer upon which marks the candle power on the scale, *d*. When the photometer is in use, the opening above, *d*, is fitted with a little framework of blackened wood, to which is fastened by black cloth a black paper frame, which fits closely the face of the observer, enclosing that portion of the face between the middle of the forehead and the upper lip, so that no rays of light from without can possibly strike upon the disc while the observation is being made. When the apparatus is not in use, this mask, as it may be called, is removed, the moveable frame fastened with a thumb-screw, and the sliding door, *m*, closed and locked. Joined to E, by means of hinges on the lower surface at *i*, is the hollow box, D. D simply sets into B, at *k*, so that it can readily be separated. Thus all light is excluded from the inside of the apparatus, and all of the conditions necessary for the performance of a photometric test are fulfilled. The joint is made at *i*, simply for convenience of transportation, D, folding beneath E, and its end being fastened to C, by a catch. The two parts, C, D, E, and B, are fitted accurately into a large box, in which the apparatus is easily transported. By the use of this photometer, the objections incident to the employment of different instruments were avoided, since all of the tests were made by the same observer with the same apparatus.

The specific gravity was determined by an apparatus devised and made by W. W. Goodwin and Co., of Philadelphia. It depends for its principle upon the fact that the times required for two gases to stream out through a fine opening in a thin metallic plate are proportional to the squares of their densities. Knowing, therefore, the time and the density of one of the gases (air), we can easily calculate that of the other. The temperature and pressure must be the same in both cases. This apparatus consists of a glass cylinder for containing water; a glass tube divided into a number of equal parts for measuring the gas; a moveable cap, by means of which the graduated tube may be fastened into the cylinder; a stopcock attached to the tube, and a tip which contains a fine hole in a metallic plate, through which equal volumes of gas and air are made to pass under the same pressure. The times required are observed by means of a stop-watch, marking to the quarter of a second. The specific gravity of the air being 1.000, we calculate that of the gas by the following proportion:—

$$(\text{Air time})_x : (\text{gas time})_y = 1.000 : x = \text{specific gravity of the gas.}$$

The amount of sulphur in the gas was determined by means of the London "Referees apparatus," in which a small jet of gas is burned in an atmosphere of ammonia. The sulphur of the gas will burn to form sulphurous or sulphuric acids, which will be at once neutralized by the ammonia. The steam (formed by the combustion of the hydrogen of the gas), with the ammoniac sulphate and sulphite, is condensed and collected by being conducted through tubes filled with glass beads. These are thoroughly washed with distilled water, and the water added to the fluid collected during the operation. This gives us a solution containing all of the sulphur in the form of ammoniac sulphite and sulphate. By boiling with nitric acid we convert it all to sulphuric acid, and estimate the amount of this by precipitating it with a solution of chloride of barium, washing and weighing the precipitated sulphate of barium. From this the amount of sulphur is readily calculated by the following proportion:—

$$116.5 \text{ (the equivalent weight of sulphate of barium)} : 16 \text{ (the equivalent weight of sulphur)} = \text{weight of sulphate of barium} : x = \text{weight of sulphur.}$$

The amount of ammonia was estimated by passing the gas through a dilute solution of sulphuric acid of known strength until it was neutralized. The acid is coloured with a few drops of a solution of cochineal, and placed in a bulb tube. As soon as the acid is neutralized, the cochineal changes from a light red to a violet colour. The amount of gas passed through the bulb tube contains just that amount of ammonia which is sufficient to convert the acid in the bulbs to an ammonium salt, and knowing these amounts, it is easy to calculate the amount of ammonia in 100 cubic feet.

These tests were all performed at a distance from the gas-works, the gas always being taken from the burner of a consumer, and without the knowledge of the officers of the company. This last precaution was considered advisable, as enabling us to learn, as nearly as possible, from an examination at one or two times, the quality of the gas supplied to the consumer, and to avoid the possibility of the objection which might be brought forward by a rival company, or parties interested in some other process, that the gas was made richer or purer on account of the previous announcement of our arrival for the purpose of testing it. And it may be stated here that not much reliance has been placed upon results which have been obtained by a single test, or tests made during a single week, since it may happen that, for some good reason unknown to us, the gas may have been, during a short period, poor in quality. For example, at one time more than 52 grains of ammonia were found in 100 cubic feet of Cambridge gas, and upon inquiry it was found that the gas was tested just before a new washer was introduced into the works. Since that time the amount has been quite small.

(To be continued.)

THE COMBUSTION OF VEGETABLE REFUSE AS FUEL.

At the Meeting of the Institution of Civil Engineers, on Tuesday, the 30th ult.—Mr. G. R. STEPHENSON, President, in the chair—the paper read was "On the Combustion of Refuse Vegetable Substances for Raising Steam," by Mr. John Head, Assoc. Inst. C.E.

Hitherto there has been no opportunity of testing the value of such materials as straw, reeds, cotton stalks, brushwood, megass, &c., as fuel for steam-boilers, from pre-conceived notions in favour of coal and wood, the use and efficiency of which were well known. But in Hungary and South Russia, India, Egypt, the West and South of Italy, North America, and New Zealand, where coal and wood were scarce, the only way in which steam could be applied was by the employment of refuse vegetable products.

In 1872 experiments were made by the author and the late Mr. Schemioth, a Russian engineer, with a locomotive boiler adapted to a portable engine, in order to perfect the combustion of straw and other refuse. It was decided to inject the fuel automatically into the furnace, by an apparatus not unlike the feed motion of a chaff-cutter. The chemical composition of various materials, in their ordinary air-dried condition, having been stated, the average proportion of calorific effect found in practice to exist between coal and other products, when used as fuel, was shown by the following figures:—Thus, 1 lb. of good coal, or 2 lbs. of dry peat, or $2\frac{1}{2}$ lbs. of dry wood, or $2\frac{1}{2}$ to 3 lbs. of cotton stalks, brushwood, or megass, or $3\frac{1}{2}$ lbs. to 3 $\frac{3}{4}$ lbs. of wheat or barley straw, would evaporate 8 lbs. of water in an ordinary tubular boiler. From calculations it appeared that in England it would be five times as costly to use straw as to use coal under steam-boilers. But these figures were materially altered in the countries named, where the cost of coal would be three and a half times as much as that of straw. Taking an agricultural engine of 12 effective horse power, and the consumption of straw at 20 lbs. per horse power per hour, the produce of straw per acre would enable the engine to work from 12 to 18 hours.

A description followed of some of the earlier means by which straw had been burned under steam-boilers; as in Russia, by an adaptation of a brick furnace in a pit to the boiler of an ordinary portable engine, and in Hungary and in Wallachia, where a modification of that system allowed of a shallower pit being used. In one of the most recent engines, which was capable of burning almost every description of fuel, the fuel was forced, by a continuous mechanical feed, into the furnace, in a thin stream in the form of a fan. The fresh fuel was practically held in suspension for a short time, which allowed the separate stalks to become immersed in the flames. The long pieces of straw, reeds, or brushwood had the effect of stirring up the half-burnt material in the furnace, and keeping the whole in motion, besides permitting a free ingress of air. The apparatus, designed for feeding the refuse into the fire-box consisted of a pair of serrated rollers, which, in the case of engines of from 6-horse power to 20-horse power, were about 5 inches in diameter, and 18 inches long, placed at a minimum distance of a quarter of an inch apart; but the upper roller was capable of rising, so that the distance between the rollers could be increased to $1\frac{1}{2}$ inch. The under roller was set in motion by a strap from the crank-shaft of the engine, and both rollers, being connected by wheels with long teeth, made about 45 revolutions per minute; when the engine was getting up steam, the lower roller was turned by hand with an ordinary crank. The rollers were set in a cast-iron frame, fixed to the boiler by a hinge. To the front of this frame was attached a trough for holding the supply of vegetable fuel. To test the practical value of the apparatus, and to arrive at the best proportions of heating surface, and the best position for the automatic feeding arrangement, three engines, each of about 10 nominal horse power, were constructed by Messrs. Ransomes, Sims, and Head. Thus it had been determined that whereas for coal the areas of the grate, the fire-box, and the tube surfaces were 0.62 square foot, 2.8, and 15.24 square feet respectively per nominal horse power, those dimensions were for vegetable products, 0.93 square foot, 4.3, and 21.82 square feet per nominal horse power. Also that tubes $2\frac{1}{2}$ inches in diameter gave better results in the consumption of vegetable refuse than tubes $2\frac{3}{4}$ or 3 inches in diameter, the size usually employed in the boilers of portable engines adapted for coal. It was next ascertained that when the fuel was injected into the fire at 5 or 6 inches from the top of the grate-bars, the greatest economy was obtained, there being a more rapid combustion with less smoke than in any other position. The combustion could be maintained with vegetable refuse containing

more than the natural amount of moisture, by forcing the fuel into the hottest part of the fire, and by supplying it alternately on the right and left hand sides of the fire-box, so that the fire on one side was always clear and bright. To prevent the deposit of silica and slag on the grate-bars, the most efficacious system had been proved to be the use, underneath the grate-bars, of a sliding rake with five or six teeth, according to the width of the fire-box; the top of the teeth projecting about 2 inches above the bars. When the tubes were furred, a steam-jet, consisting of a wrought-iron pipe with a brass rose at one end, was inserted through the flap in the front of the boiler, and the whole of the silicious deposit was blown through the tubes into the smoke-box. In an accompanying table the author gave the proportions and weights of different portable engines, varying from 4 to 20 nominal horse power, constructed on the system described, and fitted with a single slide-valve, a single feed-pump and a branch pipe from the exhaust for heating the feed-water.

Modifications of the apparatus, for burning cotton stalks, had been applied to a tubular boiler, constructed by Messrs. J. and H. Gwynne, for supplying steam to a 12 nominal horse power pumping-engine in Egypt; also for burning megass, or sugar-cane refuse, in the furnace of one of the tubular boilers of His Highness the Khedive's sugar mills in Egypt, constructed by Messrs. Eastons and Anderson. The automatic feeding apparatus had likewise been adapted by Messrs. John Fowler and Co. to their steam ploughing engines, supplemented by a means for supplying vegetable fuel with a fork by hand, through an opening in the fire-box, fitted with a balance door, which closed immediately the fuel was inserted. The heating surface was much larger in these straw-burning than in coal-burning engines, while other alterations had been made; thus, the large driving wheels were in the forward part of the engine, under the centre of the boiler; the winding drum was under the smoke-box, in front of the driving wheels; the steering wheels were attached to a wrought-iron frame extending behind the fire-box. This frame besides carrying the hind axle served as the sides of the trough for holding the straw to be passed by the rollers into the furnace. The apparatus was driven by a pitched chain from the crank-shaft. In Russia, during the year 1876, two of these engines when ploughing 10 inches deep, had consumed, on an average, about 6 cwt. of straw per acre. The mean produce was about 2750 lbs. per acre; dividing that quantity by 672 lbs.—the consumption in ploughing one acre—it was found that 4.09 acres could be cultivated with the refuse straw produced by one acre. Comparing this result with the steam-plough trials at Wolverhampton in 1871, it would appear that 1 lb. of coal was equivalent to 4.17 lbs. of straw.

The difficulty of obtaining reliable information as to the performances of other straw-burning engines, which had been brought out both in England and in the United States, had prevented a general notice of all the various inventions being included in the paper. In conclusion, the belief was expressed that as the demand for mechanical appliances increased, so would the difficulties of obtaining the "best" qualities of fuel for steam-boilers in rural districts. It was thought, therefore, that the only method of rendering the use of steam power universal, particularly for agriculture, would be to construct the boiler of the engine so as to utilize the local supplies of combustible material of every kind.

INSTITUTION OF CIVIL ENGINEERS.—The council of this institution have recently transferred Mr. H. Gooch, engineer of the Cardiff Water-Works, from the class of associates to that of members. At the monthly ballot on the 6th inst., Mr. C. E. Botley, manager of the Wormwood Scrubs Gas-Works; Mr. W. J. Boys, borough surveyor, Walsall; Mr. A. Hardwicke, borough surveyor, Longton; Mr. W. J. Jones, Malta and Mediterranean Gas Company; Mr. P. W. St. George, deputy city engineer, Montreal; and Mr. R. H. Swindlehurst, superintendent of water-works, Bolton, were elected associates of the institution.

WEARDALE AND SHILDON WATER-WORKS COMPANY.—The half-yearly meeting was held at Darlington on the 5th inst.—Mr. H. Pease in the chair. In moving the adoption of the report, the chairman remarked upon the agreeable fact that they had 16,000 shares, and not a single arrear. During the first half year they had expended the sum of £50,771 4s. 2d., and the gross revenue for the same period had been £7184 2s. 10d., an increase of £1326 7s. 1d. He thought this a satisfactory result, considering the great depression in the trade of the district. 12,106 houses were supplied by the company, being an increase on the previous half year of 2166. The population supplied by water was over 60,000. The report having been adopted, it was resolved—"That a dividend, clear of income-tax, of 11s. 3d. per share on the Shares Act, 1866, 4s. 0.6d. per share of the First Issue Shares Act, 1875, and 10.8d. on the Second Issue Shares Act, 1875, for the half year ending Dec. 31, 1876, be, and hereby is, declared, and that it be payable on Wednesday, the 7th inst., to the proprietors on the register of the company on Jan. 23, 1877." The meeting having been made special, the following resolution was carried unanimously:—"That, in pursuance of the powers contained in the Weardale and Shildon District Water-Works Act, 1875, the company be authorized to borrow, on mortgage, the further sum of £25,000 (in addition to the sum of £37,500 already authorized to be borrowed under the powers of the same Act), in such sums, and at such rate of interest, not exceeding £5 per cent. per annum, as the directors of the company may think proper."

WIMBLEDON GAS SUPPLY.—At the meeting of the Wimbledon Local Board, on Wednesday last, a deputation attended to present a petition complaining of the quality of the gas supplied to the parish, and requesting the interference of the board. Mr. Newitt, who introduced the deputation, said the board were probably well aware of the many complaints that had been made from time to time in the parish concerning the price, the quality, and the quantity of the gas supplied by the company. The gas was without doubt injurious to health, and that being so, the question came under the powers possessed by the board as the health authority for the district. For the last few weeks a great deal of improvement had been noticeable in the quality and quantity of the supply. He did not say that this was on account of the agitation, but it had taken place since the committee of consumers had been formed. Gas was very much cheaper in other districts similarly situated, and there was no reason why it should be exceptionally dear in Wimbledon. The board had power to appoint a gas inspector, who could keep the company up to the proper standard. It had been said that any five ratepayers could take the matter in hand and compel the company to allow a test of their gas, but the ratepayers naturally looked upon the board as the authority, which should deal with matters of the kind. He, in conclusion, drew attention to the fact that the board could take the making of gas into their own hands, and could in that way put considerable pressure upon the company. The Chairman pointed out that the board had had the question several times before them, and on one occasion succeeded in obtaining a reduction of 6d. per 1000 feet. Personally he had a very strong objection to the quality of the gas, as it was very impure, and soiled the ceilings of rooms very quickly. The board would give their best attention to the matter, and would no doubt bring pressure to bear upon the company should the gas again fall below its present improved standard. The deputation, having thanked the board, withdrew. The discussion on the petition was adjourned until the next meeting.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been only a moderate amount of business doing here during the week, whether in respect of raw materials, pig iron, or finished iron, each of which is nominally firm in price, but in reality to be purchased at rather under the quoted prices of makers.

There continues to be a considerable tonnage of Northamptonshire and North Lincolnshire ore brought here, as well as some few consignments of late from the Mid-Lincolnshire district, where new deposits are just being opened out. North Lincolnshire pig also has a fair share of patronage amongst the West and South Yorkshire ironmasters, some of it being of very fair quality indeed, whilst other brands contain a large admixture of cinders.

Local pig is selling very well in Staffordshire and Lancashire in competition with the native products there, but at present the demand is not so large as to lead to the supposition that higher prices will be obtained for some time henceforward. The foundries near this town are rather better employed just now; consequently I find it chronicled in the local papers that a large number of additional men have been put on in the pipe shops at Staveley, the largest local concern devoted to that class of work. Whilst speaking of Staveley, I may say that the directors of the company have just declared an interim dividend on the various classes of shares equal to about 8½ per cent.—a division of profits which is, to say the least, equal to the highest expectations of the shareholders.

What I have prophesied, without venturing to infer much, in respect of colliers wages, is now on the point of becoming an accomplished fact, inasmuch as the associated coalowners of South Yorkshire and North Derbyshire have called a general meeting for the purpose of considering the best steps to be taken to reduce their miners wages to the level of the remainder of the country. At present the local miners are receiving about 1½ per cent. more than the colliers of any other district. At the pits of the Sheffield Coal Company, the Nunnery Colliery Company, Denaby Main, Stratford, and other collieries, many men are being discharged, and others only kept on lower pay. Trade still rules excessively quiet in all classes of fuel.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is no material change to notice in the position of the coal trade of this district, and there is little or no prospect of improvement. The season is now too far advanced to expect any of the usual winter demand for house fire classes of coal, and in other classes of round coal suitable for gas-making purposes there is very little doing in the way of new business beyond a few shipping orders at about late prices. Common classes of coal are a complete drug, and engine fuel is difficult to dispose of. Although list rates nominally are not lower, colliery proprietors have to take less for large orders, and prices are very irregular in the open market. Good Arley coal at the pit mouth is quoted at 10s. 6d. to 11s.; Pemberton four-feet, 8s. 6d. to 9s.; common coal, 6s. 6d. to 7s. 6d.; burgy, 5s. 6d.; and slack, 2s. 6d. to 3s. 6d. per ton; but for sales in bulk many of the coalowners are willing to take lower prices than the above.

Large numbers of the pits have been put on short time, and colliery proprietors complain that prices have now been cut so low that it is exceedingly difficult for them to hold their own, and there are very few collieries which are now working at a profit. In some quarters a substantial reduction in wages is being strongly urged, but several of the large firms are averse to such a step, as they anticipate that it would simply be followed by a further fall in values, which would leave them in quite as bad a position as before.

The iron trade continues in a very depressed condition, and although makers in most cases are holding for late rates, there is a great deal of underselling, and what little business is being done is chiefly going into the hands of middlemen, who are offering iron at fully 1s. per ton below the makers quotations. The local makers of pig are still altogether out of the market, but they maintain late rates, which they contend are the lowest they can afford to take without an absolute loss on the cost of production. Lancashire pig iron, delivered into the Manchester district, is quoted at 56s. 6d. to 57s. 6d. per ton for No. 3 foundry, 54s. 6d. to 55s. 6d. per ton for No. 4 forge; Middlesbrough, 53s. 9d. for No. 3 foundry, and 52s. 6d. per ton for No. 4 forge. The finished iron trade is quieter, very few new orders are coming to hand, and many of the forges are not now fully employed; but prices are about the same, local makers asking £6 12s. 6d. to £6 15s., and Staffordshire makers about £7 per ton for bars, delivered into the Manchester district.

A magnificent presentation of plate, valued at about £250, was on Tuesday last made to Mr. G. C. Greenwell, C.E., F.G.S., as a recognition of his high character and abilities as a mining engineer, and the eminent services he has rendered to the coal trade generally. Mr. Greenwell's retirement from this district has been made the occasion for the presentation, which took place at a complimentary dinner, held at the "Church Hotel," Manchester, and at which there were present the principal representatives of the coal trade throughout Lancashire, Cheshire, and North Staffordshire.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England remains in the same dull state as reported last week. The shipments from the Tyne Dock have not been so good during the past week as in January. Business has been less active in the despatch of best gas coals, and though tonnage is somewhat scant, the rates paid to sailing ships, upon the whole, have been lower, and the few coasting orders which have been in the market have been taken up rapidly. There are more vessels in the harbour than there is employment for. Quotations for small sailing ships to load coals have been as follows:—London, to deliver at the wharves, 6s. 6d. (7s. 6d. bricks); Poole, 7s. 6d.; Littlehampton, 7s. 9d.; Isle of Wight, 9s. per ton; and Plymouth, £7 per keel. French business is quiet, the large gas companies having apparently laid in their stocks for the winter. The figures current are—Caen, £9; St. Valery, £9 18s.; Granville, £9 to £9 5s.; Esney, £9 10s. per keel. Rates for steamers to load coals for the Mediterranean have been about 10s. per keel less than the week before last. The prices of best gas coals do not alter, they are about 9s. 6d. per ton; moderate qualities range from 6s. to 7s. per ton. Inferior sorts are very bad to sell, even at these low quotations; and most of the second-class Durham collieries are, like the whole of the pits in the Northumberland districts, working upon half time.

The trade dispute in the Durham colliery district in regard to deputies is not settled; it is an open question which is causing a good deal of irritation amongst the pitmen.

House coals are quoted in the Tyne at 11s. per ton best; inferior are 1s. per ton less money. The mild weather is stopping all demand. The house coal trade of the North of England is in a very poor way, and few of the collieries are paying expenses.

General manufacturing business continues in a very dull semi-collapsed state. The iron trade is feeling the effects of the uncertainty which prevails in the East.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

A special meeting of the Police Commissioners of Johnstone was held last Thursday night, for the purpose of considering whether or not the Burghs Gas Supply (Scotland) Act, 1876, should be adopted in and applied to the burgh. After a fruitless attempt to delay consideration of the question for fourteen days, on account of the absence of four or five members, three of whom were known to be in favour of the adoption of the measure, it was unanimously resolved, on the motion of the chairman, to adopt the Act.

The same subject was under the consideration of a special meeting of the Town Council of Dumfries on Friday week. The Provost, in explaining the object of the meeting, said, if the former resolution were confirmed, it was still in the power of the ratepayers to control their decision, and, if they chose, to render their proceedings inoperative. Moreover, the resolution bound them to no exact terms, but simply put them in a position to deal with the gas proprietors on terms which, in their opinion, were conducive to the interests of the burgh. On the motion of Bailie Wood, seconded by Bailie Nicholson, the resolution of the 22nd of September last was confirmed, and the Gas Act adopted. Bailie Wood said the whole tendency of modern legislation had been towards the transfer of such undertakings as gas and water from private companies to communities. Previous to last year those transfers were of an exceedingly costly character, inasmuch as a private Bill had in each case to be obtained. After some further remarks on the subject, he said that in Leeds, where the price of gas was 3s. 3d., the profit for last year to the ratepayers was £36,000. The transfer of the works of the Dumfries Gas Company to the Corporation, if it took place, would be a very great saving to the inhabitants, for, taking the quality of the gas as it had been supplied, and was now being supplied, it was exceedingly dear at 4s. per 1000 cubic feet.

The gas-rental for Dundee, collected during January was stated at the last monthly meeting at £5889 15s. 6d.

The following are the last results to hand regarding the quality of the Perth gas:—Maximum, 29.69 candles; minimum, 28.68 candles; average, 29.06 candles. On two occasions the gas made at the Dawsholm station of the Glasgow Gas Corporation, for the week ending the 3rd of February, was under the minimum illuminating power fixed by the Act of Parliament. The highest maximum was 28.85 candles. Professor Brazier reports that the gas supplied by the Aberdeen Gas Corporation was tested by him on the 18th of November, and 26th and 29th of December, 1876, when he found the mean illuminating power to be, respectively, 30.17 candles, 30.80 candles, and 30.50 candles. The gas was tested on several times for sulphuretted hydrogen, ammonia, and carbonic acid, and on no occasion could more than traces of ammonia and carbonic acid be detected. An Inverness paper says that the gas supply of the town was greatly improved for some time, but that recently there appears to have been a slight falling off. It is said that it would be satisfactory to have an official test applied periodically, and the result published in the newspapers. Bailie Wood is still keeping up his weekly testings of the gas supplied in Dumfries. Leaving out the towns which I have already mentioned in this paragraph, his return for the week ending Feb. 3, gives the following results as to illuminating power:—Dumfries, 20.80 candles; Edinburgh, 30.63 candles; Leith, 27.53; Greenock (monthly average), 30.17; Paisley (monthly average), 28.86; Kirkcaldy, 28.00; Kilmarnock, 28.05; Dundee, 26.80; Stirling, 28.00; Galashiels, 29.00. The prices range from 3s. 9d. per 1000 feet at Galashiels to 5s. at Kilmarnock.

On Tuesday last, the annual meeting of the shareholders of the Kilmalcolm Gas Company, Limited, was held, when a dividend of 2 per cent. was declared, and it was agreed to reduce the price of gas to consumers from 10s. 6d. to 9s. 7d. per 1000 cubic feet—a reduction of 1½d.

The fifteenth annual festival of the *employés* of the Partick, Hillhead, and Maryhill Gas Company took place last Friday night. Mr. James Hislop, manager, presided. Among those present were—Provost Shaw, Maryhill; Provost Cowan, Hillhead; Messrs. Wilson, town-clerk, Hillhead; M'Leod, Glasgow; M'Gilchrist, Dumbarton; Crawford, Hillhead; and the Rev. J. M'Crae, Maryhill. After tea, the chairman, in the course of his address, said it was five years since he cut the first turf of the company's works, and four years since they began to make and send out gas. By that time they had 32 miles of pipe laid down, but now they had upwards of 70 miles of piping, the sizes ranging from 2 to 30 inches in diameter. Addresses were also delivered by other gentlemen present.

At the ordinary meeting of the Town Council of Aberdeen, held last week, there were submitted the minutes of the Gas Committee, which contained a report from Mr. Smith, the manager, in reference to the fire which took place in the works about a month ago. On the recommendation of that gentleman, it was resolved to reconstruct the roof of the purifier-house, and to employ wrought iron and slates in doing so, and that a new fireproof meter-house should be erected. The committee recommended that Mr. Smith's salary should be increased from £350 to £450 per annum, which was unanimously agreed to.

The monthly meeting of the Police Commissioners of Motherwell was held last Tuesday evening, when the clerk read the agreement between the Public Works Loan Commissioners and the burgh of Motherwell, for £15,000, for the construction of the new water-works, the sum to be repaid in 50 years at the rate of £4 13s. 2d. per cent. per annum, when the whole of the £15,000 will be paid up.

The commissioners of the burgh of Wishaw have agreed to instruct their engineer, Mr. Tait, to survey a site lying between the two reservoirs at present in use, with the object of providing an additional supply of water storage to the extent of from 30 to 35 million gallons, the former larger scheme being too expensive and otherwise unsatisfactory.

Messrs. Hawksley (London) and Leslie (Edinburgh) have just visited Perth with the view of getting up the case for the opponents of the new Water Bill.

The Dundee Water Commissioners have lodged their detailed statement of claims against the water contractors in the case which the latter have raised in the Court of Session. The "proof," which has been fixed to commence next Wednesday, is expected to last several days.

Business was done in the Glasgow pig iron market on Friday forenoon at 56s. 8d. 25 days, and the market closed for the week, buyers 56s. 6d. cash and 56s. 7½d. one month; sellers 1½d. per ton more. In the early part of the week there was a downward tendency, but towards the close the market recovered.

Coal sales are comparatively unimportant. The demand is small, and prices are even being reduced to secure orders.

ALFRETON GAS SUPPLY.—At the meeting of the Local Board of Alfreton, on the 6th inst., a discussion ensued with respect to the lighting of the town with gas, and the great expense incurred during the last quarter for gas. Special reference was made to the hours for lighting and extinguishing the lamps. It was resolved that an agreement should be made, between the board and the gas company, to the effect that the latter supply the former with gas at 4s. 6d. per 1000 feet, and such agreement to continue in force for three months. It was also resolved that the lamps should be put out at one o'clock instead of three o'clock as heretofore.

BATH WATER SUPPLY.—The Local Government Board have authorized the Corporation of Bath to borrow £900 for the extension of water-mains.

QUALITY OF THE BIRMINGHAM GAS.—Mr. Thos. Jackson reports that during the month of January, at the four gas-making stations of the corporation, there were 18 examinations made of the illuminating power of the gas supplied to the borough. The maximum light in sperm candles was 18.93; minimum, 16.21; average, 17.52. The parliamentary standard is 15 candles, with Sugg's No. 1 "London" burner.

NEWCASTLE AND GATESHEAD WATER COMPANY.—The Parliamentary Committee of the Newcastle Town Council have recommended the Corporation not to oppose the Bill of the company, on condition that a clause be inserted providing that, in addition to the 53rd section of the Water-Works Clauses Act, it be provided that in case of default of providing a sufficient supply of wholesome water fit for domestic purposes and effectually filtered, the company shall be liable to a penalty of not exceeding £10 for every day during which such default shall continue, provided that such penalty shall only be sued for and recoverable by the Corporation of Newcastle.

DREGHORN GAS SUPPLY.—By the enterprise of a number of gentlemen in the village of Dreghorn and neighbourhood, the inhabitants have been furnished with the means of lighting their houses with gas. A company, with a capital of £3000 was formed at the end of last summer, and the works were completed so far as to admit of the gas being turned on on the 3rd inst. The works, which have been erected at a short distance from the village, are capable of supplying 7000 feet per diem, with a storage capacity of 10,000 feet, and cost £1800. It is proposed to extend the supply to Croft Inn, about a mile and a half from Dreghorn. The gas will be sold at 7s. 6d. per 1000 feet.—*Glasgow Herald*.

COAL TAR A PRESERVATIVE OF WOOD.—A correspondent of the *American Cultivator* says: "We often notice that coal tar is named as a preservative of wood, and the comment is correct if those who advise would add that, in using, it must have the acid in it destroyed by mingling fresh quicklime with it. Half a bushel of lime, freshly dissolved and mingled with a barrel of tar, has kept posts, saturated with it and planted in clay ground, perfect over 20 years." [The acids in coal tar are really preservative agents, and a coating of pitch keeps out all atmospheric moisture. When wood decays after coal tar has been applied, it may be assumed that the wood was wet at the time of the application, and that the confined moisture induced eremacansis.—Ed. J. G. L.]

CROFT AND HURWORTH GAS COMPANY.—The half-yearly meeting of this company was held at Darlington on the 5th inst.—Colonel Scurfield, the chairman, presiding. The directors recommended a dividend at the rate of 6 per cent. for the last half year. The accounts showed an income of £392 12s. 7d., and an expenditure of £232 18s. 2d., leaving a balance available for dividend of £159 14s. 5d., and a balance of £39 14s. 5d. to be carried to the reserve-fund. The directors expect that during the present half year they will have to make some extensions or renewals, in order to meet the growing demand for gas, and increase the size of the mains in the village of Hurworth. The report was passed, and Mr. R. Brown, of Croft, was appointed a director in the place of Mr. Harrison, deceased. The chairman and other officers were re-appointed.

STAFFORD GAS COMPANY.—On Monday, the 5th inst., the half-yearly meeting was held at the offices—Mr. T. Turner, chairman of the board of directors, presiding. The report stated that in consequence of the corporation having obtained compulsory powers to purchase the undertaking of the company, the directors were taking the necessary steps to carry out the transfer on as favourable terms for the shareholders as they considered right and just to both parties. It had been expedient to apply for powers to increase the capital of the company, which the directors had done under the Gas and Water Facilities Act, but the issuing of the shares would depend upon the negotiations now in progress with the corporation being carried out. The directors recommended the maximum dividend to be paid—viz., 10 per cent. per annum on the old shares, and 8 per cent. per annum on the new, free of income-tax. The report was adopted, and the retiring directors (Messrs. T. Turner and W. Bowen) were re-elected. Mr. M. Banks, of Birmingham, was elected to fill a vacancy on the directorate caused by the death of Mr. J. Kenderdine. Mr. Tilston was elected auditor, in the room of Mr. J. Nevitt, who declined nomination on account of his engagements with the Town Council. The usual votes of thanks were passed.

RUSTING OF IRON.—In *Dingler's Polytechnic Journal* will be found the results of a series of experiments made by A. Wagner, on the production of rust upon slips of iron exposed to water containing various salts in solution, and in the presence of air free from carbonic acid, and of air containing that gas at various temperatures, and also in sealed tubes from which the air had previously been expelled. Whilst pure water in presence of air caused the iron to rust, this was found to occur more rapidly if carbonic acid was present at the same time, and the production of rust was materially increased by the presence of the chlorides of magnesium, ammonium, sodium, potassium, barium, and calcium, the first mentioned being the most active in this respect. Iron immersed in river water, concentrated by evaporation, was found to rust more slowly than when in distilled water; and whilst the presence of oils or fats greatly diminished the rapidity of rusting, it was found that alkalies prevented it entirely. A solution of chloride of magnesium, in the absence of air, attacked iron at the temperature of boiling water, but solutions of the chloride of sodium, potassium, barium, or calcium, were not found to do so.

PROPOSED PURCHASE OF THE PENRITH GAS-WORKS.—On Thursday last, Mr. Morgan, an inspector from the Local Government Board, held a public inquiry at Penrith with reference to the scheme of the local board to purchase the gas and other works connected therewith. Mr. C. Fairer (clerk), Mr. Hepworth, of Carlisle, and Mr. Malam, gas manager, from Dumfries, as arbitrator, represented the local board, and in the interest of the gas company there were present the chairman (Mr. Nanson), Mr. W. Little, solicitor to the company, Mr. Dempster, Halifax, arbitrator. At the outset Mr. Fairer laid before the commissioner a statement of the proceedings of the local board in reference to the gas question. He then read a very concise and intelligible report on the condition of the works, prepared by Mr. Hepworth. Their area, he said, was 5726 square yards, including a plot of land recently acquired for the purpose of future extension. The site of the works was both suitable and convenient. The works were erected in 1830, and considerable additions appear to have been made about the years 1851 and 1864. Mr. Hepworth in general terms expressed his approval of the buildings. The existing retorts are equal to the daily manufacture of about 100,000 cubic feet of gas. The chimney is 80 feet high and 2 feet diameter, and appeared to be quite equal to the requirements. The condensers and scrubber were not sufficiently large. There are three gas-holders. Two of these will contain about 10,000 feet of gas each, and the third and last one erected, about 100,000 cubic feet of gas, the storage capacity being about 120,000 cubic feet if the three holders were sound. He was not in a position to speak as to the condition of the gas mains and services, inasmuch as he had made no examination of them. It was more than probable, however, that both mains and services require con-

siderable repairs. The quantity of gas made at the works during the year 1876 was 17,407,500 cubic feet, or rather more than 2000 cubic feet per head of population, which was about the average of towns about the size of Penrith. The charge for gas in Penrith at the present time was 4s. 10d. per 1000 cubic feet, and the illuminating power 14 candles. The price of gas to public lamps, of which there are 119, is 3s. 8d. per 1000 feet—a low price, and the average cost per lamp per year for gas alone was about 45s., the lamps burning 2000 hours per annum. In concluding his report, Mr. Hepworth said that the gas-works at Carlisle were acquired by the corporation under the powers of a special Act, passed in 1850, at a net cost of about £12,000. When it was proposed to constitute a new company, the price was reduced from 8s. to 6s. 8d.; and when in 1847 the corporation practically controlled the works, the price was reduced to 5s.; in 1852 it was further reduced to 4s. 2d.; in 1861 to 4s.; in 1863 to 3s. 8d.; in 1865 to 3s., at which price it is now sold, whilst the quality of the gas has been increased from 11 to 19 sperm candles. The profits realized in Carlisle last year were £5401 4s. 7d.; and from the time the gas-works were acquired £69,736 17s. 5d. The works have been paid for out of the profits, and the amount of assets in excess of liabilities is now £43,393 13s. 2d. He considered that the gas consumers of Carlisle had reaped large advantages from the possession of the gas-works by the corporation. Mr. James Graham and Mr. William Nevison complained that the probable cost had never been mentioned, consequently the ratepayers were in the dark on that question. It was explained, however, that if a price was named it might influence the decision of the arbitrators. The commissioner explained that the board now merely sought to obtain a Provisional Order under which a valuation might be made; but it did not follow that if the board thought the works too dear they would go on with the purchase. Mr. Little said the company would offer no opposition. They would be quite content whether the order was granted or not. After some further conversation the inquiry terminated.

Register of New Patents.

940.—BRAY, G., Leeds, "Improvements in gas-burners." Patent dated March 4, 1876.

These improvements have reference to common metal burners, but more particularly to that class of burners which are partly constructed of earthenware, or other non-corrosive material, such parts being generally fixed in a metal case, in a similar manner to the arrangement described in Patent No. 2335, in the year 1872.

The invention relates to the burner known as the "fish-tail," or "union jet." In ordinary burners, the holes that produce the desired form of flame are made round, and formed in the burner at an angle from about 40° to 50°, causing the flames from the holes to impinge upon each other at that angle. In these improvements the holes are made by preference from between 20° to 40°, or any more obtuse angle up to a straight horizontal line. By combining the elliptical shape of hole with the altered angles, a spread of flame is obtained whereby the gas may be consumed at a much lower pressure than with the ordinary burner.

The next part of these improvements is applicable to "bat's-wing" and other burners, and consists in an arrangement in the burner for diminishing the pressure or supply of gas to that part of the burner which imparts the desired form to the flame. This arrangement is also intended to strengthen the outer case of metal in that part most liable to rough usage from the gasfitter's pliers, by having a washer or plate of metal or earthenware, or the two combined, or other suitable material, made to fit tightly in the interior of the case; and when the case is in one part, it is preferred to place the washer in the top part of the taper formed for the screw. It is made of any suitable thickness, and may be recessed or not on the top side. In each washer a hole is provided, passing vertically through it, the size of the hole varying in accordance with the size or number of the burner.

When a metal washer is used, in a hole therein is inserted an earthenware or other non-corrosive tip or bush, having the requisite hole in the centre. From this supply or diminishing arrangement, as with all ordinary known means for diminishing the pressure or supply of gas by confined aperture or apertures in the burner, great agitation of the gas ensues, which shows itself in the flame; this is particularly observable in the "union-jet" burner. To suppress this agitation of the gas there is used, in combination with the pressure-diminishing arrangement, one or more layers of muslin or other woven or fibrous materials, which are fixed in the interior of the case by means of a ring, at a suitable distance from the washer. This not only has the effect of steadying the gas, but also prevents the hissing or whistling.

The improvements further consist in placing a diminishing tip or bush, with vertical hole at the bottom of the burner socket, placing the muslin arrangement a suitable distance therefrom; or this tip or bush may be placed in any suitable position within the case.

The above arrangements have the effect of giving a steady flow of gas, consequently a steady and noiseless flame.

949.—STUART, C., Halifax, "Improvements in the construction of taps or valves for controlling and regulating the flow of steam, water, gas, or other fluids." Provisional protection only obtained. Dated March 6, 1876.

This invention relates more especially to the mechanism for operating the valves to or from their seats as required, and consists in arranging one or more levers, in connexion with the valve within a casing, and hinging or joining them together to the main spindle, or by the application of a worm wheel and screw operating a cross spindle, which is attached to the valves in such manner that, upon the main spindle being moved to open or close the valves, a simultaneous action will be produced, causing the valves to travel laterally to the spindle, thereby presenting an opening for the outlet of the fluids.

961.—PLUSH, R. H., Liverpool, "Improvements in pumps." Provisional protection only obtained. Dated March 6, 1876.

In constructing a pump according to this invention, the barrel or cylinder, made of any known form, is fitted at its lower end with any suitable description of foot or suction valve, either in a distinct valve-box or fitted to the end of the pump. The pump-barrel or cylinder has a hollow ram or plunger, the head or outer end of which is provided with a discharge or delivery valve, either in a distinct box attached or fitted in the head or outer end of the ram or plunger. This works by preference on a slipper or other suitable guide, and from the discharge or delivery valve at the head of the ram or plunger a pipe is continued of inside diameter equal to that of the ram or plunger. This pipe works in a suitable stuffing-box from which is led the discharge or delivery pipe of the pump.

968.—SMITH, W., Kennington, Surrey, "Improvements in dry gas-meters." Patent dated March 6, 1876.

According to this invention, the upper rim of the diaphragm of the meter is made somewhat larger than the lower one, which latter is of about the ordinary size, and the leather is preferably shaped so that it has the bulge nearer the upper rim. The rims are made in working preferably to approach one another, so that the bottom of the upper rim may pass below

the top of the lower rim if necessary. A diaphragm is thus obtained which can register considerably larger volumes than the ordinary ones, and the action of which is better, the friction is lessened, and less leather is used.

970.—SUGG, W. T., Vincent Works, Westminster, "*Improvements in gas burners and fittings, or parts thereof, and in the method of manufacturing the same.*" Patent dated March 6, 1876.

This invention has for its object the improvement of gas-burners, either Argand or flat-flame, whereby the arms attached to the same for the purpose of carrying shades, screens, or globes, together with the fittings for their suspension or support, may be made by a reduced number of operations to that by which they have hitherto been made, more uniform, rigid, capable of increased ornamentation, and at a comparatively reduced cost.

The invention consists in constructing metallic moulds, being counterparts of the burner, or a portion of the burner in the case of an Argand burner, and in reference to a flat-flame burner, of the supports and case in which the burner tip or top is fixed. These moulds are made in two, three, or more pieces, and in them are laid wires of copper, steel, or other suitable metal for giving rigidity and strength to the arms. Melted metal, consisting of an alloy of tin, lead, and antimony, is then poured into the moulds, and on the metal becoming cool the moulds are separated, and the burner consisting of those parts capable of being cast together, that is, with their arms or supports either ornamented or not, are withdrawn in one piece, requiring but little additional work to finish them ready for use.

The fittings, by which burners are frequently suspended or otherwise supported, it is proposed to make by forming metallic moulds in which the tubes for the conveyance of the gas or support of the burner may be laid. Melted metal is then poured into the moulds, thus uniting the tubes, ornamenting them with appropriate devices, and providing the shell for the insertion of a suitable plug or tap to form a stopcock.

971.—SUGG, W. T., Vincent Works, Westminster, "*Improvements in public light gas-meters, the receptacles for containing them, and connexions to the same.*" Patent dated March 6, 1876.

This invention has for its object the construction of gas-meters and the connexions thereto, specially adapted to ascertain the consumption of gas in public lamps, and in the receptacles for containing the meters so that they may be conveniently accessible for replenishing with liquid, clearing out the supply and service pipes, and for adjustment for repair, and for ascertaining the quantity of gas consumed by the lamps to which they are attached.

The apparatus consists of a meter-wheel or drum of comparatively shallow depth but large diameter, mounted on a frame attached to an enclosed front chamber, the front of which is made removable. This frame and chamber are enclosed in another case or chamber capable of containing the liquid in which the drum may revolve. On the top of this case is fixed the index, filling tube, and draw-off tube, together with the inlet and outlet for gas.

The whole of the foregoing constitutes the meter, which is placed within a cast-iron receptacle to be embedded in the ground, the receptacle being provided with a cover having a glass plate through which to view the index, and cross-bars, lugs, and screws, whereby, with the aid of india-rubber packing, the case may be made securely gas and water tight. The inlet and outlet connexions are fixed to the exterior of this case, and are arranged in such a manner that the gas may be shut off therefrom, and the pipes cleared, should any obstruction occur therein, without the necessity of disturbing them from the surrounding soil. On the inside, the inlet and outlet connexions with the meter are made of flexible tubing (of the kind described in patent No. 2842, Aug. 12, 1875) and metallic couplings. The upper part of the outside case consists of a frame and hinged flap-door cast separately from the other parts, but capable of being attached thereto and adjusted in such a manner as to make the upper surface correspond in level or inclination with that of the pavement.

The whole of the cases are made of cast iron, and the flap door is secured by means of a lock or fastening, which, while it admits of being easily opened by a suitable key, is not likely to become fixed with dirt.

988.—LAKE, W. R., Southampton Buildings, London, "*Improvements in gaseliers.*" A communication. Patent dated March 7, 1876.

The object of this invention is to produce improved mechanism for sustaining the weight in a gaselier of the extension or drop tube and its lights, and consists of a drop or extension tube, provided externally with a spiral rib or equivalent device, a frictional spring, and a two-part clutch. These are so arranged that when the drop tube is at rest the clutch will be engaged and provide sufficient frictional power to support the extension or drop light tube and its attachments; and that when the drop tube is being moved upward the clutch will be disengaged and offer no resistance.

989.—CROSSLEY, F. W., and BRIDGETT, G. A., Manchester, "*Improvements in direct-acting steam-pumps, applicable also to pumps worked by compressed air or other fluid pressure.*" Provisional protection only obtained. Dated March 7, 1876.

This invention relates to a construction and mode of operating the valves of pumps which are worked directly from a piston moved in a cylinder by steam, compressed air, or other fluid pressure, the admission and emission of the working fluid being governed by a valve or slide moved by the pressure of the working fluid admitted to act on it through ports governed by the piston or by tappets moved by the piston. The improvements consist in adapting, to a pump so worked, a slide of a kind similar to a steam slide, in lieu of the clack or other valves ordinarily employed for the passage of the water to and from the pump-barrel, and in working such slide by connecting it directly to the slide of the working cylinder, so as to be moved by and simultaneously with it.

1003.—WRIGHT, L. T., Harrow Road, London, "*A new process for revivifying foul gas lime and obtaining the volatile products therefrom.*" Provisional protection only obtained. Dated March 8, 1876.

According to this invention the foul gas lime is distilled by subjecting it to heat in a retort communicating with a condenser, and provided with a pipe or pipes for the introduction of steam to assist in driving off the volatile matters. The material, after its removal from the retort, is treated, preferably while hot, with sufficient steam or water to convert the protosulphide of calcium into sulphuride of calcium and hydrate of lime, whereupon it can be used again for the purification of crude coal gas, and when spent can again be revived in the same manner. By effecting the condensation at a sufficiently low temperature bisulphide of carbon, which is one of the volatile matters expelled by the distillation, can be obtained in a liquid form.

1013.—CALDWELL, A., Strathbungo, N.B., "*A new or improved apparatus for controlling or regulating the flow of water or liquids in dwelling-houses, factories, and other buildings, the same being applicable as a water or liquid meter.*" Patent dated March 9, 1876.

This invention consists of a cylindrical chamber or vessel, closed at both ends, and within which a piston composed of leather, india-rubber, or other equivalent material, is so placed as to fit water-tight around the interior. The piston is fixed on one end of a rod, on the other end of which a smaller piston is so placed as to fit water-tight around the interior of a tube about half the length of the cylindrical chamber. At that end of

the rod whereon the larger piston is situated, a valve is fixed which alternately opens and closes the entrance to an exit-pipe attached to the end of the chamber. When the cock or valve of the service-pipe is closed, the pressure of water within the apparatus acting upon the smaller piston draws the larger one towards the centre of the chamber, two or more small openings being made in the larger piston to permit of the passage of water through it, and allow of such motion being effected. The quantity of water passed through these holes is discharged by the pressure of water against the inner side of the larger piston, forcing it towards the end of the chamber or vessel.

Under a modification of the apparatus it may be made to discharge at both ends, and instead of making holes in the larger piston, a pipe or pipes may be employed to conduct the water from the inlet to the outlet side of the piston.

The apparatus may also be provided with an indicator, and employed as a meter for indicating the flow of water or other liquids.

1014.—HOERTMANN, O., Charlton, Kent, "*Improvements in gas lighting, which consists in adjusting the supply of air to the burner so as to give maximum light for a given consumption of gas.*" Provisional protection only obtained. Dated March 9, 1876.

This invention consists in adjusting the supply of air by regulating the size either of the orifice where the air inflows to the burner, or of the efflux orifice, or both. This may be accomplished by adjusting a diaphragm at the top of the chamber in which the light burns, so as to regulate the distance of the edges of the chimney glass and the chamber, the space between the edge of the chimney and the edges of the diaphragm being the efflux orifice.

1034.—KIDD, J., Dartmouth Street, Westminster, "*Improvements in gas-producing furnaces, and in the methods of utilizing the gases generated therefrom.*" Application dated March 10, 1876. Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.

This invention is an improvement on patents Nos. 520 and 531, of 1873, and consists of various modifications of the apparatus which cannot now be described apart from the drawings which accompanied the former specifications.

1057.—MALFROY, A., Rochester, "*A new water-meter, applicable also for measuring other liquids.*" A communication. Patent dated March 11, 1876.

The aim of this meter is to measure accurately the quantity of water or of any other liquid running from a cock, whatever the variable pressure of the column of liquid may be. It can be situated at any distance from the place where the liquid originates, without causing any alteration in the accuracy of the measuring of the liquid.

1063.—JONES, H. E., Bow, Middlesex, "*Improvements in apparatus for regulating and correcting alterations in the pressure of gas flowing through street-mains.*" Provisional protection only obtained. Dated March 11, 1876.

This invention relates to means of reducing the increase of pressure which is produced at the upper part of a gas-main which ascends an incline, and of restoring the pressure to the same as that at the foot of the incline. This reduction or restoration is maintained in exact relation with every rise and fall of the initial pressure, a result which differs from that obtained by the use of the ordinary regulators employed for this purpose, which have simply the effect of reducing the pressure to a fixed and uniform measure. Thus by the use of this invention, as the pressure, while it is reduced to the extent adjusted for, is also caused to follow all the variations of the original pressure, great regularity is secured in distribution, and economy in leakage.

For this purpose the gas is passed through a holder working in a closed tank or chamber, and weighted to resist the excess of pressure to be removed. In the crown of the holder there is fitted a valve which opens as the holder rises, and closes as it descends, so as to vary the area of the passage for the gas. From this arrangement it follows that the pressure of the gas after passing the holder must always be less than that of the gas supplied to it, by exactly as much pressure as is required to keep the holder in suspension.

The valve in the crown of the holder may be of any known kind that involves little or no friction in its working. For this purpose it is preferred to employ a conical or conoidal plug fixed in the lower or stationary part of the machine, and projecting through a hole in the crown of the holder, so that as the latter rises the annular area of the passage round the plug increases, and *vice versa*.

APPLICATIONS FOR LETTERS PATENT.

358.—HUNT, B., Lincoln's Inn, London, "*Improvements in direct-acting steam-engines for pumping and other purposes.*" A communication. Jan. 27, 1877.

448.—WIGHTMAN, G., Elksley, Nottingham, and ALLEY, S., Glasgow, "*Improvements in water-meters.*" Feb. 2, 1877.

451.—FINCH, B., High Holborn, London, "*An improvement in valve water-closets, and in water-supply valves for the same.*" Feb. 2, 1877.

480.—ROSS, W., Glasgow, "*Improvements in apparatus or valves for regulating and supplying uniform quantities of water to, and preventing waste in water-closets, urinals, and other vessels.*" Feb. 5, 1877.

487.—MATHER, W., Salford, Lancs, "*Improvements in apparatus to be used in raising water from artesian and other wells.*" Feb. 5, 1877.

488.—JOHNSON, J. H., Lincoln's Inn Fields, London, "*Improvements in the treatment of sewage and in the production of manure therefrom, and also in the manufacture of materials therefor, and in the machinery or apparatus to be employed for such purposes.*" A communication. Feb. 5, 1877.

491.—ORTO, N. A., Deutz, Germany, and CROSSLEY, F. W., Manchester, "*Improvements in gas motor engines.*" Feb. 5, 1877.

502.—CHATWIN, T., Birmingham, "*Improvements in screw-wrenches or screw-spanners, and in gas-grips.*" Feb. 6, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

3138.—FOX, ST. G. L., Onslow Gardens, London, "*Improvements in the means or apparatus for lighting and extinguishing gas lamps by electricity.*" Aug. 8, 1876.

3227.—BALDWIN, T., Manchester, and BAILEY, W. H., Salford, "*Improvements in pressure-gauges.*" Aug. 16, 1876.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

353.—CHARLES, P., "*Improvements in apparatus for controlling the supply of water to closets, lavatories, and other places, and preventing waste.*" Jan. 28, 1874.

403.—LUMLEY, T., "*Improvements in steam-pumps.*" Jan. 31, 1874.

404.—CHERRY, H., "*Improvements in steam-pumps.*" Jan. 31, 1874.

481.—DENNIS, T. H. P., "*A new or improved water-waste preventer.*" Feb. 3, 1874.

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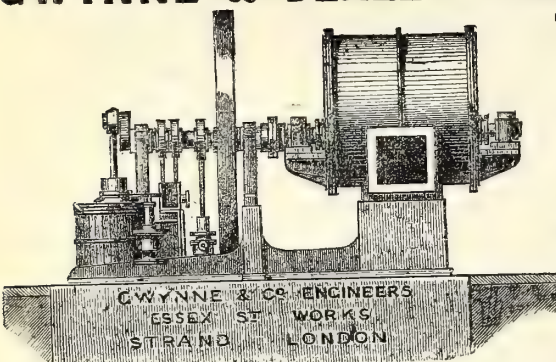


FIG. 224.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the most perfect system of action yet discovered. Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement. Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters at alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

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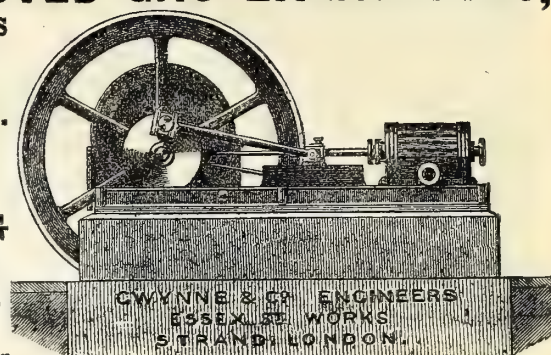
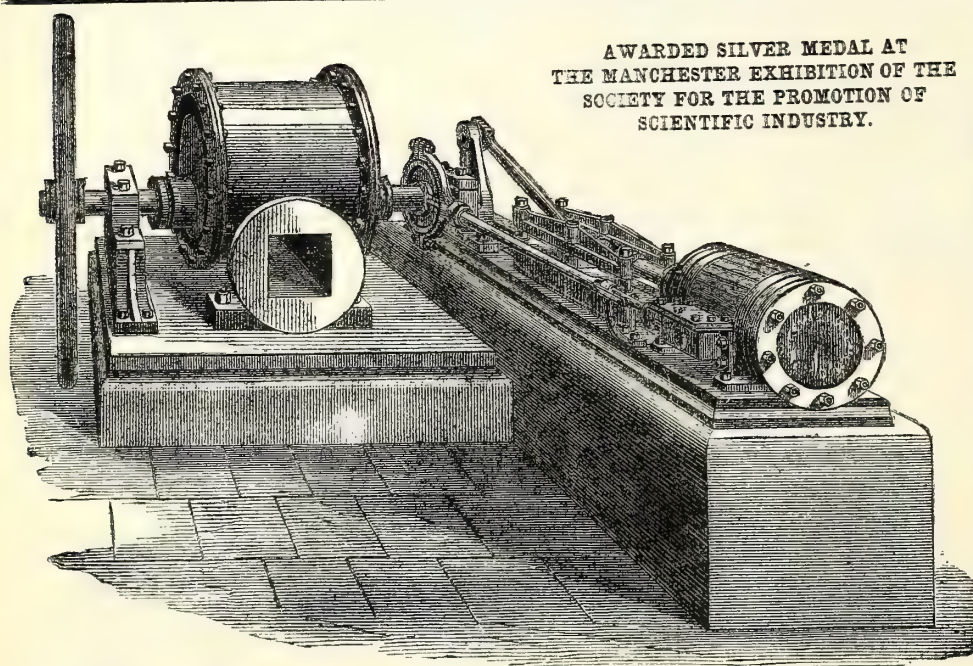


FIG. 225.

D. BRUCE PEEBLES & CO.,
 ENGINEERS,

FOUNTAINBRIDGE WORKS, EDINBURGH,
MANUFACTURERS OF WET AND DRY GAS-METERS;
Patentees and Sole Manufacturers of "PEEBLES' GAS-GOVERNORS,"
FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS,
OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.

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 THE MANCHESTER EXHIBITION OF THE
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TO CORRESPONDENTS.

R. B., Leeds.—A bright red-hot poker, the temperature of which is the same as that of a flame, will ignite gas.
E. S. CATHELS, Montreal.—Your letter received and in type, but must stand over till next week.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 20, 1877.

Circular to Gas Companies.

THE list of Bills, which we print in another column, shows that, in all probability eight more gas undertakings will soon pass into the hands of Local Authorities. We mention eight only, because we cannot believe that Parliament will sanction the confiscation of the Isle of Thanet Company. The Bill of the Ramsgate Local Board is the only one in the list which proposes to make a downright compulsory purchase. There are other cases, it will be seen, in which no arrangement has yet been come to between the Companies and the Authorities who desire to buy; but we think we are right in stating that, in no instance but that of Ramsgate will serious opposition be offered to the design of the Authority. In five out of the eight cases an amicable understanding has been arrived at, and Parliament is simply asked to sanction the agreement entered into by the respective parties. Thus the Burslem, Dukinfield, Hanley, Longton, and Warrington Bills will probably pass unchallenged, and so many undertakings will cease to have a commercial character. A little qualification must be made, since we notice that most of the authorities appear to be anxious to get something out of gas consumers to be applied in aid of rates. We shall not stop now to argue this question over again; it will be sufficient to put the consumers on their guard as respects high prices, and to tell them that a town-hall might, with just as much right and reason, be built with funds derived from an excessive police-rate as with gas profits.

As regards the price to be paid for undertakings in connexion with which the terms of purchase have been settled, we are bound to say that, on the whole, they must command satisfaction. They are, as will be seen, those which have invariably been sanctioned by Parliament, and which may be said to be the fixed statutory value. Annuities equal to maximum dividends redeemable at twenty-five years purchase, or the equivalent in a gross sum, is the recognized price of a gas undertaking against the management of which nothing serious can be alleged. In the case of an exceptionally valuable undertaking, like that at Warrington, a bonus is very properly added, which, we think, should have been double the amount agreed upon. Taken altogether, however, we are not dissatisfied with the terms when arranged, and we are not afraid to trust the results of arbitration in cases where no terms have been agreed upon. Admitted principles form the basis of all arbitrations, and, as we have said, the value of a gas undertaking in fair working order is easily settled.

It is beyond our purpose, just now, to discuss at any length the question whether the several districts will be any better off under the Authorities than they have been under the Companies. In no case do the Authority propose to supply better gas, and, so far as we can see, in no case do they intend to reduce the price. Things will go on exactly as before, except that the bills will have to be paid to another party.

We observe that, in some cases, a more extended period is proposed, in the course of which borrowed money is to be paid off by means of a sinking-fund. Eighty years—which means practically eighty-five—are asked for in some instances; but probably the Local Government Board will suggest an alteration and abridgment.

When referring, some weeks ago, to the Bills of the Ramsgate Local Board and the Isle of Thanet Gas Company, we mentioned that the Board proposed a maximum price of sixpence per 1000 feet lower than that proposed by the Company. We did not, however, mention at the time, that the Board seek power to levy a gas-rate in case the revenue of the undertaking (supposing they get possession of it) should not, with gas at what is, by a figure of speech, called the *maximum* price, be sufficient to meet all the charges on the undertaking. Perhaps the Ramsgate ratepayer has not sufficiently considered this matter. If the Gas Company cannot make their profits with gas at the maximum price, they must go without them, put up with the loss, or seek some such legislative relief as was afforded by the temporary Act of 1873. But the power to levy a rate to make up a deficiency of gas revenue, which would fall alike on consumers and non-consumers, we regard as highly objectionable. Putting, for the moment, the charge for public lights out of the question, it is clear that any deficiency should be made good by increasing the price of gas. We are sorry to see that no English local authority have proposed to manage their gas undertakings on the plan common, though not universal, in Scotland, where the price is fixed by an annual estimate, a loss being made good by an extra charge in the following year, and a surplus going towards a reduction of prices. The Ramsgate ratepayer may have no immediate reason to fear a gas-rate, but we cannot help thinking that the power to levy one would be a dangerous gift to the Local Board.

Our readers will remember that we have for many years contended that the gas suppliers should have legal power to follow the gas from the main to the point of combustion; or, in other words, to exercise some control over internal fittings. Many have expressed an agreement with our opinion, but until now no definite plan has been proposed to carry out our idea. It will be seen, however, in another column, that the Corporation of Leeds insert, in a schedule to the Improvement Bill they are now promoting, a series of regulations, which, if sanctioned by Parliament, will confer many of the powers which we deem it advisable that gas suppliers should possess. So far as our memory serves us, this is the first instance in which a Corporation have claimed to exercise such powers. No Gas Company, we are certain, have ever applied for similar rights. We congratulate the Corporation of Leeds on having set a precedent which, we have little doubt, will in time be extensively followed. We will, for the present, leave these regulations for the consideration of our readers, candidly stating that they hardly go far enough to satisfy us. Something, however, must be left to the taste, or want of taste, of the individual consumer, and the design of the fitter. It is mortifying to see people put up what they consider tasteful fittings, which cut off seventy-five per cent. of the light the gas gives, and then hear them complain that the gas gives no light; but such vagaries cannot be interfered with. On all essential points the regulations are very explicit. An outcry will, no doubt, be made against giving a gas manager so much control as

the first of the regulations will confer; but we believe that it would presently be found that the manager advised rather than compelled, and his advice would be earnestly sought after. We cannot think that the conditions of things recently described by Mr. Woodall as obtaining on the premises of many consumers in Leeds, could result from anything but the grossest ignorance; but, in any case, it is time they were put an end to, and, as already said, the Corporation of Leeds and their gas manager deserve credit for making an attempt to protect gas consumers from the consequences of their own folly, and the stupidity of the ordinary gas-fitter. We hope that when the Bill comes before a Committee of either House of Parliament, these regulations will be adopted in their entirety, and that they will thereafter be carried out with the exercise of a wise discretion.

We recommended, last week, that the Corporation of Leeds should open an exhibition of good and bad burners, in a shop in Briggate, and we have many times suggested that Gas Companies in this country might imitate, with advantage, the Paris Gas Company, and make a display of apparatus used in the consumption of gas for economic purposes. Except at one of those abortive exhibitions at South Kensington two or three years ago, we do not remember to have seen any considerable collection of gas cooking stoves, and apparatuses used for the distribution of heat produced by the combustion of gas. In our advertisement columns, to-day, however, will be seen an announcement that the South Shields Gas Company have projected an exhibition, for which we desire the most complete success. We must refer our readers to the advertisement itself for full details of the scheme of the Directors, but we could not allow the opportunity to pass without congratulating the Company on their enterprise, and expressing a hope that inventors and manufacturers will liberally assist in making the exhibition the success it deserves to be. We notice one omission. The Paris Gas Company make a profit—not large, it is true—by letting on hire and selling iron stoves specially adapted for the consumption of coke. It is not, however, a matter of much importance in the North. Coal is cheap for the million, and, in good and prosperous times, coke commands a ready sale for manufacturing purposes in South Shields. But we in the south should be glad to see the consumption of coke more general, and the introduction of a good stove for the purpose would assist in promoting the object.

The Corporation of Wigan have not opened an exhibition, but something like a shop. They have laid in a large stock of what they call "Sugg's Patent Burners"—bat's-wings or fish-tails, of course—which they advertise for sale at one penny each, and the Gas Committee strongly recommend their use by all consumers. The Committee have taken a step in the right direction. Leeds might follow suit with advantage, and induce the consumers to replace the "rusty iron burners" now commonly in use with good steatite jets.

The question as to the proper application of gas profits has come up again in Birmingham, and we find one of the Corporation auditors contending, in a very able letter, that surplus profits belong to the consumer, who is, as we maintain, subjected to additional taxation when these profits are devoted to public purposes. This fact is brought out strongly when the statement is made, that in the borough of Birmingham "only half the householders are consumers of gas, and that only about one-third of the ratepayers may be said to be profit-paying consumers." If this statement be true—and we cannot suppose that Mr. Beard speaks without an accurate knowledge of the facts—the policy for the Gas Committee to pursue is evident enough. Cheapen gas to the lowest possible limit, and so promote a more general consumption. When every ratepayer is a consumer, it does not matter how gas profits are appropriated.

That a small Local Board should be irate when a Government Department do not fall in with their wishes, and adopt their suggestions, is but natural. The Guisborough Gas Company have applied for a Provisional Order, authorizing them to raise further capital, and the Local Board presented a memorial against the granting of it. It would appear that the Local Board are anxious to get possession of the undertaking, and that they want to acquire it at cost price. With this object, the Local Board asked the Board of Trade to insert a clause in the Order, empowering them to make a compulsory purchase. This, of course, the Board of Trade have no power to do, and plainly say so. Whereupon the Local Board consider themselves unfairly treated, and resolve to ask the Board of Trade to reconsider the matter. The grievance of the local authority lies, as we have said, in the fact that the Company will not sell their undertaking for the money they have laid out on it, but want, like sensible men, nearly double the prime cost, which the Board will pay if they ever get the works.

The neat address of Mr. Wood, of Hastings, the President of the Southern Association of Gas Managers, printed in another column, deserves a word of notice. Mr. Wood enjoys a deservedly high reputation in the gas world, in which he has been active for a great number of years, and all he says is certain to command the respect of his brother managers. It is satisfactory to obtain from a man of his wide experience a denial of the assertion that the receipt of "commissions" is common among gas managers. The controversy has now ceased, and we think that gas managers have sufficiently vindicated themselves from the sweeping charge made by the "Commission Abolitionist."

The Corporation of the City of London have a "Various Powers" Bill before Parliament, which, among other things, proposes to re-enact the substance of two clauses which were contained in the City of London Gas Act, 1868; but which, somehow or other, dropped out of The Gaslight and Coke Company's Act, 1876. The object of the clauses is to make the Gas Company liable for the salaries and expenses of the Chief Gas Examiner and Official Auditor, which, by the way, they have always paid, and would have continued to pay, and to make the Corporation and Metropolitan Board of Works responsible for the payment of the Examiners they appoint, and the costs they incur in the execution of their duties—a responsibility which we do not suppose they desire to shirk.

The Metropolitan Board, at their last meeting, appointed one Examiner to test the gas at the two stations of the Commercial Company. It seems to be the opinion of the Board that some further legislation, relating to the place at which the gas is tested, will be necessary when mains from many manufacturing stations communicate with each other. All that is required, as we have said before, is to test the gas at the station where it is made, and before it can possibly become mixed with that from any other source.

Water and Sanitary Notes.

THE condition of the water supply of Richmond (Surrey) cannot be said to improve; on the contrary, perhaps it gets worse. The supply is of the scantiest, and the quality of the water must be regarded as of a doubtful nature. Some of the sources from which water is now drawn are undoubtedly polluted, and since neither subsiding-tanks nor filtering-beds are in operation, it is not surprising that some of the water distributed is described as in colour like that of the "Yellow Sea." And, unfortunately, it is not probable that this state of things will soon be remedied. The difficulties of the Vestry are, we believe, only beginning. It must be many months before the machinery of distribution can be got into order, and then will come the still more important matter of finding water to distribute. It is reported that one day last week an energetic workman succeeded in removing some obstruction in the bore of the artesian well, and incidentally drowned two pumps by the rush of water which rewarded his efforts. The inhabitants of Richmond have not yet been benefited by the man's exertions, for there has been nothing to pump the water with; and we suspect that when a powerful pump has been fixed—as may be the case in a few months time—the well will soon be pumped dry again. This well, the principal source of the supply of good water relied upon, will not, we fear, last. It has, we believe, failed before, and may fail again, and what then will be the condition of things in Richmond? It looks to us highly probable that, before very many weeks are over, the inhabitants will find it absolutely necessary to have recourse once more to the Southwark and Vauxhall Company, and we hope the Company will deal liberally with them. All necessary connexions can be made in the course of twelve hours, and then Richmond will be itself again. The present state of things cannot be much longer endured, and we do hope that the Vestry and the Company, both confessing past errors, may come to an amicable arrangement which will relieve the town of its present distress.

There would seem now to be a probability that the Corporation of Manchester will soon come forward with a grand scheme for obtaining a large additional supply of water. The Woodhead gathering-grounds are now barely sufficient to supply the water required for Manchester. As our readers know, a scheme was proposed for bringing a supply for both Liverpool and Manchester from Windermere Lake. The combined scheme, we believe, was never seriously entertained by either Liverpool or Manchester, although there was much to be said in favour of it. However, the recent decision of the Liverpool Town Council to further test the well system before they decided on a large scheme, makes it necessary that Manchester should act alone; and, accordingly, we find the Water Committee of the Corporation of the latter city engaged in the considera-

tion of a scheme devised by Messrs. Bateman and Hill for bringing the water of Thirlmere Lake to Manchester. This is the nearest of the Cumberland lakes, but still it is one hundred miles distant, and, to convey the water, an aqueduct of that length will be required. The lake is sufficiently high for the water to travel by natural gravitation, and the aqueduct will be entirely underground, valleys being crossed by syphons. It is proposed, as before, that towns lying along the route of the aqueduct shall be supplied, and thus the expense to Manchester lessened. We have not, as yet, seen any estimate of the cost of the works, &c., but it will necessarily be of an enormous amount. The Corporation of Manchester, however, are not stopped by trifles, and we confidently expect that this scheme will be carried out. Its importance will necessitate a further notice when we obtain fuller details.

GAS BILLS FOR 1877.

(Continued from page 228.)

THE next group of Bills we notice consists of those promoted by Local Authorities to obtain power to acquire gas undertakings.

The *Ashton-under-Lyne Improvement Bill* is, among other things, to enable the Corporation of Ashton to purchase the undertaking of the Ashton Gas Company. If the measure should pass, the Corporation will have power to acquire the undertaking at any time within seven years, on giving notice to the Company. The consideration may be a gross sum or annuities, the amount being settled by agreement or arbitration. The Corporation propose to supply fourteen-candle gas, tested by Sugg's "London" Argand; and the maximum price, we may take it, is to be that now chargeable by the Company. With reference to the gas purchase, the Corporation seek power to borrow as much money as may be required to effect it.

The *Blackburn Borough Gas, Water, and Extension Bill* is (*inter alia*) to give the Corporation power to acquire the undertaking of the Blackburn Gaslight Company at any time after the passing of the Act, on giving due notice. The terms are to be settled by agreement, or by arbitration under the Railway Clauses Act, 1845. The Corporation propose to supply sixteen-candle gas, tested by the "London" Argand, No. 1. The maximum price will be that sanctioned by the Company's Act. The consideration may, as usual, be a sum in gross or annuities. If the latter, the Corporation seek power to redeem them at twenty-five years purchase. As in the previously-mentioned case, power is sought to borrow as much money as may be required to effect the purchase, or as may be wanted, from time to time, to redeem annuities.

The *Burslem Local Board Bill* was noticed before. It is to enable the Board to acquire the undertaking of the Burslem and Tunstall Gas Company for the sum of £86,000. The Board propose to supply fourteen-candle gas, at a price not to exceed 5s. per 1000 feet. They may appoint a Gas Examiner, who will report to the Gas Committee once a week. Power is sought to borrow the purchase-money—£86,000—and a further sum of £20,000, as it may be required, for the purposes of the Act. Net profits may be applied in forming and maintaining a reserve-fund, which is never to exceed £1000. Any surplus, and also the interest on the invested fund, is to be carried to the district-fund.

The *Dukinfield and Denton Local Boards of Health Bill* is to enable the two Boards jointly to acquire the undertaking of the Dukinfield Gas Company. The consideration is to be perpetual annuities of ten per cent., which may be redeemed at twenty-five years purchase. The undertaking is to be managed by a joint committee of the two Boards specified, with power to take in the Sanitary Authority of Haughton. The Bill proposes a supply of fifteen-candle gas, tested by an Argand or other approved burner, at a price not to exceed 5s. per 1000 feet.

The *Hanley Corporation Gas Bill* is to enable the Corporation to acquire the Etruria works of the British Gaslight Company, who supply gas to the borough of Hanley, and the parishes of Wolstanton and Bolton-in-the-Moors. The consideration is to be the payment, in perpetuity, of the annual sum of £5382, which is, in round numbers, ten per cent. on the capital invested in the undertaking. The Corporation, however, seek power, at their option, to issue annuities to individual shareholders. In either case, the annuity or annuities may be redeemed at twenty-five years purchase. The Corporation propose to supply fourteen-candle gas, at a price not to exceed 3s. 6d. per 1000 feet. As regards the application of profits, it is provided that a reserve-fund may be formed and maintained, not to exceed £2000, and that when gas is sold for 3s., or less, the Corporation may apply surplus profits to improvement and other public purposes. The gas districts in the Potteries are a good deal mixed up, and this Bill will give the Corporation power to sell to the Local Board

of Tunstall so much of the Hanley undertaking as lies within the limits of the Board. The Corporation seek power to borrow such sums of money as they may require, the aggregate amount not to exceed £150,000.

The *Longton Corporation Gas Bill* is to authorize the transfer of the undertaking of the Longton Gas Company to the Corporation. The consideration is to be the payment of the sum of £75,150 in cash. Power is sought to borrow £100,000 for the purposes of the Act. The Company's Act, 1875, will apply to the Corporation, so the quality of the gas and the maximum price chargeable will remain the same.

The *Newcastle-under-Lyme Borough Extension and Improvement Bill* is, among other things, to enable the Corporation to acquire within seven years the undertaking of the Newcastle-under-Lyme Gaslight Company. No arrangement seems to have been entered into, so the terms of purchase will be settled by agreement or arbitration. They may, of course, be the payment of a sum in gross, or the issue of annuities to represent shares. If by the latter, the Corporation seek power to redeem them on agreement or by arbitration. Authority is sought to borrow as much money as the Corporation may require for the purchase. The Corporation propose to supply fourteen-candle gas, and as the Company's Act will continue to apply, the maximum price will remain the same.

The *Ramsgate Local Board Bill* has been noticed more than once in our "Circular." Its object is, among other things, to effect a compulsory purchase of the Isle of Thanet Gas Company. The Board, if they succeed, will supply fourteen-candle gas at a price not to exceed 5s. per 1000 feet.

The *Warrington Corporation Gas Bill* has also been repeatedly noticed. Its object is to obtain the sanction of Parliament for the purchase of the undertaking of the Warrington Gas Company on terms which our readers know have been already arranged. The consideration is to be annuities equal to maximum dividends on all the paid-up capital with a bonus of ten shillings per share. The Corporation are to pay the income-tax on the annuities, and to assume all the debts of the Company. Annuities may be redeemed at the usual rate—twenty-five years purchase. The Corporation propose to supply sixteen-candle gas at a price not to exceed, within the borough, 4s. per 1000 feet. Beyond the limits of the borough sixpence additional per 1000 will be charged for every mile of distance, provided, however, that consumers without the borough of not less than 250,000 feet in the half year are to be charged the same price as consumers within the borough. Liberal discounts, according to the quantity of gas consumed, are to be allowed for prompt payment. As regards the application of profits, it is provided that after defraying all charges, the Corporation shall form and maintain a reserve-fund, not to exceed £10,000, and then any surplus, together with the interest on the invested reserve, is to be carried to the Borough Improvement Fund. The Corporation seek power to borrow, for the purposes of the Act, £200,000, with a limitation which need not be mentioned.

The following Bills are promoted by authorities already possessing gas undertakings, with various objects irrespective of gas concerns, but are here only noticed so far as they relate to gas matters.

The *Bolton Improvement Bill* is, among other things, to authorize the Corporation to raise £100,000 for gas purposes.

The *Dundee Gas Bill* is to empower the Dundee Gas Commissioners to borrow the additional sum of £100,000, and to acquire additional land for the extension of their gas-works.

The *Leeds Improvement Bill* is to enable the Corporation of Leeds to acquire additional land on which to erect manufacturing and storage works, and also to extend the limits of gas supply. The novel course has been adopted in this case of proposing a series of regulations, in a schedule, for "the prevention of waste, misuse, and undue consumption of gas," which regulations are to take effect as if enacted in the body of the Bill. In consequence of their novelty, we print the proposed regulations at full length:—

Regulations to be observed to Prevent the Waste, Misuse, or Undue Consumption of Gas supplied by the Corporation.

1. Any person who shall refuse, neglect, or fail to obey the directions of the gas manager of the Corporation for the time being, with reference to the construction or position of all fittings, pipes, cocks, and other things in, or in connexion with, any house or building, or who shall fail to observe the regulations made by the Corporation, shall forfeit and pay a sum not exceeding forty shillings.
2. In cases where the regulations are not complied with, and the fittings not executed to the satisfaction of the Corporation or their manager, gas shall not be supplied, although payment may have been made in advance.
3. No person shall fix or remove any meter without the special permission of the manager, in writing, under a penalty not exceeding five pounds.
4. No person shall interfere with stopcocks, valves, or other matters or things belonging to the Corporation without the special permission of the manager, under a penalty not exceeding forty shillings.
5. Every incoming tenant must give immediate notice at the offices of the Corporation before commencing to consume gas, in default of which he

MAIN-LAYING APPARATUS (for Description, see opposite page).

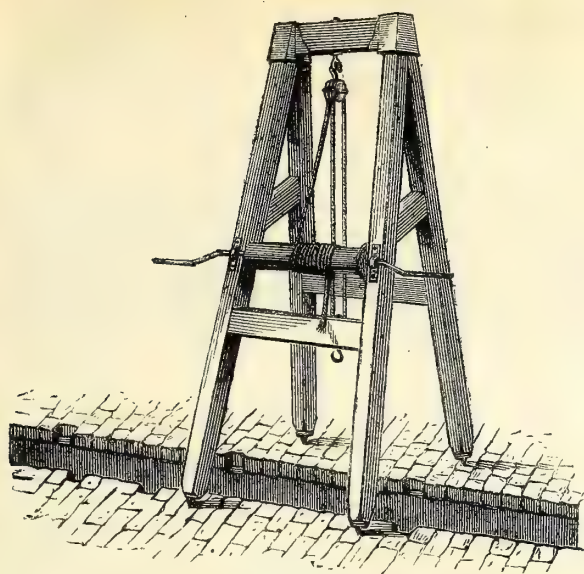


FIG. 49.

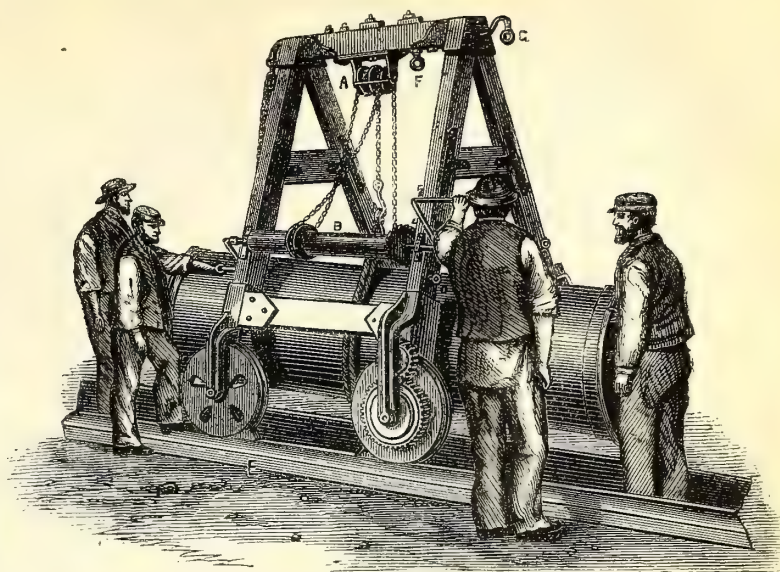


FIG. 50.

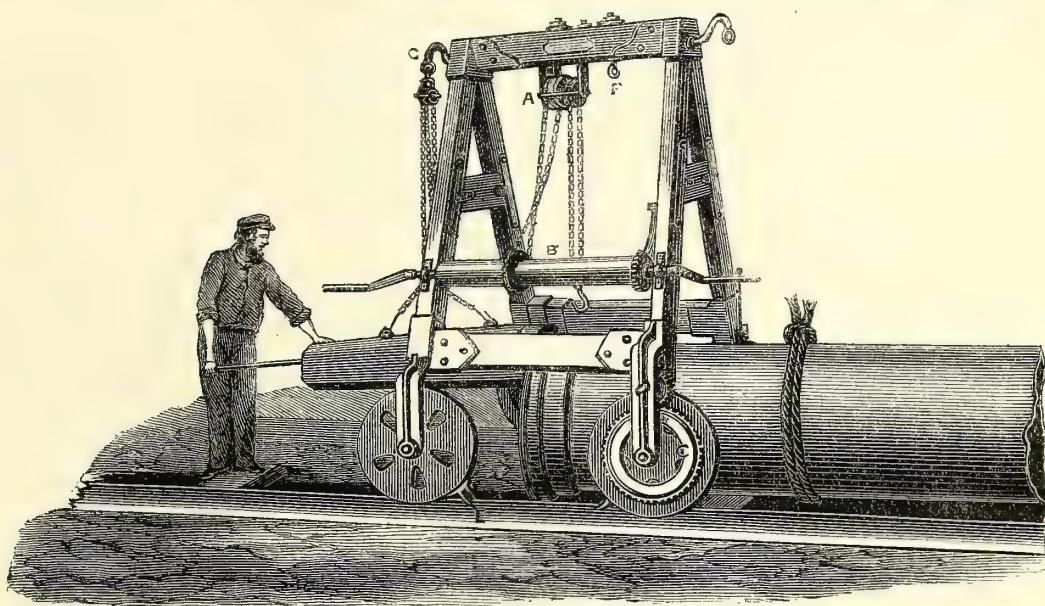


FIG. 51.

Correspondence.

WET AND DRY GAS-METERS.

SIR,—As an advocate of that beautiful but often ill-used, and, for trade purposes, vilified instrument—the wet gas-meter—I was much gratified to read the report of Mr. Warner's lecture in your issue of the 30th ult. Having had a somewhat long experience of its duties, I can indorse all Mr. Warner has stated with reference to it, and have long held the opinion that the wet meter would ultimately stand alone; for it possesses qualities which must ensure its adoption, at all events by those engineers who will give the subject their own personal attention. My long experience of dry meters compels me to admit that Mr. Warner has given them more than their due, and I quite agree with him when he says we should insist upon absolute accuracy of registration, seeing that this has now been attained. Dry-meter advocates say that, with constant supervision and testing, they can get satisfactory results from their use; but I maintain that a dry meter may be correct to-day and not to-morrow, and I will give one instance out of many such which have come under my notice.

About three months ago I tested a 20-light meter and found it correct, even when passing only one light; but to-day I have tested it again, and find that, at full speed, it is 3.43 per cent. slow, and at 30 feet per hour it is 28 per cent. slow. This meter was fixed at a shop with private house attached, and during business hours would probably be working up to its full capacity, when there would not be much the matter; but after closing time, when only 6 lights were going, it was registering 28 per cent. slow, and when only 2 or 3 lights were burning, would not register at all. Advocates of the dry meter will say you will find other meters registering fast, thus robbing Peter to pay Paul. The latter may be satisfied; but what will Peter say? There are other evils arising out of this state of things, besides the constant annoyance which suspicion of the instrument gives. These go to create a bad feeling with the public against the company (and this is bad enough already), and are, I believe, often the cause of complaints that terminate in competition and opposition. So long as a meter will work correctly, all may go on well; but as soon as you suspect it is going wrong, and wish to have it tested, there comes a suspicion that, because it is the consumer's property, you are not doing him justice. Therefore I say, if we can have absolute accuracy of registration without all these annoyances and bad feelings, which are so inimical to the interests of those concerned, by all means let us have it.

The public have a right to demand accuracy, combined with good management; but I know many consumers prefer the dry meter, because they think it will register in their favour; but if told a wet meter is a better investment, they are very incredulous. As I am writing, perhaps you will allow me to say that companies ought to be very careful to see that those officers who come into contact with their consumers are well up in their business, kind and courteous in their manners, and anxious to give the consumer all the information he requires, the Sales of Gas Act notwithstanding.

In conclusion, I would say that, although I have an interest in two meters that bear my name, I should be pleased to advocate the dry meter if its present defects could be removed.

G. GOLDSMITH.

19, Oxford Street, Leicester, Feb. 5, 1877.

QUANTITY OF BRICKWORK IN RETORT-SETTINGS.

SIR,—I do not think that the arguments in my letter on retort-settings, written over two years ago, and until now unanswered, are in anywise shaken by the criticisms of your correspondent, "C. T. S."

To avoid false issues, let me state distinctly that I do not advocate any excess of brickwork in a setting; but I object, as strongly as ever, to the policy of those who would minimize its amount to the utmost extent possible. My letter was written to combat some very extreme theories that had been broached on this head. A happy medium, as your correspondent, "S. N. A. P.," puts it, may be attained if sought for. Let us descend to particulars. Vague, general statements are often misleading, and seldom instructive. Clay retorts are best from 2½ to 3 inches in thickness, according as they are made by machine or by hand, and the chief point to be observed, in setting them, is to let the heat have free scope for circulating throughout the oven. With this object in mind, there should be none of that mistaken contraction of the nostrils leading out of the furnace; it is here where the evil in some settings exists, obstructing the passage of the heat as it is generated, and hastening the premature destruction of the furnace bag. Clay retorts, 8 feet 6 inches long, are adequately supported by four transverse supports, in addition to the back ledge and the front wall, and only one of these four need be 9 inches thick. With a setting of this description, having ample space for the exit of the heat from the furnace into the oven, and through the flues, the best results, both as regards heating and economy of fuel, hitherto achieved, are obtained.

It has been stated that the perfection of a retort would be one made of thin platinum, which would offer only the smallest possible obstruction

to the conduction of heat to the coal undergoing carbonization. Under the present system of firing a bench of retorts, I have grave doubts about the correctness of this view.

It is safe to dogmatize on the point, however, as the experiment is too costly ever to be put to the test, but one has an instinctive forecast that it would prove a failure if it were tried. The fact that fire-clay, in spite of all that was urged against it by its early opponents, has proved to be the best material for retorts, not merely on account of its refractory qualities, but also by reason of the bulk of heat (so to speak) which it supplies, is in itself sufficient proof that it is not so much perfect conduction, as a generous body of heat in the vicinity of the material undergoing distillation, that is required.

Although one cannot hope to put the platinum retort theory to the test, we can judge what the effect would be, by considering the known facts as regards iron. What are the facts in regard to the use of iron retorts, putting aside the question of their durability? Iron is a comparatively good conductor of heat, and if economy in fuel is mainly dependent on the conductivity of the substance composing the retort, it will follow, as a necessary corollary, that in the use of iron retorts there will be a distinct saving in the quantity of fuel required for carbonizing. The experiment of employing iron retorts in an open setting, without the intervention of any protecting fire-clay covering, has repeatedly been tried, but never with the resulting saving in fuel that the advocates of perfect conductivity would have us believe.

Facility in conduction, in fact, cuts two ways. There are times when the temperature within the oven is below that in the retort—after the furnace has been newly charged with coke, for example; and at such times the result, with a retort made of good conducting material, is undoubtedly the abstraction of heat from the mass of coal being distilled, and in the absence of the proximity of a body of fire-brick, the disadvantage in this respect would be more distinctly appreciable.

It is a purblind argument, in the face of actual facts, to insist on the necessity, or, at least, the desirability, of perfect conduction in the substance of a retort. The conductivity of heated fire-clay, whatever its proportion as compared with the metals, seems to me to be just suited to the work of carbonizing, and those who are so loud in lamenting the non-conducting power of clay materials had better abate the vigour of their lamentations, as it has been proved by the results obtained in working the Ponsard gas furnace,* that the conducting power of fire-brick is much greater at high furnace heats than at ordinary temperatures.

THOS. NEWBIGGING.

5, Norfolk Street, Manchester, Feb. 14, 1877.

STREET-LAMP LIGHTING.

SIR,—Your correspondent, "W. M. A.," instances a case where the local board have resolved to lay a separate main-pipe for the supply of the public lamps. My object in addressing you is not to enter upon any detailed argument of the advantages or otherwise of this step, but to suggest that as they have (probably for sound reasons) resolved upon it, they should complete the arrangement by fitting the lamps with automatic lighters and regulators.

A very interesting and, so far, successful experiment is now being carried out with 20 of these lighters on the South Metropolitan district in the Old Kent and Peckham Roads, and, so far, not only as a lighter and extinguisher, but also as a regulator, the action has been satisfactory. The only doubt I myself entertain in the matter is whether the general main-pipes, supplying ordinary consumers, will be reliable in giving a constant pressure—that is, whether an increased or diminished consumption by consumers may not affect the pressure in the mains to the extent of rendering the action irregular. This doubt has not, however, been verified hitherto, as the lamps are generally lighted before, and extinguished after, the ordinary consumption is required.

A special system of mains would entirely obviate any difficulty of this kind, and I have no hesitation whatever in predicting that, with such an arrangement, automatic lamp-lighting would be perfectly successful.

I venture in this way to solicit, through your JOURNAL, a means of communicating with the local board referred to. I am not the patentee of the lighter, and have only consented to assist in the promotion of the scheme from a desire which I have long felt to further this improvement in street lighting, and will only add that any information desired may be had on application to me, or to Messrs. Borradaile and Wright, Midway Chambers, 82, Bishopsgate Street, E.C.

34, St. George's Road, Southwark, Feb. 15, 1877. A. F. WILSON.

MANCHESTER DISTRICT ASSOCIATION OF GAS ENGINEERS.

SIR,—Kindly allow me, through the medium of your JOURNAL, to say that on Feb. 1, 1877, the President of the Manchester District Association of Gas Engineers invited the committee and several other friends to visit the Stafford Gas-Works, which they did, and the remarks made by Mr. Hunter, of Salford, appertaining to the efficiency of the gas-works at Stafford were upheld by all the engineers present. The error in the first paragraph which appeared in your JOURNAL was in quoting the above as the twenty-ninth quarterly meeting of the members.

WILLIAM LONGWORTH, Hon. Sec.

Gas Offices, Dukinfield, Feb. 14, 1877.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, FEB. 12, 1877.

The Lord Chancellor acquainted the House that the Standing Orders applicable to the Newport (Monmouthshire) Gas and the Bristol United Gas Bills have been complied with.

The following Bills were presented and read the first time:—Blackburn Borough Gas, Water, and Extension; Bromsgrove, Droitwich, and Redditch Water; East Worcestershire Water; North-East Worcestershire Water.

The Lowestoft Water, Gas, and Market Bill was presented, read the first time, and referred to the Examiners.

TUESDAY, FEB. 13.

The Londonderry Gas Bill was presented, read the first time, and referred to the Examiners.

FRIDAY, FEB. 16.

The East Worcestershire Water Bill was read a second time.

HOUSE OF COMMONS.

MONDAY, FEB. 12, 1877.

Mr. RAIKES reported that, in accordance with Standing Order 79, he had conferred with the Chairman of Committees of the House of Lords, for the purpose of determining in which House of Parliament the respective Private Bills should be first considered, and that they had determined that the Bills contained in the following list should originate in the House of Lords, viz.:—Blackburn Borough Gas, Water, and Extension; Bromsgrove, Droitwich, and Redditch Water; Dublin Improvement Acts Amendment; East Worcestershire Water; Londonderry Gas; Lowestoft Water, Gas, and Market; North-East Worcester Water.

The London Corporation Bill was read the first time; to be read a second time.

TUESDAY, FEB. 13.

The following Bills were read the first time, and referred to the Examiners, viz.:—Carshalton Gas; Croydon Commercial Gas; The Gaslight and Coke Company; Ramsgate Water; Thanet Gas; Coatbridge Gas; West Surrey Water; Newport (Monmouthshire) Gas; Wakefield Gas; Waterford Gas; Woolwich, Plumstead, and Charlton Consumers Gas; Bristol United Gas; Alliance and Dublin Consumers Gas (Bray Supply); Colne Gas; Crystal Palace District Gas; Louth Gas; Warrington Corporation Gas; Bishop Auckland District Gas; Stretford Gas; North Cheshire Water; Southend Gas; Christchurch Gas; Epsom and Ewell Gas; Kent Water; Ashton-under-Lyne Gas; Falmouth Water; Heywood Water; Leicester Gas; Newcastle and Gateshead Water; United General Gas Company (Limerick).

The following Bills were read the first time; to be read a second time, viz.:—Newcastle-under-Lyme Borough Extension and Improvement; Wakefield Improvement; Perth Water; Tunbridge Wells Water; Sunningdale District Water; Glasgow Corporation Water; Leeds Improvement; Limerick Gas; Rotherham Corporation; Edinburgh and District Water; Dundee Gas; Sittingbourne Gas; Middlesbrough Corporation; Ashton-under-Lyne Improvement; Ramsgate Local Board; Bristol District Water; Carnforth District Water; Stamford Water; Tudhoe and Sunderland Bridge Gas; Maryport District and Harbour (Gas); Burslem Local Board; Bridgwater (Corporation) Water; Bolton Improvement; Dukinfield and Denton Local Boards of Health; Hanley Corporation Gas; Longton Corporation.

THURSDAY, FEB. 15.

Petitions against the following Bills were presented:—Leeds Improvement Bill from Middleton Estate and Colliery Company, Limited, and others; Newcastle and Gateshead Water Bill from Corporation of Gateshead; Newcastle-under-Lyme Borough Extension and Improvement Bill from (1) Stoke Fenton and Longton Gas Company, (2) Corporation of Stoke-upon-Trent, (3) ratepayers and owners in Stoke-upon-Trent.

Mr. FAWCETT gave notice that on Tuesday, the 20th inst., he would ask the President of the Local Government Board whether, if, as reported in the public journals, the local authorities of Croydon have decided to apply for permission to convert 100 acres of Mitcham Common into a sewage farm, he will promise either to refuse the application, or not to grant it until the House has had an opportunity of expressing its opinion upon the proposed conversion to such a purpose of a considerable portion of a valuable open space near the Metropolis.

Mr. ALEXANDER BROWN gave notice, deferring his motion in respect to the Water Supply of Villages and Rural Districts from Friday, the 16th, to Tuesday, the 20th inst.

SATURDAY, FEB. 17.

Petitions against the Bolton Improvement Bill were presented from (1) Astley Bridge Local Board, (2) Halliwell Local Board.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

TUESDAY, FEB. 13.

(Before Lords Justices MELLISH, BAGGALLAY, and Sir W. B. BRETT.)

SUGG v. SILEER.

Mr. L. W. CAVE and Mr. R. E. WEBSTER appeared for the appellant (the plaintiff in the action); Mr. ASTON and Mr. HARRISON were counsel for the respondent (the defendant in the Court below).

This was an action brought by Mr. W. T. Sugg, gas engineer, of Westminster, for an infringement by the defendant of a patent taken out by the plaintiff for "improvements in gas-burners, and in the method of constructing and manufacturing the same." The case was tried before Justice Blackburn, in May last year, and reported at great length in the JOURNAL. On the trial, the jury found a verdict for the plaintiff, and the learned judge reserved a point of law as to the sufficiency of the specification. The Queen's Bench Division of the High Court of Justice, having heard arguments thereon, ruled that the specification of the plaintiff, in claiming two things, one of which was not the subject-matter of a patent, was bad, and consequently that the patent was void. The Court thereupon directed judgment to be entered for the defendant, and the plaintiff now appealed against that decision. The hearing of the arguments on the appeal commenced on the 10th inst., and were continued till this day.

In delivering judgment,

Lord Justice MELLISH said: In this case the objection to the patent which was taken at the trial was upon the ground that there was a separate claim for the means of manufacturing the gas-burners, and that that separate claim was for something which was not the proper subject-matter of a patent. In the first place, there appears to have been some question as to what actually passed at the trial. Now, I think it is quite clear that the learned judge at the trial assumed that it was admitted that these alleged improvements in manufacturing were not themselves new, so as to make the proper subject-matter of a patent, and that the points of law which he intended to reserve were two—viz.: First, the question whether the notice of objections was sufficient; and the other, and more material one—viz., Upon the true construction of this patent, is there a separate claim for the means of manufacturing the gas-burners separate and distinct from the claim for the improved gas-burners themselves. Now, it has been argued before us that the admission at the trial was simply an admission that casting and fixing together, in the mode described here, would not be in itself new, but that it was still open for the plaintiff to contend that, although it might not be in itself new, yet that the casting and fitting together, at one operation, the principal parts—that is, the supply-tubes—might be new. Now, certainly, that view seems to me quite

* Vide "Mémoires de la Société des Ingénieurs Civils," April 16, 1875.

clearly never to have occurred to the learned judge at the trial, nor does it seem to me to have occurred to the learned judges in the Court below. It is not mentioned at all in their judgment. They considered that what was really claimed here was the casting of the particular parts in one operation. Then the first question which arises is, Is that really open? Whose business was it, looking at the way in which the case was conducted at the trial, to have called the attention of the judge to the fact that the alleged improvement, in this part of it, consists simply in the casting at one operation? In my opinion it was the business of the plaintiff's counsel. When the learned judge put the question, and said that is admitted, and proceeded to reserve these two points, if they wished to say that there was a real novelty of invention because of the supply-tubes being fixed, in one operation, to the casting—if they meant to say that this was such an invention that it might possibly be the subject matter of a patent—I think it was their business to have said it at the time, and not to have allowed the learned judge to reserve the point upon the assumption that it was admitted that, in themselves, the alleged improvements in manufacturing were not the subject matter of a patent. But, notwithstanding that, if I thought it was a real misapprehension of what took place at the trial, and if I thought there was a real case to go to the jury, from which it could be reasonably expected that the jury might find that the addition of the supply-tubes to the casting did make an alteration so novel that it might possibly be the subject matter of a patent—if I thought there was any reasonable chance of that, I should be disposed to allow, not a new trial generally, but to allow an issue to be directed to the jury to try that particular question. But I am persuaded that this is a mere ingenious invention of Mr. Cave's, made for the purpose of arguing this case before us, and that it has not been seriously alleged by anybody—that is to say, by anybody who understands the scientific part of the question. It has not been seriously alleged by anybody that the putting in of the supply-tubes, at the same time with the casting, would make such a substantial novelty that a jury would find it to be a novelty, and I think we ought not to direct an issue simply for the purpose of trying something which necessarily, as it appears to us, must be found in favour of the defendant. Therefore the case must turn, I think, upon the two points that were reserved at the trial. With reference to the first—as to the notice of objections—the authorities cited by Mr. Cave were all cases where objections had been taken to the notices of objections at the time they were delivered, and further and better particulars were asked for. In my opinion, there is a very large difference between a case where a judge has ordered further particulars to satisfy the objection more specifically, and a case at the trial where the party ought to be prevented from availing himself of an objection, of which sufficient notice had not been given. It is perfectly obvious that if Mr. Cave was right in saying that the two questions are the same, and wherever the Court would order further particulars because the objections had not been particularly specified, it would also hold that the party was precluded from raising it at the trial, nobody would be foolish enough to go and ask a judge for further particulars, because it might be said, "You cannot rely upon this objection at the trial." In my opinion, at the trial, if the words had included the objection, for instance, although they do not specifically point, when the invention consisted of several claims, to which of the particular claims it alludes, but the general objection that the invention is not the subject matter of a patent, is sufficient to open the objection that the whole or some particular part of it is not the subject matter of a patent so as to make the patent bad. Therefore I am of opinion that the notices of objections were sufficient. Then we come to what is the real question which we have to decide—What is the construction of this specification, and does it claim the means of manufacturing separate and distinct from the making of the burners, and, what is also very material, is it, upon the true construction of the claim, confined to the mode of manufacturing any specific improved burners, or does it include the mode of manufacturing burners generally, so that if anybody adopted the first part of the specification he would infringe the second? That the patentee does really intend to claim the mode of manufacturing seems to be clear beyond all question. From the very title, and the course of the specification itself, it is plain that he does; because he begins by saying, "Improvements in gas-burners and in the method of constructing and manufacturing the same." He seems clearly to have thought, even from his title, that he had not only found out an improved gas-burner, but he had found out some novel method of constructing and manufacturing the same. I admit that the term, "the same," is ambiguous, and might mean either this particular improved gas-burner, or might be more general—so as to be generally an improvement upon the manufacture of gas-burners—and we must look to the specification to see which it is. He begins by describing the improvements, and the principle which he says he has discovered, and the mode which he adopts for applying that principle. Then, having done that, he begins: "The improvements in manufacturing the burners consist chiefly." That plainly is not merely describing how it is to be manufactured, which, no doubt, it would have been quite right that he should describe, whether he claimed it or not, but the words, "the improvements in manufacturing," lead one to suppose that he has found some improved mode of manufacturing, and he says, "The improvements in manufacturing the burners consist chiefly in casting and fixing together the principal parts constructed of metal at one operation." Then he goes on to describe how that may be done. Then there are the drawings showing the improved gas-burner, which had been described in the first part of the specification, and then we come to the claim which is the part upon which the whole question turns. He says, "Having now described and particularly set forth the nature of this invention, and the mode of manufacturing the improved burner, I would observe, in conclusion, that I do not confine or restrict myself to the precise details described or referred to, as variations may be made without deviating from the general method by which these improvements are produced." I look upon this particular part about the details more than the first part, because he means to say, "You may adopt my principle without adopting my details," and if you adopt his principle, I think he alludes more to that than he does to the second part, as to the mode of manufacturing. Then he goes on to say, "But what I consider to be novel and original, and, therefore, claim as the invention secured to me by the hereinbefore in part recited letters patent, is the constructing, manufacturing, and means employed in making gas-burners substantially as herein described." Now, it is perfectly plain, as it seems to me, that he does say beyond all question that he conceives the means of manufacturing gas-burners, which he has discovered, to be novel and original—that means that they are novel in themselves. I cannot construe that as simply meaning that they are novel because the gas-burners which are to be made by them are novel—that is not the natural meaning of saying that the means he has discovered are novel. He says, "I claim the gas-burners because they are new; but besides that I have discovered new means of making gas-burners, and because they are novel and original I claim those new means." That seems to me to be the fair mode of construing it. It has been said that it is superfluous. In a certain sense, no doubt, if it could be confined to this particular gas-burner it would be open to the

argument that has been mentioned, that inasmuch as there is a claim for making improved gas-burners, going on to claim the mode of making them is superfluous. But when the man tells you that he thinks the mode he has discovered is novel and original, that he thinks that it is new, and, therefore, claims it because it is new, he must mean to say, "I claim that new mode, whether you apply it to these gas-burners, or whether you apply it to any other gas-burners." It seems to me it is quite possible that a gas-burner might be made which would not necessarily be an infringement of the first part, and yet would be an infringement of the second part, if these means were really, as he says they are, novel and original. Therefore, in my opinion, it does come within the case of *Harwood v. The Great Northern Railway Company*. He has claimed the application of old means to the construction of that particular article to which they have not been applied before, and he has not shown that for the purpose of making that application any new invention, or any new discovery in mechanics, was required. He has simply employed means which are old. That is not the proper subject matter of a patent, and, in my opinion, the objection taken in the Court below was a good one, and their decision must be affirmed.

Lord Justice BAGGALLAY: I am of the same opinion, and for the same reasons. I should only be occupying time by repeating them, although I have every desire to give this specification a construction as favourable as possible to the patentee.

Sir W. B. BRETT: In this case it has been argued, on the part of the defendant, that the specification is bad, on the ground that it claims two independent inventions, and that one of those inventions is bad on the ground that it is a claim in respect of that which is not properly the subject matter of a patent. It was answered, on the part of the plaintiff, that, even supposing the objections to be good, they were not properly pointed out in the notice of objections, and that if they were properly pointed out in the notice of objections, that was not valid; and it was said on the part of the plaintiff that there was no claim to two inventions, but only one, and that, if there were two claims, both were good. It was further suggested—I will not say by whom or when—that, even though there were two claims, and the one was bad, yet that, under the circumstances, taking into consideration what the second claim was, the claim might be rejected as surplusage, and the specification would still remain good. Now, as to the validity of the notice of objections, it seems to me that the rule is, that where there is a notice of objection which points to an objection, but not sufficiently, such a defect can only be taken advantage of before the trial, and upon a motion for further and better particulars, and that the only question, if the objection taken is pointed out at all in the notice, is whether the notice is large enough to include the objection. If the objection taken at the trial is not glanced at at all in the notice of objections, it cannot be taken; but if it be glanced at at all, although only imperfectly, that is no objection at the trial. This being, as I apprehend, the rule, I think here the notice of objections was sufficient to raise the point which had been raised. With regard to the question whether this is a claim in respect of two inventions or not, I think it is a claim of two inventions, and not of one only. I think that is to be gathered both from the title of the patent and the words in which the improvements are claimed or described, and also from the claim itself. The title claims improvements in gas-burners, and in the method of constructing and manufacturing the same. There is, then, as it seems to me, the description of an alleged improvement in gas-burners, which description, made applicable by the drawings, is complete in itself, and shows that which, for the purpose of this judgment, is to be construed as an improvement in gas-burners. That is, an improvement in the thing when it is made. Then there is a further statement of improvements in manufacturing the thing, and in the mode of manufacture; those are separate, and are described separately and distinctly, and then the claim is in respect of these improvements. It seems to me that the claim, both of the thing itself and the mode of making something, whether it is the thing itself or not, is to be ordinarily construed. It is a claim, therefore, in respect of two inventions, both of which are inventions by way of improvement. The first, therefore, is a claim for an improved gas burner, and for the present purpose it is to be assumed that that is a good claim. The objection taken is to the second claim, which is as to the mode of making. It was said on the one side that the alleged improvement in the mode of making the burners was bad, whether it was applied only to the casting of the things in moulds, or whether it applied to the casting in moulds and the fixing this casting to something which was not cast, by one operation, that it was bad in either view. In the first place, it seems to me that it does not claim the mere casting; that what it does claim as an improvement is the casting, and the joining that casting to something which is not cast, by one operation. There was a misunderstanding at the trial, I really do think, as to the extent of the admission; but whether that be so or not, I agree with my lord that if we had thought there was any substantial reason for supposing that there might have been a question for the jury as to the facts upon which we should have to construe this, then I should have thought that there might be a new trial, so as to determine what those facts are. But I confess I can see very little colour for supposing that there is any real dispute as to the facts. As to saying the casting is a new process, that, of course, is simply ridiculous, and nobody suggests it. As to saying that joining something which is not cast, to that which is cast, in the moment of casting, is new, that has more colour in it, but very little more, to my mind, and I cannot think there is any real dispute about the matter. Therefore, whichever way you construe the second part of the patent, it does seem to me that it is a claim of something which is not the subject matter of a patent. But then comes the other point, and that is, that although it is claimed, and although the person who made this specification intended to claim it, yet it might be rejected as surplusage. Now, I take it the thing which is claimed at first is an improved gas-burner, and if that be new, the novelty of it would carry with it, of course, the right to the monopoly of it; and if any person were to make the thing substantially, or any substantial part of it, by any means, he would infringe. Therefore the right given to the patentee by that part of the claim, when he claims the thing itself, if the thing is new, gives him, in effect, the monopoly of every mode of making the thing, and his monopoly would be infringed by any mode of making it. Then if the second part, therefore, had claimed only one mode of making the particular burner, it would have claimed in the second part a monopoly of that which, as it would seem to me, had already been obtained by the first part—it would have claimed over again a monopoly of that which is, in effect, claimed and granted in the first part; and if we could have construed the claim to be of the second part, one of the modes of making the burner which is claimed in the first part, I cannot help thinking, and my impression is that it would have been claiming in a superfluous way that which was already obtained in the first part. The truth is, that there is a defect in the formation of this specification; that which we call the second part is made to play a double part, one which is proper, and one which is improper. It is made to play the part of describing the mode of making the burner which is claimed in the first part—that is proper, and I should apprehend it was necessary—but the inventor, or the person who drew the specification for him, has tried to make it claim not only that part but another part—namely, by a

description not only of the mode of making the thing in the first part, but the making of a claim, and an independent claim, in the second part. Although he has made that mistake, if it had pleased Providence that he had confined his mistake to this—to claiming only one mode of making the burner claimed in the first part—as I said before, I should have thought we might have treated that as a superfluous claim, as claiming that which was already claimed and obtained, and we might have said, therefore, that it would not damage the patent, of which the first part was quite good. But that point depends entirely upon this, whether, when we come to look at the claim, it really is a claim of one mode of making this burner, or whether it is a claim of this mode of making any gas-burner, and, although in the second part I think the description of the mode of making the gas-burners is a description of the mode of making these burners only, and although I think, in the preparatory part of the claim it is confined to the mode of manufacturing the burner, yet I cannot think, upon any honest construction, I can say that the claim is not larger than the description, and I cannot properly say that the claim is not in respect of all gas-burners. That depends, as I ventured to point out before, upon which of the words you are to join the adverbial phrase, “substantially as herein described,” to; and if I thought that we could have defined that phrase, as applicable only to the words “gas-burners,” then I think it should have been read, “the gas-burners herein described,” and that would have been the same as “the gas-burners,” and then it would have been confined to a claim of making these gas-burners, and, as I said before, might have been treated as a superfluity. But I think the only grammatical construction of that claim, and the only honest construction, if we are to take into account what is the obvious intention of the man who thought that this mode of doing the thing was new, is that the phrase is to be applied to the words “constructing, manufacturing, and means employed in making,” and is not applicable to the words “gas-burners.” Therefore, that part of the claim is to be read as if it were “the constructing substantially as herein described, and the manufacturing substantially as herein described, and the means employed in making, substantially as herein described,” not “the gas-burners,” but “gas-burners.” It is, therefore, a claim of applying the improvements in manufacturing not only to these gas-burners, but to all gas-burners; and if that be true, it is not superfluous, but it is an independent claim of an independent invention, and being a claim of a mode which is not only not novel, but which has this greater fault, that it is a mode of doing things which is known to all the world, and which has been known to all the world, therefore the defect is not that he is claiming something which is not novel, but that he is claiming something which is not the subject matter of a patent at all. That, therefore, is bad, and the badness of that part of the claim, unfortunately, until disclaimed, makes the whole specification bad, and makes that which was the former good part of the patent, until there is a disclaimer, bad also. Therefore I think the judgment of the Court below was right.

Mr. ASTON: The appeal will be dismissed with costs, I presume?

Sir W. B. BRETT: The costs follow.

GREENWICH POLICE COURT.—FRIDAY, FEB. 16.

(Before Mr. PATTESON.)

BREACH OF CONTRACT OF SERVICE BY GAS STOKERS.

Six summonses were entered for hearing against men employed as stokers at the works of the Phoenix Gas Company at Greenwich, to show cause why they should not compensate their employers for the loss they had put them to by leaving their employment without notice.

Mr. HALE, solicitor, who appeared on behalf of the company, said that it was with reluctance that the present proceedings were taken against the defendants; but the company believed it was a public duty to do so, as the act of gangs of men leaving their employment without notice might place the whole district in darkness. The defendants had signed an agreement to work by the week, and a week's notice was to be given on either side. On Saturday evening, the 3rd inst., the defendants ought to have resumed work, but they kept away, and the men at work on Sunday evening had extra work to perform. It was the practice of the engineer of the works to prevent work being done between six o'clock in the morning and six in the evening of Sunday.

Mr. POOK said he represented all the defendants, and he had to express their sorrow for what they had done. He would suggest, as he had already suggested to Mr. Hale, that the costs of the proceedings should be borne by the defendants, and the day's money due to each should be retained. The men were willing to return to their employment.

Mr. WATES, the company's engineer, said he was willing that this course should be adopted.

Mr. PATTESON told the defendants that the company had acted most leniently towards them, and they then left the Court.

WOLVERHAMPTON POLICE COURT.—FRIDAY, FEB. 9.

(Before Mr. SPOONER.)

REFUSAL TO SUPPLY GAS FOR NON-PAYMENT OF RENT.

Mr. G. A. Davenport, chemist and druggist, of Queen Square and Chapel Ash, summoned the Wolverhampton Gas Company for illegally cutting off the supply of gas to his two places of business.

Mr. PLUMPTREE appeared for the plaintiff, and Mr. UNDERHILL for the defendants.

The case for the plaintiff was that, in the year 1874, he, believing that the gas-meter supplied to his Chapel Ash premises by the defendants was incorrect, made a complaint to that effect, and alleged that he was thus charged for more gas than he consumed. He was desirous to have a dry meter fixed at each house, but this the company objected to, and eventually it was arranged that the suspected meter, which was on the premises at Chapel Ash, should be removed, and sent to London or Birmingham to be tested. If found to be correct, the expense was to be paid by Mr. Davenport; if incorrect, by the company. The meter was never returned to him, but he was informed that the result of the test showed that it was accurate. Plaintiff declined to pay £4, the cost of testing, and the matter had remained unsettled up to the present time. Eventually the company sent him an account for £23 odd for gas supplied, but against that he had a claim for £19 as a set-off for goods supplied, leaving a balance of over £4 alleged to be due to the gas company. After considerable correspondence between the parties, the dispute not being settled, on the 27th of January the company cut off the supply of gas at both his shops, and it had been cut off ever since. Although the complainant did not claim any penalty, the penalty was 40s. for each day that the gas was cut off improperly. The plaintiff contended that, under the circumstances, the company were not entitled to cut off the supply at all, but must recover by civil proceedings as for ordinary debt, and that, even if they were entitled, their power of suspension of supply was confined to the premises at Chapel Ash, which was the disputed supply.

Plaintiff, in his evidence, stated that, owing to his having been involved in a heavy Chancery suit in 1874, he deemed it advisable, amongst other things, to reduce his burning of gas to enable him to find funds for the Chancery suit. Instead of his gas bill being very much lower, he found that it increased. He said the company took away the meter about

which he complained, and he had never heard of the result of the test from the day it was removed up to the present time. He spoke to a number of disputed items in the accounts between the company and himself, and also as to paying the account from September to December 31, which he did not dispute. He did not pay under a threat to cut off his supply.

In cross-examination, plaintiff said he had never promised Mr. Manby to pay the money in dispute if he was allowed time until after Christmas. He was still without gas at the present time.

Confirmatory evidence having been given by Mr. C. A. Davenport, a son of the plaintiff,

Mr. UNDERHILL addressed the magistrates on behalf of the defendants, and submitted that the Bench had no jurisdiction to make an order under the summons, as by their Act the company were authorized to cut off the supply of gas when a consumer neglected or refused to pay his gas-rent.

The MAGISTRATE said the point he had to decide was whether there was any actual dispute between the complainant and defendants, and if so, whether the latter were bound to proceed with the cutting off the supply, particularly with regard to the Queen Square shop.

Mr. UNDERHILL said the arbitrary powers of the company were given them to meet cases exactly like the present one, the complainant being one of those persons who trouble the company to the very last.

The MAGISTRATE said that though he considered the question of dispute was merely nominal, if not a sham, yet he also thought that the gas company had acted harshly in the matter. They ought to have taken steps to recover the gas-rents due, before cutting off the supply of gas.

Mr. UNDERHILL said nothing could have been easier than for Mr. Davenport to pay the money in dispute under protest, and then he could have brought his action for an illegal demand.

The MAGISTRATE said he found entirely that the question of dispute raised was “a mere sham,” but he still thought that the company had acted harshly in cutting off the supply of gas at both shops. He decided for the gas company by dismissing both summonses, but gave them no costs.

The summons with respect to the Queen Square shop was dismissed, subject to the complainant taking a case for a superior Court.

NORWICH POLICE COURT.—FRIDAY, FEB. 9.

(Before Messrs. BETTS, HARVEY, REEVE, WELLS, and BARNARD.)

CONVICTION FOR FRAUDULENTLY DISCONNECTING A METER.

William Sillis, of the “Excise Coffee-House” public-house, Goat Lane, was summoned for feloniously stealing 20 cubic feet of gas, of the value of one penny, the property of the British Gaslight Company, Limited. He was further charged with causing to be laid a certain pipe to communicate with a certain other pipe, for conveying gas to his premises, belonging to the said company.

Mr. A. PRESTON (solicitor to the company) prosecuted, and having opened the case to the Bench, called the following witnesses:—

Mr. E. Crowe, an inspector in the employ of the company, said that about half-past seven on Saturday-night, the 3rd inst., he went with another inspector, named Metcalfe, to the defendant's house. The defendant and Mr. Fiske were behind the bar. Witness called for some beer and gin for Metcalfe and himself. Defendant then asked witness to have something at his expense, but this witness declined, and told defendant he wanted to have a word with him. Witness then passed behind the bar, and went into a kind of lobby, and told Mr. Sillis that he wanted to look at the gas-meter. Defendant said he could not see it that night. Witness replied that he must see it, and defendant said, “What do you want to see it for?” and witness replied, “For the purpose of taking the register,” and that he was specially sent, and must not leave the house until he had seen it. Defendant then said, “You can leave the house for a few minutes,” but witness said he could not do that, as the Act gave him power to see the meter at any time. Defendant thereupon told witness to go across the way and get a glass, adding that he would “square” him when he came back. Witness said that would have no weight with him, and that he would see the meter. Defendant said, “I am a poor, hard-working man, and do you want to ruin me? What do you want to do to me?” Witness said he had nothing to fear, but if he refused to let him see the meter he must send for Mr. Hoddy. Defendant asked who Mr. Hoddy was, and witness replied that he was the chief clerk at the company's town office. Defendant then left witness, and went into the bar, and had some conversation with Fiske, which witness could not hear. Sillis then went down a trap-door at the back of the counter into the cellar, and Fiske stood on the trap-door. Witness waited quite a quarter of an hour without seeing Sillis again, and for about two minutes of that time the gas went very nearly out. When defendant came up from the cellar witness went down with him. When there Sillis said, “Now what do you want?” and lifted up the door of the meter, and asked witness what the register was. Witness told him, and defendant asked what the last register was, but this witness did not know. Witness then looked about the place, and after examining the meter he told defendant that the meter unions had been tampered with. Defendant said, “What do you mean?” and witness said that he was sure the pipes had been tampered with. The pipes were mouldy, but the unions were bright. Witness saw Mr. Hoddy at the top of the steps, and called him down; and when he came down witness repeated his charge against defendant, but he said that he knew nothing about it. Witness asked defendant to produce the pipe with which he supposed the tampering had been done; but defendant said he knew nothing about it. Mr. Hoddy said he would have a search warrant, and the defendant said they could search where they liked. They did search the cellar, and in a kind of dead well witness found the piece of pipe produced. It consisted of two pieces of iron bend fastened together with a piece of india-rubber tube. It was about 1½ inch in diameter. As it was it would exactly fit upon the two unions each side of the meter, so that the gas passing through it would not go through the meter. When witness first found the pipe it smelt very strong of gas, and the screws had the appearance of having been very recently used.

In cross-examination by Mr. LINAY, who appeared for the defendant, witness said he had fitted the pipe produced upon two unions exactly the same as on Sillis's meter, and it fitted exactly. The screw was bright when he first saw it. The distance from the inlet-pipe to the outlet-pipe corresponded precisely with the length of pipe produced. It was possible to disconnect two pipes, and lights continue to burn for two minutes. It was a very uncommon thing for the unions to be bright; but if repairs had been recently made to them, that would tend to brighten them, but would not make them as bright as they were on defendant's meter.

Mr. REEVE asked Mr. Preston to let witness take the pipe down to the defendant's house and fit it upon the unions in the presence of a policeman and Mr. Linay's clerk; for if they did not fit, there would be an end to the case for the prosecution.

Mr. Metcalfe, the other inspector, corroborated the last witness.

Mr. R. W. Hoddy said that on Saturday last he went to the defendant's house about eight o'clock, with Metcalfe and a police officer. He went down the cellar and inspected the meter and unions. They looked bright, as if they had been recently disturbed, and witness accused defendant of having used a pipe for the purpose of obtaining gas without its passing through the meter. The pipe was large enough to supply half a street.

In cross-examination by Mr. LINAY, witness said that defendant's gas bill had increased since the last quarter. The bills for the months of December and January were about the same.

In answer to Mr. REEVE, witness said that he gave the man special instructions to go to defendant's house, as he had suspicions that such an instrument was being used by the defendant.

Mr. Crowe, recalled, said that he had just been to the defendant's house, and the piece of pipe produced exactly fitted the unions on defendant's meter, and it could be so applied as to obtain gas without its going through the meter.

In answer to Mr. LINAY, witness said he could not fit the pipe on the meter without taking it down from a shelf. He did not notice that the shelf was very dusty, and that it had the appearance of not having been disturbed for a long time. He did not notice that when the meter was disturbed, a quantity of corks and a bung fell from behind it. Witness considered that the meter could be taken down and the connexions made in the space of one or two minutes.

The BENCH, after hearing Mr. Linay, decided to hear the other cases before adjudicating upon this.

The same defendant and *James Fiske* were then charged with having hindered Edward Crowe, duly appointed by the company, from entering a certain place, viz., a cellar, to ascertain the quantity of gas consumed or supplied by them. Crowe having given evidence similar to that in the first case, Mr. Linay submitted that there was no case against them, as in the first place Crowe did not even ask Fiske to let him go down the cellar, but when he said he must go, Sillis came up, and they then went down together, and therefore he could not see how Crowe had been hindered in any way whatever.

Mr. PRESTON said he would withdraw the case of stealing gas.

The CHAIRMAN characterized the offence as a very grave one, as it would be a very serious thing for the shareholders of the company if they were robbed in this way by people whom they supplied with gas. For the first offence, Sillis would be fined £5 and £1 17s. costs, or two months imprisonment. In the second case he would be fined £2 and 7s. costs, or one month's imprisonment. The case against Fiske would be dismissed. In the event of the fines not being paid, they would be levied by distress.

WARRINGTON POLICE COURT.—FRIDAY, FEB. 16.
(Before Aldermen HOLMES and Mr. RIGBY.)
A GAS STOKER SENT TO PRISON.

Edward Lucie, a stoker in the employ of the Warrington Gas Company, was brought up in custody under the Masters and Servants Act, and charged with breach of contract.

Mr. *Paterson*, the manager, said that the prisoner had absented himself from his work without leave on Sunday and Monday last. The foreman called upon him on Sunday night, and he promised to come the next day, but he failed to do so. The loss the company had sustained through his absence was considerable, but it was estimated at the nominal value of 20s. Several of the men had also absented themselves, and it was necessary to press this case as a warning to others. There was a notice put up in the works stating the consequence of their absenting themselves without leave, but it had no effect.

The prisoner said he did not feel well on Sunday, and that was the reason he did not go. He admitted having wilfully remained away the next day.

The MAGISTRATES said the Act gave them no option in the matter, and sentenced him to 21 days imprisonment with hard labour.

LEEDS POLICE COURT.—WEDNESDAY, FEB. 14.
(Before Mr. BRUCE.)
ILLEGAL USE OF CORPORATION WATER.

Mr. *Samuel Wolfe*, of the Leeds Lead-Works, New Briggate, was summoned, under the 43rd section of the Leeds Improvement Act, for having used the Corporation water for purposes other than that for which it had been agreed to be supplied.

The TOWN-CLERK prosecuted, and stated that the defendant had been supplied with water for building a number of houses in St. George's Terrace, and without permission he had taken the water into one of the houses and used it for domestic purposes.

The Defendant pleaded guilty, and was fined £10.

ABERDEEN POLICE COURT.—THURSDAY, FEB. 8.
(Before Bailie SMITH.)
CONVICTION FOR STEALING GAS.

Timothy Shaw, shoemaker, residing in the Gallowgate, was charged with having contravened the Aberdeen Municipality Extension Act, in so far as during the three months prior to the 31st of January last he had fraudulently prevented the index of the gas-meter placed in his house from duly registering the proper quantity of gas supplied.

Defendant pleaded guilty.

The BAILIE said it was an offence that must be put a stop to, for only the other week he had had to deal with a similar case. It was as mean an offence as one could possibly commit, seeing the price of gas was not dear, and it was an offence against the whole community of Aberdeen. Defendant would have to pay a fine of £4, with the alternative of 40 days imprisonment.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

COURT OF COMMON COUNCIL.—At the meeting of the Court on Thursday last, the Gas and Water Committee reported the proceedings they had taken during last year under the several references relative to the Metropolitan Gas Companies Bill in Parliament. The report ended by stating that the Remembrancer had reported to the committee that he is, under the orders of the Corn and Coal and Finance Committee, by the authority of the Court, promoting a Bill for giving various powers to the Corporation, and that he proposes in that Bill to correct a mistake made last session in The Gaslight and Coke Company Act; and the Remembrancer further reported that the Metropolitan Board of Works concurred in the steps he had taken. The mistake was the omission of the 91st and 92nd clauses of the City of London Gas Act, 1868, which it was intended to embody in the new Act. On the motion of Mr. Shuter, the report was adopted.

METROPOLITAN BOARD OF WORKS.—At the meeting of the Board on Friday last, the Works and General Purposes Committee made a report in which they recommended that Mr. Addenbrooke be appointed Gas Examiner to test the gas supplied by the Commercial Gas Company, at the two testing-places fixed by the Gas Referees in Wellclose Square and Parnell Road, at a salary of £150 per annum. The other conditions of his appointment being the same as those attached to the appointment of the other Gas Examiners. They further recommended that the Board of

Trade should be informed, with reference to the letter of the Gas Referees, as to the difficulty of fixing testing-places, in consequence of intercommunication between the mains coming from different works, that in the opinion of the Board the difficulty can only be removed by an amendment of the Act of Parliament. The Clerk read a letter from the Woolwich, Plumstead, and Charlton Gas Company, in answer to a communication from the Board, asking whether, in the Bill promoted by them this session, they were willing to adopt the provisions of the South Metropolitan Gas Act of last year, so far as they relate to price, illuminating power, and mode of raising capital. The company stated that they had referred the matter to their parliamentary agent for consideration. This reply not being deemed satisfactory, the Board resolved to petition Parliament against the Bill, so as to obtain a *locus standi*.

Dr. Stevenson's report on the gas supplied by The Gaslight and Coke Company to the vestry of St. Pancras, during the month of January:—Maximum light, estimated by sperm candles, according to the Act—17.5. Minimum light, sperm candles—16.1. Average light, sperm candles—16.3. Traces of ammonia, indicated by turmeric test-paper—Traces on all occasions. Traces of sulphuretted hydrogen, indicated by lead test-paper—none. Sulphur determinations not given, as a leakage was discovered in the meter, which vitiated the experiments.

Dr. Whitmore's report on the illuminating power, pressure, and quality of the coal gas consumed in the parish of Marylebone, supplied by The Gaslight and Coke Company, during January:—

	Illuminating Power in Sperm Candles.			Mean Pres- sure in Tenths of an Inch.		Mean Quantity of Sulphur in 100 Cu. Ft.	Mean Quantity of Ammonia in 100 Cu. Ft.	Sulphu- retted Hydrogen.
	*Mean of 24 Obser.	High- est.	Low- est.	High- est.	Low- est.	Grains.	Grains.	
Gas supplied from the Fulham works	16.35	17.59	15.91	22.26	8.44	15.66	0.53	No trace
Gas supplied from the Beckton and Bow works	16.08	17.04	15.52	29.38	15.01	11.99	0.46	No trace
Cannel gas supplied from the Pimlico works	20.40	21.40	19.31	18.61	11.52	15.40	0.53	No trace

Mean of daily readings of barometer 29.61
" " " thermometer 58.99
* Each observation consists of ten readings of the photometer, at intervals of one minute.

The mean illuminating power of the gas supplied from the Fulham works was equal to 16½ candles, from the Beekton and Bow works to rather over 16 candles, and of the cannel gas from the Pimlico works to about 20½ candles; they ranged from about half a candle under the standard to a candle and a half above the standard. The mean quantity of sulphur found in 100 cubic feet of the Fulham gas was 15½ grains, and of ammonia half a grain; in the gas from Beekton and Bow the sulphur amounted to a mean of 12 grains, and the ammonia to less than half a grain; and in the cannel gas the sulphur amounted to a mean of 15½ grains, and the ammonia to half a grain. The night pressure of all the gases was very good, but the day pressure of the Fulham gas was occasionally low. No trace of sulphuretted hydrogen was on any occasion found in either of them by the ordinary tests.

METROPOLIS WATER SUPPLY.

The Registrar-General publishes the following return of the average daily quantity of water supplied by the London Water Companies during January. According to this, 112,205,609 gallons, or 509,801 cubic metres of water (equal to about as many *tuns* by measure, *tons* by weight), were supplied daily; or 212 gallons (96.1 decalitres) rather less than a *ton* by weight, to each house, and 29.8 gallons (13.5 decalitres) to each person, against 30.1 gallons during January, 1876.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	Jan., 1876.	Jan., 1877.	Jan., 1876.	Jan., 1877.
Total supply	523,487	530,464	112,034,444	112,205,619
From Thames	245,766	247,965	56,732,457	56,521,086
„ Lea and other Sources	277,721	282,499	55,301,987	55,684,533
THAMES.				
Chelsea	28,600	28,737	6,709,800	6,869,000
West Middlesex	47,490	48,762	9,252,877	9,290,314
Southwark and Vauxhall	80,322	77,800	18,100,000	17,500,000
Grand Junction	36,036	37,055	10,380,880	10,858,962
Lambeth	53,318	55,611	12,288,900	12,002,800
LEA AND OTHER SOURCES.				
New River	124,056	125,100	26,089,000	25,192,000
East London	109,375	111,967	22,562,000	23,902,000
Kent	44,290	45,432	6,650,987	6,590,533

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for January, 1877, as compared with that for the corresponding month of 1876, shows an increase of 6977 houses, and of 171,165 gallons of water supplied daily. A decline of 2522 was shown in the number of houses supplied by the Southwark and Vauxhall Company, in consequence of their having withdrawn their supply from Richmond.

Dr. Frankland, F.R.S., reports, as the results of his analysis of the waters supplied to the inner, and portions of the outer, circle of the Metropolitan during the month of January, that, taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the last nine years as unity, the proportional amount in an equal volume of water supplied by each of the Metropolitan Water Companies, and by the Tottenham Local Board of Health, was—Tottenham 0.7, Kent 1.3, Colne Valley 1.4, New River 5.0, East London 5.1, West Middlesex 6.0, Lambeth 6.0, Grand Junction 6.9, Chelsea 7.0, and Southwark 8.0. The Thames continued in high flood during the month, and in consequence the water delivered by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies, was again much polluted by organic matter of a very objectionable origin. Although the pollution was somewhat less intense than in December, the water was still quite unfit for dietetic purposes, even when delivered in an efficiently filtered condition. The West Middlesex was, however, the only company, drawing from the Thames, who sent out to their customers efficiently filtered water; the supplies of the Lambeth, Southwark and Vauxhall, Grand Junction, and Chelsea Companies contained moving organisms, and the water of the three last-named companies fungoid growths. The water of the Lea, though better than that of the Thames, was much more

polluted in January than in December, and was unfit for domestic use. The East London Company filtered this water efficiently, but the New River Company supplied it in a slightly turbid condition, and moving organisms were found amongst the suspended matters. The water supplied from deep wells to the inner circle by the Kent Company, and to the outer circle by the Colne Valley Water Company and the Tottenham Local Board of Health, was entirely unaffected by the long continued rains and floods. It was palatable, bright, and sparkling, and contained only mere traces of organic matter, and was of most excellent quality for dietetic purposes. The water of the Colne Valley Company is softened by lime before delivery, and is thus rendered serviceable for washing and bathing. Whilst the Kent and Tottenham waters have respectively 28° and 33½° hardness, the Colne Valley has only 5°. The proportion of total solid matters in solution is also correspondingly reduced by this softening process. It was water from this source and this quality which the Rivers Pollution Commission recommended to be gradually substituted for the water supplied to inner London. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and Tottenham waters were clear and colourless, the East London was clear and very nearly colourless, the West Middlesex clear and pale yellow, the New River slightly turbid and very pale brown, the Lambeth slightly turbid and pale brownish yellow, the Chelsea slightly turbid and pale brown, the Grand Junction slightly turbid and brownish yellow, and the Southwark turbid and brown.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Mat- ters.	Or- ganic Car- bon.	Or- ganic Nitro- gen.	Ammonia.	Nitrogen, as Ni- trates and Nitrites.	Total combined Nitro- gen.	Chlo- rine.	Total Hard- ness.
Inner Circle.								
Thames—								
Chelsea	27.52	.355	.058	0	.244	.302	1.42	17.4
West Middlesex	27.94	.285	.071	0	.289	.360	1.47	18.0
Southwark and Vauxhall.	27.60	.403	.067	0	.228	.295	1.45	18.3
Grand Junction	28.20	.335	.071	0	.239	.316	1.50	18.4
Lambeth	30.20	.296	.058	0	.320	.378	1.65	19.1
Other Sources—								
New River	30.20	.255	.041	0	.333	.374	1.50	20.3
East London	31.40	.249	.051	0	.236	.281	1.72	19.7
Kent	43.68	.056	.021	0	.472	.493	2.35	28.1
Outer Circle.								
Colne Valley	12.26	.059	.025	0	.310	.335	1.35	5.0
Tottenham Board of Health	55.52	.028	.015	.032	1.450	1.491	4.52	33.5
Corporation of Birming- } ham*	27.02	.528	.093	.003	.154	.249	1.40	19.6
Corporation of Glasgow†.	2.00	.151	.053	.002	.003	.058	.71	.7

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of the Andersonian University, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

Dr. Whitmore's report on the composition of Thames companies and other waters supplied to Marylebone during January:—

	In Grains, per Gallon.			In Parts, per Million.			In Degrees.	
	Total Solid Matter.	Loss by Incine- ration.*	Chlo- rine.	Free Ammo- nia.	Albu- minoid Ammo- nia.	Hard- ness.	Hardness after boil- ing Fifteen Minutes.	
West Middlesex	20.32	1.00	1.18	.026	.099	14.1	3.2	
Grand Junction	20.42	1.12	1.21	.016	.108	14.2	3.3	

* The loss by incineration represents the amount of organic and other volatile matters contained in the Imperial gallon (70,000 grains) of water.

During the month the water supplied by the West Middlesex Company maintained its customary clearness and brightness; the water supplied by the Grand Junction Company was, on two or three occasions, slightly turbid and coloured. The heavy rainfalls in the month rendered the water of the Thames at times very turbid.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The Second Annual Meeting of this Association was held at the Bedford Hotel, Southampton Row, London, on Thursday, the 10th inst. There were 17 members present.

Mr. ELDRIDGE (Richmond) was called to the chair, and he proposed that Mr. Wood, of Hastings, should again be asked to act as president, he having so ably filled that post during the past year; and considering the youth of the Association, and the manner it had progressed under him, it would be much to its advantage to re-elect Mr. Wood.

The proposition was carried unanimously, and Mr. Eldridge vacated, and Mr. Wood took the chair.

Messrs. West and Farrand were elected committeemen in the place of Messrs. Parlyb and Price, retiring by rotation. Mr. Eldridge was again elected treasurer, and Mr. Chapman honorary secretary. Messrs. Botley and Price were elected auditors. Five new members were added, making a total of 32 since the formation of the Association, at the end of the year 1875.

The PRESIDENT then read the following address:—

Gentlemen,—Allow me to thank you very cordially for the confidence you have manifested towards me in again asking me to take the presidential chair of this Association. I confess, without any mock-modesty, that I hoped some one of our members, better qualified than myself, would step forward, and allow me to drop back into the ranks; but, as it seems to be desirable that as little change as possible should take place in the management of the Association for another twelvemonth, I bow to your invitation, and promise, however humble may be my efforts, that I will do my best for the interests of the society.

The Association is as yet young, but has, as a district one, been in every way all that we expected. It is distinctly understood amongst us that our meeting together should be of the most communicative character. We are anxious to drop as much of formalities as it is possible to do, consistent with the interest and object of our meetings, and to show as little reserve, and throw open for each other's use all those details in gas manufacture which could not be done in a more extensive Association in the way that we can do in our mutual gatherings.

That this has been fully attained no one who has met with us can for one moment doubt. The very nature of the papers that we have had, and more especially the nature of the discussions on them, have proved this to be the case. There has been a frankness and an openness of communication in all our meetings, which, by being thoroughly unrobed from ordinary

speech-making, has been productive of a large amount of interest, and I may conscientiously add profit; and the questions which have been asked and answered have proved beyond a doubt the willingness of one and all to add to the general store of information.

If we take a short review of the papers we have been favoured with, we shall, I think, find all that I have advanced fully borne out. First, we had Mr. West's paper on "Mechanical Stoking;" and, although many of us had both heard Mr. West, and seen the apparatus in operation, the subject had lost none of its interest; but, when we came to the discussion, the value of our proceedings was specially manifest. The pertinent questions which were good-humouredly hurled at the reader by dozens, and the satisfactory answers which were as readily given, proved the value of our chit-chat meetings, and of our mutual mode of proceeding, beyond a doubt.

Then we were favoured with a very useful and practical paper by Mr. Scott, "On the Setting of Retorts." Iron retorts had their share of discussion (and, perhaps, a little more than their share), and clay retorts had their share—every question relative to shape and size, large settings and small, benches and drafts, furnaces and chimneys, was thoroughly ventilated; and one and all owned we had had a most useful and instructive meeting.

Our third meeting was profitably occupied by discussing the very trying and perplexing question of one of our most important residuals—"Coke." Every one regretted that Mr. Farrand, from indisposition, could not be with us to read his paper on this subject, and join in the discussion; still he was well represented, and the subject received its due consideration. I am afraid, from the mildness of the past winter, and the consequent sluggishness of the market in this residual, that we may have to consider the subject again, and I am not at all sure that some mechanical means of crushing coke, so as to enable us to sell it as breeze or ashes, might not enable us to realize better financial results than the present low prices yield us. Ashes are, in some districts, in such demand for brick-making, and realize such a high price, while coke itself is low, that it becomes simply the question of labour and expense of crushing, as to whether it will not yield better results to make coke into ashes than to sell it as it is.

Our last meeting was occupied by considering the important question of "Washing and Scrubbing,"—ably brought forward by Mr. Eldridge. All the old means of washing, as well as all the new, were fairly and properly discussed. The Coffey still had another hearing, and all agreed that both the paper and discussion were not only very instructing, but also interesting. It is an important subject, and well deserves further consideration.

Nor have I the least fear but that our future papers will be fully as interesting as the past ones have been, as there is not one of the multitudinous qualifications of a gas manager that may not form a profitable subject for discussion; a gas manager consisting of almost every variety of commercial, mechanical, and chemical qualification rolled into one individual, and that individual supposed to be possessed of all the details of each subject, and ready at any moment to answer any and every question referring to it.

Take, for instance, the all-important subject of carbonization of coal. There is, in the first place, the commercial qualification to be brought out in the purchase of the yearly stock—and this sometimes involves considerable anxiety and forethought—the proper coal to purchase, the best time to make the contracts, the different times of delivery, are all, more or less, questions which require mature consideration. Then, in other cases, the mode of transit; and, if by water, the best time to make freight contracts, together with cartage, trimming, and other matters connected with storing, all tax the commercial part of the gas manager. Sometimes an extra discount can be procured on the coal. At other parts of the year freights vary to a considerable figure per ton. Sometimes railway authorities are squeezable to the extent of a few pence per ton; and, at other times, cartage, delivery, trimming, &c., can be contracted for at a lower figure than at other times. All these things put together, and multiplied by some thousands of tons, make important items in the financial condition of the company, and frequently have an important influence on the half year's dividends. Hence the necessity of the gas manager being a truly commercial man, and keeping himself well informed on those points referring to the commercial interests of his company; and I do not know of any better means of promoting this than by meetings like our own. On this subject we proved their value in 1872, and may, perhaps, have to do so again.

But no sooner has the manager carried out this commercial part of his undertaking, than his skill has to be exerted in the mechanical department, hence the very valuable paper by Mr. Scott, to which I alluded just now; and here a mixture of his commercial and mechanical qualifications of necessity crops up. Not only which is the best bench and setting of retorts has to be considered, not only their size, shape, and number, but which are the best in construction, which endure most wear and tear, which are made of the best material, which are the most lasting. It costs as much to set a bad retort as it does a good one, and, therefore, it requires but little calculation to prove that a retort may be 6d. or 9d. per foot run higher in price in the first instance, and yet may be cheaper in the end, and all this the manager has to consider before he commences to carbonize his coal.

And now comes the necessity of a still further admixture of qualifications. Some amount of chemical knowledge here makes itself manifest. I once heard of a manager—at least, one who had the responsibility of a manager—who said he did not bother himself about high or low heats, nor did he know anything about quality or illuminating power. What he did was to put the coal into the retorts, and out came the gas into the holders. This was all he knew, and all he cared to know. I confess this was some 25 or 30 years ago, the acknowledgment being made on his being asked to adopt a photometer. I am not at all sanguine that this gentleman's certificates would secure him a very lucrative appointment in the present day, nor am I aware how long his qualifications retained to him his then position. Certain I am that it would not do now, and that if he did not increase his knowledge apace, some one of his younger brethren would want his shoes.

But here, I say, the properly qualified manager has to exert his skill and chemical knowledge in addition to, and intermixed with, his mechanical experience. He has to decompose his coal into its constituent parts, and he has to do this in the most economical manner. Some are contented if they can make 9600 or 9700 cubic feet of gas from a ton of Newcastle coal, others hold the doctrine that if there be 10,000 cubic feet in the ton, it ought to be had out. The man who argues for the smaller quantity can afford to work with rather lower heats, with less wear and tear on his retorts, and probably a less per centage of cannel to make up his illuminating power, while the 10,000 man has to drive at very high heats, or use less charges, use more cannel, and condemn his retorts at a less age. Which of these two is the better? Which is the more economical? Which in the end makes the most of his ton of coal? Or, in still plainer terms, which yields the best financial results? This is an important question, which can sometimes only be decided by the manager in charge, and who is sometimes governed by circumstances of a local character, that do not so much affect another place. I am not here to-day

to give an opinion as to which of these courses is the best; but I throw out these hints as being suggestive of a good and useful subject for discussion.

One thing here I feel it my duty to make a remark upon, and that is that there should be no interference of the directors in these matters. I say it with all due respect, that directors, as a rule, are not competent to judge what coal should be used, or how much gas should be made from it. I have known cases where an inferior coal has been forced upon the manager, and yet the highest results expected from him. This is altogether an anomaly; you might as well expect "grapes from thorns, or figs from thistles," as to expect the highest results from a second-class coal. The coal should be of the highest class, and then the manager may be expected to yield good results at the end of the financial period, whether he be a 10,000 feet man or not.

And what are condensing, washing, scrubbing, and purifying but the true employment of a manufacturing chemist? Chemical combinations are continually going on, impurities attracted by stronger allies, ammonia, sulphur, and other impurities, extracted and left behind, while the gas, in its cleansed and purified form, passes on, until it is produced fit for the consumers' burners; all this is the work of a true practical chemist. And question upon question arises in the thinking manager's mind as to the best and cheapest mode of carrying out these operations. Shall we have old-fashioned scrubbers, *douché* scrubbers, washers, or the Coffey still? Shall we fill up our scrubbers with boulders, coke, drain-pipes, furze, boards, or some other unheard-of material? Shall we work with a pressure from these, or aim at working without? All these questions the manager has to decide, and adopt that which promises him the best results with the least wear and tear and cost.

The same remarks apply to purifying. Some works, and large ones too, still use only lime for purifying, others use oxide of iron, and some a combination of the two; and then comes the question again, which is best? No doubt locality has much to do in deciding this question. Lime may be used at some places, while we dare not name it at others, but are compelled to fall back upon a manufactured article.

And then comes the question, if we are compelled to use a manufactured article, which is the best—which takes up the impurity the easiest, holds it to the greatest extent, and is capable of working with the highest amount of impurity in combination? All this has to be well considered by the manager as most suited to his particular case, overruled very often by the local circumstances by which he is surrounded.

Intimately connected with these questions is the important one of temperature. We are all aware of the increase and decrease of volume dependent on the variations of temperature, and how requisite it is to take accurate observations on this point at the inlet and outlet of the station-meters, in order to ensure a proper measurement of gas manufactured; but there are other considerations closely connected with the question of temperature, to which we shall do well to give our serious consideration. It is generally admitted that the more slowly and the more evenly the gas is cooled, and the longer it is kept in connexion with the warm condensing liquid hydrocarbons, the more the gas will retain of its original richness, and for this reason it is customary with most of us to carry our gas round the inside of the retort-house, and make it travel as long a passage as we can before it reaches the actual condenser; and the longer passage it travels, in reason, before it reaches this stage of manufacture, the better for the permanent quality of the gas. Nothing is so detrimental to the luminosity as a sudden check of temperature, and nothing so productive of stoppages of apparatus as this. Hence it is wise on our parts, not only to watch the temperature of our gas as it enters and leaves our station-meters, for the sake of the accurate measurement, but also to watch it at every point of every process of the manufacture, main thermometers being fixed in every available position, especially at the inlet and outlet of the condenser, at two or three suitable points on the washer or scrubber, at all suitable points in the inlets and outlets of the purifiers, and at any other part of the works where an indication might be useful in detecting any sudden falls of temperature. These thermometers should be protected from the sun's rays and all auxiliary heat, and the register taken regularly once or twice a day; by this means we should always discover any sudden change of temperature, prevent deposit and stoppage, and frequently save something in the shape of quality in our gas.

There is one very important question in the present day, which I think our society will be very useful in enabling us to cope with. I allude to the labour question. Since our troubles of 1872, iron has gone down considerably; coal has followed in a measure; but the labour question is still as difficult as ever, and, in some cases, more so. If men will combine for their interest, managers must do the same for theirs. I am quite aware that the market value of labour is different in almost every locality. I had a proof of that recently, when I wrote to something like twenty-five managers on the question of stokers' pay, and found no two answers alike in the whole twenty-five replies; but, notwithstanding this, we can interchange much useful information on the subject, both as regards the amount of work done per man per day, and the amount of remuneration given.

There are other questions, however, in the management of men apart from the question of wages. The general treatment of our men should be such as to gain their respect. Some of them, we know, are rough diamonds; but they are men, nevertheless, and as men and fellow-men, too, we should treat them. If we find some thoroughly unworthy of our confidence, after sufficient testing, the sooner we part with them the better, or they will, perhaps, corrupt their fellow-workmen; but, if worthy of our confidence, the meanest labourer is entitled to our good feeling, and ought to be treated as our fellow-man.

Nor is this a matter of good feeling only, as I am quite sure in the long run it is a matter of advantage to the manager and the company. A smile will get far more work done than a frown. A good word will make a man work with pluck, while an angry one will but encourage him to lag as soon as your back is turned. The question is quite a mutual one, and we ought to aim at gaining the confidence of our men, as well as expecting them to gain the confidence of their manager. I cannot help feeling we are responsible for the good treatment and kind behaviour towards those who are under us, and well may one of old say on this point, "If I did despise the cause of my manservant, or of my maidservant, when they contended with me, what then shall I do when God riseth up, and when he visiteth what shall I answer him? Did not he that made me in the womb make him? And did not one fashion us in the womb?" My brother managers, we are far nearer a level with the men who work under us than we are sometimes apt to think; and it will do us no harm, now that we are by ourselves, to take that view of it, and, when we are with them, to treat them kindly and as men.

Now, what I have said in relation to our duties to the companies we represent, I have not said with a view of dictating those duties to my brother managers; but simply with a view of breaking up the fallow ground for future papers and future discussions. As I remarked before, our qualifications are very multitudinous; but, many as they are, they are all suitable for our mutual consideration at our future gatherings.

Granted, then, that our duties are very varied; that we require not only commercial, mechanical, and chemical knowledge, but are required to know a little of almost every branch of science; that we are at all calls,

morning, noon, and night; that almost every meal is liable to be broken in upon; that we have to represent the interests of the company to some thousands of customers, to the satisfaction, perhaps, of some hundreds of shareholders; that we have to manage a large number of workmen, and more or less superintend their work; what ought to be the remuneration of a gas manager, and how ought he to be paid? There is doubtless a commercial value to a gas manager, as well as a commercial value to every other profession. How is this to be arrived at? What is his real value, and how is it to be ascertained?

Sometimes it has been argued that the quantity of coal carbonized would be the proper data on which to arrive at any just and equitable conclusion; £40 or £50 per annum for every 1000 tons of coal carbonized has been spoken of as the proper sum to pay the manager; but this is open to the objection that different coals in different localities yield such different results, that one might produce quite as much gas with 8000 tons as another with 10,000 would—in fact, do quite as much work, and yield quite as good results, and yet the one using the coal at the small yield would get £100 per year more than the other, without having an atom more work in nearly every particular, nor any more responsibility.

Again, the dividend has been argued by some as the proper data for regulating the manager's salary; but this is open to the serious objection that the dividends are often ruled by other circumstances than those of management. Some works are unfortunately situated. Some have much more capital than others in proportion to their yield. Some have been forced down by agitators to extremely low prices, and some have much less mileage of main. All these causes, and many more, may dictate differences of dividend quite apart from management, and it is unfair that the manager's salary should be ruled by circumstances quite beyond his control, and in some cases circumstances that were in existence before he was born.

Then, again, the quantity of gas manufactured is looked upon by others as a legitimate ground for calculation, and certainly this is nearer the mark than the other means that I have mentioned. Nearly every million feet of gas manufactured involves a certain amount of work, supervision, and forethought, and that very similar, too, under most circumstances; still there is the question of unaccounted-for gas to be considered, and the man who made the greatest saving on this point ought not to suffer in his salary by his saving for the company. I have known cases where the loss is 19 or 20 per cent., and others where it is only 5 or 6 per cent. Now the man who had the 20 per cent. would get 15 per cent. more money than the other, because he would have to manufacture that amount more of gas in order to meet his consumption, and this would certainly be an unfair thing.

From all this I cannot help thinking, if there are to be any data at all, the most fair is to take the amount of gas brought to charge as the basis. There may be objections to it, and I have no doubt there are; but still I think the objections are less than to some of the other means that have been adopted. At all events, the manager should receive the benefit of good results yielded to the company, let them be arrived at from whatever data they may. But, it may be asked, what can be the good of our sitting here and considering a question over which we have no control—a question that is one strictly for the directors, and about which they will do as they like? I answer—much good. I believe the grand difficulty with directors in regulating their officers' salaries is the want of statistics and data. They do not want to overpay; but, as a rule, they are willing to pay a man for his attainments, qualifications, and work; and I believe it would be much easier for managers to acquire at their boards that which they are worth, when they can produce good sound evidence of the proper sum they ought to receive, than if it were all dependent upon the rule-of-thumb, and had to be decided by the judgment of those who have no means of adjusting that judgment, or of arriving at a proper conclusion. But this remuneration should, in all cases, be such as to lift the manager above the temptation of commissions. The "Commission Abolitionist," who wrote in *The Times* a week or two since, has opened the ball of this very dirty subject, and has accused nearly all the gas managers, as a body, of taking toll on everything that comes into the factories they manage; and it is for us to take the bull by the horns, and at once declare such a wholesale accusation to be a libel. I am proud to say that, so far as I am concerned, I can meet him and all his charges with much cleaner hands than he can meet me. He admits that he has made his business, to a great extent, by bribing, and then gets on the housetop to wash his hands before the public, because he now thinks he can manage to do without it. He can bribe or not bribe, as it pays him best; and the question of right and wrong is altogether eclipsed by that of profit and loss.

I believe with Mr. Livesey, who ably replied to the letter in question, that the first move in this dirty business generally comes from the manufacturer. The commercial man is anxious to increase his business, and all manner of arguments are used to carry out this object—certain winks, blinks, and pokes in the ribs are given, which are followed up with plainer terms, and if the manager be not a man of high moral rectitude, the business is done; but I am far from believing that these exceptions are few, as Mr. "Abolitionist" declares, for I have myself the pleasure of many personal friends, to whom I have from time to time talked on the subject, and who, I know, would not soil their hands, any more than I would myself, by accepting a commission on any business whatever that they did for the companies they represent.

What we want is not men who will mount the rostrum and condemn the system because they now think it pays them to do so, but men who have clean hands on the subject, and who will show their opinion because they feel it wrong—it matters not whether they are managers of gas-works or merchants who serve them—but they must be men of high moral rectitude, men who would rather work for a clean shilling than soil their pockets with a dirty guinea, and who will make their declaration because they feel it is a question of right and wrong, and not because they see it as a question of profit or loss.

Gentlemen, my task is done; it is hurriedly and poorly done, I know. I ask you to pass by its imperfections, and if there be nothing in it worthy your acceptance but this, I ask you to accept my hearty desire to serve you, and wish to have produced you a better and more appropriate address, if my ability, time, and health had permitted it.

A vote of thanks to the president was proposed and carried unanimously. It was also resolved that the address should be printed and distributed among the members.

ALDERSHOT GAS AND WATER COMPANY.—The half-yearly meeting of this company was held at their offices, Aldershot, on Wednesday, the 14th inst.—F. Eggar, Esq., in the chair. The directors recommended a dividend at the rate of 5 per cent. per annum, which was agreed to. The chairman, in the course of his address, stated that the increase in the consumption of both gas and water had been considerable, and that the new tank and gasholder just finished had turned out a most satisfactory job, and had been well conducted by all parties from beginning to end. The managers—Messrs. Wilson and Douglas—were the contractors for the excavation and building of the tank. Messrs. Cutler and Son erected the gasholder. Plans and specifications were furnished by Mr. A. F. Wilson, A.I.C.E. The proceedings terminated with the usual vote of thanks to the chairman, to the board, and to the honorary secretary.

KIDDERMINSTER GAS COMPANY.

The Hundred and Thirteenth Half-Yearly Meeting of Shareholders was held on Tuesday, the 6th inst.—Mr. J. KITELEY in the chair.

The following report of the directors was presented:—

The directors have pleasure in presenting to the shareholders the accounts of the past half year, showing a profit for that period of £1794 11s. 8d., which sum added to £993 13s., brought forward from the previous statement, makes £2788 4s. 8d. profit at present unappropriated.

The directors recommend that this amount should be applied as follows:—

In payment of dividend on original shares—viz., on £12,000, half year at 10 per cent. per annum, free of income-tax	£600	0	0
In payment of dividend on additional shares—viz., on £14,400, half year at 7 per cent. per annum, free of income-tax	504	0	0
In payment of interest on £3600 preference stock, half year at 5 per cent. per annum, free of income-tax	90	0	0
In augmentation of the reserve-fund	800	0	0

To be carried forward to next half year

£1994 0 0
794 4 8

£2788 4 8

Following the policy adopted in January, 1876, the directors desire that the consumers shall again participate in the benefit of the success which has attended the working of the year, and they propose, therefore, to make a further reduction in the prices to be charged for gas from and after Jan. 1, 1877, notice of which will be forthwith issued.

The retiring directors (who are eligible for re-election) are Joseph Kiteley, Esq., Moses Knowles, Esq., and Richard Brewster, Esq. The shareholders will also have to elect another director to supply an existing vacancy at the board.

Dr.	Profit and Loss Account, June 30 to Dec. 31, 1876.				Cr.		
Coal carbonized	£3152	13	4	Gas produced	£6107	13	6
Purifying materials	25	0	0	Residual products—viz.:			
Retorts, implements, and materials	339	8	6	Coke	827	4	3
Salaries and wages	1213	8	3	Tar and ammoniacal liquor	520	1	11
Rates and taxes	227	7	4	Meter-rents	159	9	4
Interest on loans and bankers charges	204	11	1	Abatements	12	3	7
Stationery, stamps, and advertising	33	7	5				
Accountant's charges	15	0	0				
Bad debts	15	2	6				
Depreciation of works and plant	400	0	0				
Depreciation of meters	200	11	0				
Law charges	3	11	6				
Balance carried forward	1794	11	8				
	£7626	12	7		£7626	12	7

Balance brought forward, being profit in six months, £1794 11 8

The CHAIRMAN moved the adoption of the report, and in doing so said: I am glad to be able to congratulate the shareholders that we can, as a board of directors, appear before you with a report so satisfactory as the one now presented. You are aware that at the beginning of last year we thought it right, having a sufficient balance at our disposal, to reduce the price of gas, so as to give consumers a participation in the success attending the company; and we also, in addition to that, resolved to increase the illuminating power of the gas somewhat above the parliamentary standard, for the purpose of giving the fullest satisfaction to the consumers—which, I believe, has been the case. With regard to the quality of the gas we are now making, our collector informs me that he never hears the least complaint; but, on the other hand, the greatest satisfaction is expressed by consumers, both large and small, at the manner in which gas is now produced. That statement must be very satisfactory to the shareholders. I think you will also see another gratifying feature in the report which will give satisfaction, and that is that we have been enabled to carry from the earnings of the year a certain sum to the guarantee-fund. Until the last year or two we have been without a fund of that kind; but I am one of those who believe that a company should have some kind of backbone—something to fall back upon either in case of an accident, or in the event, as it may be, that we should be called upon to defend ourselves. I hope the shareholders will think the board of directors have done right in appropriating £800 this half year to the guarantee-fund, making the total amount £1500. Our limit is £3000, and I shall not be satisfied until we have that sum in hand. It is always the property of the shareholders, and it is always satisfactory to feel that we have a nest-egg of that kind in the background. In addition, we have thought it well to pursue the same policy which we did last year; and although we do not see our way clear—I do not think it is at all clear—that our profits this year will be equal to last year's, yet we have thought it right that the consumers should participate in the profits made by the company. Hence we have reduced the price of gas to the following charges:—Consumers under 50,000 feet per quarter, 3s. 6d. per 1000; consumers above 50,000 and under 250,000 on such quarter, 3s. 5d. per 1000; consumers above 250,000 per quarter, 3s. 3d. per 1000. I believe that will give great satisfaction to the consumers, and we hope that, by the increased consumption of gas (and we are building our calculations upon that hope), we may ultimately restore the balance which we shall lose by the reduction. That is our feeling in taking the steps we have. I can only say, in conclusion, that we have lately commenced a rather more expensive process in making our gas, by using a large quantity of cannel coal; and I think the improvement in the gas is manifest to every one. The whiteness and purity of the gas has become very much greater since we adopted that course, and the illuminating power of the gas has also been increased. Taking all things into consideration, I think the board of directors come before the shareholders with a very satisfactory report, and if you think so I call upon you to pass the resolution I have moved.

Mr. M. KNOWLES seconded the motion.

Mr. HARDING asked whether the increase of the concern was such as to make it desirable to increase the capital.

The CHAIRMAN thought not. He did not think they wanted any more capital at present. If they saw the town developing they would not like to be behind.

Mr. HARDING asked if there was any communication to make to the shareholders about the action of the Town Council of the borough for purchasing the works.

Mr. CARTWRIGHT thought it was not desirable that negotiations, which he understood were *sub judice*, should be made public just now.

The CHAIRMAN said he had anticipated such a question being asked, and he could not think that there would be any impropriety in stating what had been done in the matter, but not to state what the future intentions of the directors were. In reality nothing had been done in the matter. There had been one conference with some members of the Town Council, who were told that the directors had no desire to sell the works, but that they would be prepared to consider any fair and equitable offer the council might make.

Mr. CARTWRIGHT thought that the accounts presented were very satisfactory indeed. He was pleased to find that the directors had not only been able to give the full amount of dividend which the parliamentary powers enabled them to do, but that they were at the same time increasing the illuminating power of the gas, which must be very satisfactory to the

district they supplied. He saw that the loans had exceeded their borrowing powers. He did not say that to cast the least reflection upon the board of directors, but he mentioned it with the view of calling attention to the fact. The share capital was £30,000, their further powers of borrowing were £6000, while the loans amounted to £8000. Whether that extra sum came from their bankers, or from the loan of a private gentleman, did not much matter. That was one element which the directors should bear in mind when they were discussing the reductions in the price of gas. As one who had had a good deal of experience in such works, and was familiar with many gas-works throughout the country, he was bound to say that he was of opinion that the public at large could be better served by the company than they ever would be by the corporation. He did not wish to make any critical remarks, as he was speaking in the presence of gentlemen who were, he understood, members of the corporation, but he was strongly of the opinion he had just expressed. The directors had proposed to reduce the price of their gas. Permit him to say that the price of gas supplied by the company was extremely low. He came from a district where coal was to be obtained 50 or 60 per cent. cheaper than they could get it at Kidderminster, and yet the price of gas in his district was just the same as that recommended to be charged by the directors. He thought when the public knew that fact they must be perfectly satisfied with the charges made, and would see that they were extremely moderate, and that when they got moderate price, combined with a good article, coupled with the fact that the concern was worked by practical men, engaged in the industry of the place, the public would be satisfied with the efforts of the directors.

The motion for the adoption of the report was put and carried, and on the motion of the CHAIRMAN, seconded by Mr. TALBOT, it was resolved—“That a dividend on the original shares, half year, at 10 per cent.; on the additional shares, half year, at 7 per cent.; and interest on preference stock, half year, at 5 per cent. per annum, be paid forthwith, free of income-tax.”

The retiring directors were re-elected, and Mr. E. J. Morton was appointed to the vacant seat at the board.

Votes of thanks were given to the directors and chairman, and these having been acknowledged, the proceedings terminated.

BROMSGROVE GAS CONSUMERS COMPANY, LIMITED.

The Eighth Ordinary General Meeting of the Shareholders in this Company was held at the Town-Hall, Bromsgrove, on Monday, the 12th inst.—Mr. JEFFRIES, Chairman of the Board of Directors, presiding.

The report of the directors, read by Mr. JOHN T. KEY, secretary, was as follows:—

Your directors have great pleasure on this occasion in presenting to you their eighth annual report.

Your works and mains, with but few exceptions, are in excellent condition, and what repairs are required will be attended to in the usual way when the proper time arrives.

The balance-sheet and profit and loss account for the past year are before you, having been duly audited, and a copy placed in the hands of each shareholder; it will be noticed that there is an available balance of £918 0s. 8d., out of which it is proposed to make a dividend at the rate of 10 per cent. per annum, and a resolution to that effect will be proposed at this meeting.

In compliance with the Articles of Association, Messrs. Bennett and Saywell retire from the board of directors, but being eligible they offer themselves for re-election.

The auditor also offers himself for re-election.

In conclusion, your directors again assure you that their utmost endeavours will be to maintain your property and business in its present highly satisfactory condition.

Dr.	Balance-Sheet, Dec. 31, 1876.		Cr.	
5000 shares of £1 each, paid up	£5000	0 0	Works, mains, plant, land, and	
1000 " " "	1000	0 0	houses	£7933 9 6
1000 " " "	1000	0 0	Add Crescent main	25 3 0
2000 " " "	2000	0 0	Factory Lane main	9 4 2
Sundry trade creditors	159	6 9	Preliminary expses.	£210 6 6
Reserve-fund	450	16 6	Deduct for this year's	
Add from profits of 1876	18	0 8	proportion	50 6 6
Profit and loss for dividend	900	0 0		160 0 0
			Amounts owing to the com-	
			pany for gas, &c.	1020 0 1
			Stock in hand—viz.:	
			Coals	345 0 0
			Coke, tar, lime, &c.	105 12 11
			Gas-fittings	365 18 3
			Stock of meters	£485 14 10
			Less wear and tear	24 5 9
				461 9 1
			Add meters purchased	56 2 0
			Cash in bank	44 14 10
			Cash in office	1 10 1
	£10,528	3 11		£10,528 3 11

<i>Profit and Loss Account.</i>							
Coals and haulage	£1173	12	2	Gas sold	£1948	11	7
Lime and haulage	48	5	5	Fittings	250	0	4
Gas-fittings	78	11	9	Coke, tar, lime, &c.	546	1	1
Salaries and wages	423	7	6	Rent of meters	21	10	6
Rates and taxes	37	10	4	Rent of houses	22	8	0
Sundry tradesmen for repairs				Extra stock	159	18	1
and maintenance of works, &c.	188	11	4	Interest		4	14
Wear and tear on meters	24	5	9				
Proportion of preliminary ex-							
penses	50	6	6				
Bad and doubtful debts.	3	6	3				
Discounts and allowances	7	3	1				
Balance	918	0	8				
	£2953	3	9		£2953	3	9
Dividend	£900	0	0	Balance	£918	0	8
Reserve-fund	18	0	8				
	£918	0	8		£918	0	8

Dividend	£900 0 0	Balance	£918 0 8
Reserve-fund	18 0 8		
	£918 0 8		£918 0 8

The CHAIRMAN, in moving the adoption of the report, stated that the directors had been induced to recommend the payment of the highest dividend allowed by law, by the consideration that the reserve-fund had nearly reached the maximum—namely, £500; that there was now ample capital to work the concern without borrowing of the bank; that no interest was allowed upon surplus at the bank, and that the works were in such an efficient state that there was no necessity, at any rate at present, to put by anything for depreciation, and, therefore, it was thought better to give the shareholders the benefit of the balance.

Mr. SAYWELL seconded the motion for the adoption of the report and statement of accounts, which was carried unanimously.

On the proposition of Mr. BENNETT, seconded by Mr. GREEN, it was resolved that a dividend as recommended in the report, and payable on and after the 1st of March, be made.

Mr. HUMPHREYS, a shareholder, called attention to the prospectus issued at the formation of the company, which stated that they would supply gas at a price not exceeding 4s. per 1000 feet, without charge for the use of meters. He thought many had supported the company on the strength of that promise; and looking at the accounts as issued, he was of opinion that the income would be sufficient to enable the directors this year to lower the price of gas to the sum named, and to pay 7½ per cent.

dividend to the shareholders. He therefore moved a resolution—"That this meeting respectfully request the directors, as from the 31st of December, 1876, to supply gas, according to the promise made in the prospectus of the company, at 4s. per 1000 feet."

Mr. ALLINSON, a shareholder, seconded the motion, which was carried.

The CHAIRMAN explained that when the promise was made, the directors were new to the business, and did not quite understand their position. It had been found necessary to increase the capital from £5000 to £9000, the price of coal had advanced from 11s. 6d. to as high as 23s. 6d., and it was now considerably dearer than it was when the company was formed, wages were higher, and the directors would never have power to reduce the price of the gas to 4s. till the consumption was much increased, or coal came down to its original price; nevertheless they would take into careful consideration the recommendation of the shareholders.

On the proposition of Mr. ALBERT, seconded by Mr. LEDBURY, the retiring directors were re-elected.

The thanks of the shareholders were voted to the chairman and board of directors for their continued attention to the interests of the company.

Mr. F. N. Gosling was re-elected as auditor of the company.

Pursuant to notice given, Mr. ALLINSON moved that the sum of £70 be taken from the profits of the year, and be divided, *pro rata*, amongst the directors, as remuneration to them for their services in the formation of the company.

Seconded by Mr. HUMPHREYS, and carried unanimously.

The CHAIRMAN returned thanks, and proposed that the best thanks of the directors and shareholders be given to Mr. Key, the secretary and manager, for his untiring energy and perseverance during the past year, which had placed the works in the highly satisfactory state in which they were. He said the directors had thorough confidence in Mr. Key, who was deserving of the best thanks of the company.

Mr. BENNETT seconded the proposition, which was carried unanimously, and duly acknowledged by Mr. KEY.

A vote of thanks having been passed to Mr. Gosling, the auditor, the meeting ended.

WIGAN CORPORATION GAS SUPPLY.

The following is the Report presented by Mr. HAWKINS, the Gas Manager, to the Corporation Gas Committee on the 2nd inst.:-

Gentlemen,—In compliance with your instructions, I have pleasure in making the following report, which I beg to submit to your consideration:—

Your works of distribution are unusually extensive—viz., from east to west a distance of nearly eight miles, and from north to south six miles, representing a total length of mains, without the works, of 93 miles, employed in the distribution of gas to a present population of less than 1000 persons per mile of mains, whereas generally the population of a manufacturing district like Wigan amounts to from 1500 to 2000 per mile of pipes.

The quantity of gas distributed during the half year ending the 31st of December last amounts to 97,766,000 cubic feet, or 1,051,190 cubic feet per mile of pipes laid down. The average in similar districts, for the same time, is from 2 to 2½ million cubic feet. Computing the population of Wigan and the district at 90,000 persons, the gas distributed is at the rate of 1086 cubic feet per head of population, a quantity also very much below the average in similar districts. The investment of capital in distributory plant is therefore unusually large, and the liability to a heavy leakage also proportionately increased. This, however, is the unavoidable consequence, partly of local peculiarities, and partly of the very liberal manner in which gas has been carried to all classes of the population, and to all parts of the district.

I have given considerable attention to the question of loss or leakage—i.e., the difference between the amount of gas manufactured and registered by the station-meter at the works, and the aggregate of the gas registered by the consumers meters, and charged for in the rental. The per centage of gas unaccounted-for is in general a severe test of the good or bad management, and also the condition of the mains of a gas undertaking; and generally the average per centage of loss is found to be from 10 to 16 per cent. of the gas manufactured. The per centage of loss during the year ending the 31st of December, 1875, was 32 per cent. of the total quantity of gas manufactured. On my appointment as your gas engineer, eleven months ago, my attention was directed to the inadequate supply of gas to the district, and more particularly to the townships of Pemberton, Orrell, Upholland, and Standish. The testing of pressure and supply made at that time revealed the existence of a most unsatisfactory state of things. The greatest pressure obtained in the Pemberton district during the hours of consumption was very much below what it ought to have been, whilst in the other three districts—viz., Orrell, Upholland, and Standish, there was scarcely any indication of pressure at all. The question then arose as to what should be done to remedy this, and, acting upon my recommendation, your committee have since then laid out large sums of money in laying down larger and more suitable mains into those districts, as well as a leading main from the works to the centre of the town. The effect of these alterations has been that you are now not only in a position to furnish a proper and sufficient supply of gas to the whole district to meet the present and future requirements, but you are also enabled to do so with fully a third less working pressure at the works, thereby reducing the liability of leakage to a minimum.

In connexion with this subject I have also to remark that the rapid ascents and descents of the ground within the borough and district caused me to recommend you to divide your distributory plant into three separate sections. I am pleased to report to you that this work is now complete, and has just been brought into operation. We are now enabled by this means to regulate the pressure, and equalize the distribution with facility and exactness. The total length of new mains laid down during the past year amounts to nearly 9½ miles, and the sizes range from 20 inches to 3 inches. The number of new services laid on during the past quarter is 230. The number of old services replaced by new ones during the same time is 54.

In view of the rapid growth of the district, and the increase that was expected to arise in the consumption of gas, consequent upon a better supply to the district, the producing power at the works has also received the committee's anxious consideration and attention. During the past year the 14 old benches of seven, and the 20 benches of three retorts have all been removed and replaced by others constructed on a new and improved principle. The maximum number of retorts in operation at one time during the present season was 221, compared with 244 last year, and the quantity of gas manufactured and registered by the station-meter for the half year ending the 31st of December last year was 97,766,000 cubic feet, compared with 79,832,400 cubic feet for the corresponding period of 1875.

In connexion with this subject I would remind the committee that for a short time during last Christmas season the increase in the consumption of gas assumed such enormous proportions that, with the limited number of retorts at our disposal, we experienced very considerable difficulty in maintaining a sufficient supply to the district. The new benches of retorts about to be erected next spring should, therefore, be pushed forward as rapidly as possible.

During the past year you have erected two new exhausters, of improved make, each capable of exhausting 50,000 cubic feet of gas per hour. These are arranged in duplicate, and have taken the place of the two old ones formerly in use.

A gas exhauster is an apparatus employed for the purpose of relieving the retort from pressure or resistance offered to it during carbonization by the weight of the gasholders, purifiers, and other machinery. It is obvious, therefore, that without an apparatus of this kind the whole weight of the gasholders and the resistance offered by the purifying material, through which the gas has to pass to be purified, is thrown back upon the retorts, the effect of which would be a reduction of about 2000 cubic feet in the yield of gas for every ton of coal carbonized.

The old gasholder-tank, which last year was partly filled with rubbish, has now been cleaned out and arched over, and now forms an ample store for the tar and ammoniacal liquor manufactured at these works, the want of which must have been attended with enormous loss to the corporation.

Having carefully inquired into the cause of the increase that has shown itself in many of the consumers accounts for the past quarter, and in order that I may give you my opinion upon this important subject, I am reluctantly compelled to refer to the past management of your undertaking.

With the view of making this subject clearly understood, I will deal with the question of consumers meters, their construction and regular inspection, which undoubtedly forms one of the most important subjects which concern the prosperity of a gas undertaking. A meter is an instrument used for the purpose of determining the quantity of gas passed through it, and the quantity so determined is that for which the consumer is charged. It seldom happens, however, that we meet with a meter that will register exactly the quantity of gas sent through it, notwithstanding that every attention and care are given to its manufacture; but in order that gas-meters should be made to

register within certain limits, the Sales of Gas Act was brought into force. By this Act every meter in use in the district must of necessity have passed through the hands of a Government inspector and been tested, and, as I said before, it seldom happened that we found a meter that would register absolutely correct; therefore, to meet this difficulty, the Act states that so long as any meter does not register more than 3 per cent. against the gas company, nor 2 per cent. against the consumer, that meter shall be considered correct, and the Government inspector is in duty bound to affix his seal to it as being a correct means of registration of gas within the meaning of that Act. This, then, is all that can be reasonably expected, both by the buyer and the seller of gas. In order, however, that gas-meters may continue to register correctly for any length of time, it is imperative that they should undergo a regular and systematic inspection, say once in each month; and if there happened to be found on inspection any meters not registering, or meters indicating an unusually large consumption, due to leakage or some other cause, the same could be immediately dealt with and put right.

To show how exceedingly important this matter is to owners of gas undertakings, we will suppose a certain meter to have been inspected to-day, and that it is now registering correctly, next week it may register 2 per cent. slow, the following week 4 per cent., the following week 8 per cent., and in a few more weeks it would cease to register at all. Still the supply of gas is kept up, the consumer experiences no difficulty with his gas, and in due course the account is presented, and he thinks when he is paying it he is paying for all the gas he has consumed, when in reality he has done nothing of the kind.

The number of meters in use at Bolton is 22,000; and to look after these there are employed eleven meter inspectors, whose duty it is to inspect the whole of the consumers meters in the district once in each month, and the mill meters every Monday. At Blackburn there are 14,791 meters in use, and for these there are eight meter inspectors, and the meters there are inspected the same as at Bolton. In Leeds there are 64 meter inspectors, and each has, on an average, 1800 meters entrusted to his care. The number of meters in Wigan is just under 9000, and to attend to these in a similar manner we should require at least five inspectors. What, then, can be said of the system of meter inspection in operation in Wigan previous to my appointment, when there was only one person to attend to the whole district, with the exception of the mills, and he, too, never did more than enter down the statements for the quarter's accounts, and it took him the whole of his time to do that, for as soon as he had got through the district once he had to begin again, so that, strictly speaking, there was no inspector at all. The so-called meter inspection, then, must, under such circumstances, have been simply a farce, and the quantity of gas appearing on the face of the accounts as having been consumed must of necessity have been entirely misleading and unreliable.

In confirmation of the extremely unsatisfactory manner in which this important work was attended to, I could refer you to scores of cases in your own books where meters have been known to stand for two, three, four, five, and even six years at a time without ever registering a single foot of gas, and the consumers accounts have all along been estimated. Well enough might many of the accounts be more now than they used to be in those days; the mistake is they were formerly too little, and a large portion of the gas which was charged to leakage actually passed through the consumers meters unregistered, and consequently was never paid for.

It is, then, to the more perfect system of meter inspection which has been brought about within the past two quarters that I attribute the increase in so many of the accounts. Of course the out-townships, as well as certain portions of the town, will be affected to a certain extent by the better supply afforded by the new pipes carried into those districts, and for which the consumers will no doubt make every allowance.

The per centage of loss, or gas unaccounted-for, during the half year ending the 31st of December last was 23 per cent. compared with 32 per cent. for the year 1875. The reduction is no doubt partly due to the larger mains recently laid down, enabling me to work at considerably less pressure than formerly.

In conclusion, I beg to say that apart from the interest I take as manager in making your undertaking a success, I have nevertheless fully considered the interests of the consumers at large; and, by way of recommendation, I would strongly advise them to pay greater attention to their fittings and burners, and also, and whenever gas is not required, to see that it is shut off at the main-tap, and in all cases whenever practicable to regulate the pressure at the meter. If the above recommendations are properly attended to, the result would be a great saving, and would help very materially to reduce the amounts charged to the consumers.

(Signed)

J. G. HAWKINS, Engineer.

This report came before the Town Council at their meeting on the 7th inst.

The MAYOR also read the following copy of a resolution which he said he had been asked to present to the council, and which was adopted at a public meeting of ratepayers and gas consumers held on the previous Friday:—"That the ratepayers and gas consumers, being thoroughly dissatisfied with the very large increase in their gas bills, and believing that gas of an equal quality can be produced at a much less cost, respectfully solicit his worship the Mayor to lay before the council the following request, viz.: That an independent gas engineer, selected by gas consumers, be allowed to inspect the mode of working and the management of the gas-works, at as early a day as possible, that his report thereon may be published for the satisfaction and guidance of the gas consumers generally."

After a long discussion, the following resolution was adopted by the council:—"That, in compliance with the request of the ratepayers and gas consumers, permission be given for any gas engineer whom they may appoint to inspect the gas-works, and the mode of working the same, at any time, and that Mr. Hawkins be instructed to give him every facility for so doing."

MACCLESFIELD CORPORATION GAS-WORKS.

At the Quarterly Meeting of the Macclesfield Town Council, on the 9th inst., the minutes of the Gas Committee came up for approval.

Alderman STANCLIFFE (chairman of the Gas Committee), in moving their adoption, said that during the past quarter the illuminating power of the gas had averaged 17.9 candles. Owing, as the committee supposed, to the depressed state of trade, a decrease had taken place in the consumption for the half year of 5.08 per cent. The committee had completed the two new purifiers at a cost of about £909; they had also completed a stable at a cost of about £830. In course of time they intended to furnish the stable and cart-house, as they thought it would be an advantage to have their own horses and carts, for many reasons. For instance, they had paid during the quarter the sum of £107 for carting; further, if they had horses and carts at their own disposal, they would be able to sell and deliver coke to customers in the town; as it was, they had to sacrifice a good deal in price, as the townspeople would not buy the coke unless it was delivered, and the committee had to sell it out of the town at a reduced price. They were anticipating other improvements and additions to the cost of about £1200. They wanted a new scrubber and a new condenser, at a cost of about £1000; if they had these the result would be satisfactory to consumers as to purification. So far as renewals were concerned, they had, as was customary, to undertake the refitting of three beds of retorts at a cost of about £200, and they also thought of putting up a new governor and pipe-house. The present governor was much the worse for wear, and they anticipated having £300 to spend there. The total anticipated expenditure amounted to £1400 or £1500. They hoped not to have to ask the council for any money, because if they did they knew they would be politely told to take it out of their profits. He had no doubt that if the committee were able to carry out the improvements contemplated they would have a good deal to add to the capital account through the further completeness and productiveness of the works.

Mr. HORDERN seconded the adoption of the committee's proceedings.

Alderman WHITE wished to call the attention of the council to the manner in which the gas profits were disposed of. The corporation had been in possession of the gas-works for nearly 16 years, and yet up to the present moment not a single penny from the gas profits had been devoted towards reducing the burdens of the ratepayers. Not only so, but he was prepared to prove that the gas-works so far from having been a profit to the ratepayers had been an additional burden. Why were the works purchased by the corporation? Surely not for the benefit of the gas consumers.

They were but a section of the ratepayers. He apprehended they were purchased for a twofold reason—first, to supply gas consumers with a good article at a moderate cost; and secondly, that the profits might be handed over to the borough-fund to lessen the rates. But had those objects been realized? So far as the quality and prices were concerned, he had nothing to say; he would leave that with the consumers; but it was certain that the second object had not been gained, for no benefit had as yet been derived by the ratepayers. During the 16 years that the gas-works had been in the possession of the corporation, about £22,000 profit had been realized, and that amount had been spent in addition to ordinary wear and tear, in adding to the capital, and in the improvement and extension of the works. This amount of £22,000 was equal to the amount available from the general district rate for improvements in the borough, and for sanitary and other purposes, during the last 20 years. It was high time that some portion of the profits should go towards lessening the general claims on the ratepayers. He wanted to know when the large expenditure of profits was to stop. He remembered that when Alderman Carr was mayor, the council had presented to them an elaborate scheme for the extension of the works, and if such a plan as that had to be carried out, even in piecemeal, some considerable time must elapse before the ratepayers would begin to receive any benefit. The present generation had as much right to benefit from the possession of the gas-works as any future generation. There could be no doubt that when the extension of the works was completed they would be the source of a very handsome revenue. They were at present; but that revenue would increase, and when the continuous outlay upon the works had ceased, these very handsome profits, or a large proportion of them, would go to lessen the general rates. But they would fall to a future generation. Therefore he again asked—How long was this heavy expenditure of profits to be continued, and had not the present generation as much right to a share of the profits as those who came after them? He would say nothing as to the management of the works; they might be very admirably managed; no doubt they were. He said nothing as to the price of gas or the quality; he said nothing whatever as to the amount of profits; he spoke only of the manner in which those profits were disposed of, and he thought it high time that the committee stayed their hands. If they sought to increase their works, let them borrow money as other committees had to do. He hoped that by the close of the present financial year, and in making arrangements for the coming year, the committee would be enabled to let the ratepayers participate to the extent at least of £1000. Last year the actual profit was £3300, and not a shilling found its way into the pockets of the ratepayers. If the alterations and extensions could not be carried out so quickly as the committee required, let them be spread over a longer period of time, and let the money be borrowed, but do not let them go on spending that portion of the income which should go towards lessening the burdens of the ratepayers.

The TOWN-CLERK, in answer to Mr. FOWLER, said the corporation had no further borrowing powers in connexion with the gas-works.

Alderman STANCLIFFE, replying to Alderman WHITE, said he was not aware how long it would be before the committee ceased doing repairs and enlargements. He could only say that so long as they found their business required extensions, so long, he being chairman of the committee, they would continue to increase them. If the council did not repose confidence in their management he would be happy to give it up to some one more able; but they might depend on one thing—the committee would not spend one penny which they were not compelled to spend for the benefit of the town. He had not been chairman of the committee very long, he had nothing to do with the purchase of the works, he found them as they were, and he took the management to do with them as he thought was best under present circumstances, and work them as he would do if it was his own private business. And what had been done would, he believed, give satisfaction to any one who chose to examine them. They were, he believed, working on a better basis than formerly, and it mattered little to the committee whether they gave up the whole of the profits or a part of them; if the works were to be increased there must be means found for increasing them. So far as the profits were concerned, he was now in a position to inform Alderman White that the balance in their favour at the bank was £629 19s. 7d. The committee would be glad to hand over £1000 a year to the council, and would do so if it was their wish, but he would like to get a little straighter first at the works.

The TOWN-CLERK, replying to Alderman WADSWORTH, said the gas profits could not be appropriated at the present time, as suggested. The provisions of the Act were that the profits must be applied (1) in paying the costs, charges, and expenses of applying for and passing the Act; (2) in paying any sums payable by the local board in respect of any contract for lighting the streets, &c.; (3) in paying the interest on all moneys borrowed by the local board under the powers of the Act; (4) in paying off mortgages by instalments, and in appropriating a sinking-fund for the payment of mortgages, &c.; (5) in constructing the works, &c., and improving, altering, enlarging, and extending the same; (6) for maintaining and extending the gas-works, pipes, &c.; (7) in repaying any money borrowed under the general district rate under the powers of the Act; (8) in paying off all principal moneys borrowed by the local board under the powers of the Act; and, lastly, in reduction of the gas-rents, lighting rates, and general rates authorized to be levied, or of such of them as the local board may from time to time direct.

Alderman CARR said the statement of Alderman White might be pleasing to the ratepayers and to the gas consumers, but the council were aware of the difficulties which the Gas Committee had had to encounter. One thing was clear, the works were bought at one-half too much money. They were rotten, used-up works at the time they came into their possession, and it had been a labour from time to time to make them available for the requirements of the town. He had, in conjunction with others, been instrumental a few years ago in placing before the council an elaborate scheme for getting the concern into good working order. He congratulated Alderman Stancliffe and his committee on having carried out that scheme as far as they could. As the town-clerk said, they had no borrowing powers in connexion with the gas-works; and the committee were doing that which was legal in appropriating the profits, because they had no other means at hand for keeping up the efficiency of the works, for the council had failed to establish what the Act said they should do—a sinking fund, which would take a considerable fund out of the revenue. Alderman White must bear in mind that it was not the enjoyment of things in their own lifetime that they all look to. There was nothing so pleasing to many of them as to look forward, on leaving this world, to giving their children a nice legacy, and in their last days they reflected with considerable pleasure that they were benefiting, or would benefit, those who were to succeed them. In lower gas-rates the town had been advantaged to a considerable degree. The illuminating power, previous to the purchase of the works, could never be more than 12 or 13 candles, whereas now it was 17.9. The Act prescribed that it should be 18 candles, but let them notice the difference between the present supply and that under the old company; the difference in quality compared with price made the difference of all the profit. He gave full credit to the present committee for endeavouring to put the works upon a sound footing. They all knew that there was nothing in which repairs were so much required

as in gas-works; they required continuous outlay year after year, and the present committee had made that outlay judiciously.

The TOWN-CLERK, in answer to a further question, said the council had already borrowed money to the extent of the amount required to purchase the works—£49,000. This was all they were authorized to do; if they wanted to go beyond that, they must apply to the proper authorities.

Mr. BOWER said if the works were purchased at more than their value, as stated by Alderman Carr, it was strange that the council should have made so much profit out of them. They had spent large sums out of profits in extensions and improvements at the works, and had handed over £10,000 towards building the town-hall.

Alderman JACKSON said the fact was they had only the power to borrow or to pay £49,000 for these works; they cost £50,000. The Board of Health lent them £1000, and they had paid that off. They were bound by the Act of Parliament. When he was a member of the Gas Committee, he said—but he stood alone, and could not carry it—“Let us reduce the number of the bondholders.” If they had acted upon that principle they might by this time have reduced the debt due to the bondholders by £10,000 or £20,000, and accordingly reduced the amount payable for interest. The fact of the matter was this—they wanted a new Act, altogether; because, when they had paid the bondholders off, what were they to do with the profits? Were they to give the gas away? As to paying as much again for the works as they ought to have paid—well, it was a regular fight before a committee of the House of Commons; it was a battle fairly fought, and the fact was simply this—they paid what they were compelled to pay, and if they had not been compelled they would not have paid it.

Alderman CLARKE said there was one thing which was very generally lost sight of when they considered this question. If they went into the open market to obtain gas shares, they might purchase them to pay 6 per cent.; 6 per cent. on £50,000 was £3000; but the superior credit of the corporation enabled them to borrow at 4 per cent., which was £2000 on £50,000, so that there was a difference of £1000 saving as between the ordinary 6 per cent. and the superior credit of the corporation. Looking at it in this light, they had £1000 year of a saving, due to their superior credit, which might fairly be applied to a sinking-fund, and they could enjoy the surplus profit. As to the financial aspect, he was glad to hear that the town-clerk had thrown upon it some new light—viz., that application might be made through the Board of Health, so that money might be borrowed, and the extension of the works might very properly be carried out with the newly formed capital at a low rate of interest. If that were done, they might, at an earlier date than had been hoped for, arrive at that state of things which Alderman White was anxious to see brought about. The ventilation he had given the subject might, perhaps, be the means of enabling the council to look at the matter in another light.

In reply to Mr. BARKER, the TOWN-CLERK stated that the bondholders had received the necessary notice, so that the corporation could at once reduce the amount of their indebtedness when they were in a position to do so.

Mr. BARKER concurred with Alderman JACKSON, that whether they paid too much or not for the gas-works, the price was arrived at after a fair contest. It had apparently been forgotten that £3000 or £4000 had been spent in obtaining the Act, and that had to be paid out of future profits. He would be glad to see an arrangement whereby they would be enabled to appropriate something towards the rates of the borough, but that could only be done by Act of Parliament; and he did not consider that any necessity had yet been shown for enlarging their powers. The works were admirably managed, they had power to extend them out of the profits, and they were enabled to borrow temporarily from the treasurer for the purpose.

Alderman CLARKE remarked, with reference to the large price paid for the works, that there had been something more than the mere plant to purchase; there was the valuable goodwill and an increasing estate. That was the reason they had to give so large a price. In the neighbouring town of Warrington, they had just agreed to take over gas-works at a cost of £155,000; and, looking at the price given for the Macclesfield works, in comparison, they appeared very cheap.

Alderman BULLOCK remarked that no doubt they ought to have provided a sinking-fund; but if they had appropriated the profits, as Alderman Jackson recommended, to paying off the bondholders as the profits arose, without extending the works as circumstances required, what would have been their position at the present time? They would have been in a state of utter darkness; they could not have carried out the lighting of the town with the old works.

Alderman JACKSON said they commenced with a debt of £50,000, and they had to improve the works to make a capital; they did so, and in addition to what was requisite and necessary, they realized profits; it was these profits, independent of the improvement of the works, which he proposed should go to reduce the amount owing to the bondholders.

Mr. SMALE thought that there was a way out of the difficulty, so far as the ratepayers were concerned, without the necessity of applying for further powers. Could not the Gas Committee give the gas, or supply it to the public lamps, at a lower price than they supplied it to the general consumers? The ratepayers could be relieved in that way.

Mr. HORDERN thought it nonsense to talk of increasing their borrowing powers for the gas-works under present circumstances. The greatest part of the improvements had been entered upon and completed; and if the council would allow the committee to go on as they were doing for another year or so, they would get the gas-works in the condition they required. In a few years—perhaps in two—they would get the works in such a state that there would be a greater accumulation of profits, which could then be appropriated legally.

After some remarks by Alderman WHITE in reply,

The motion for the adoption of the report was put and carried.

WEST BROMWICH GAS SUPPLY.—The six months, limited by the West Bromwich Improvement Act, 1876, as the time within which the Commissioners might agree with the Corporation of Birmingham for the purchase of that portion of the late Staffordshire Company's gas undertaking which is situate in the district of the board, having expired, the commissioners at their meeting on the 14th inst., accepted the recommendation of their committee, and appointed Mr. Bramwell to act as arbitrator in the matter on their behalf.

CHATHAM AND ROCHESTER GAS COMPANY.—The half-yearly meeting of shareholders was held on the 8th inst.—Mr. E. Winch in the chair. The directors report stated that the whole of the company's works at Rochester and Gillingham were in a satisfactory state. A new retort-house had been completed, and erected in such a position as to render it secure against any interruption from the high tides. The directors recommended the payment of a dividend at the rate of 10 per cent. per annum on the shares, and dividends of 7 per cent. on the other shares. The report was unanimously adopted, and Mr. J. L. Levy, the retiring director, and Mr. T. S. King, the retiring auditor, were both re-elected, the usual vote of thanks being given to the directors.

HALIFAX CORPORATION GAS-WORKS.

The Quarterly Meeting of the Halifax Town Council was held on Wednesday, the 7th inst.—the Mayor (Alderman Whitley) presiding.

The Gas Committee reported that the quantity of gas made during the quarter had been 106,005,000 cubic feet, as against 102,605,000 cubic feet for the corresponding quarter of last year, being an increase of 3,400,000 cubic feet. The quantity of cannel used had been 2178 tons, as against 2870 tons; the quantity of coal had been 8057 tons, as against 7580 tons. Total quantity of cannel and coal used 10,235 as against 10,450 tons in the corresponding quarter, showing a decrease of 215 tons. Wages paid during present quarter £2239 2s. 4d., as against £2145 19s. 6d.; increase, £93 2s. 10d. The average illuminating power had been 17.81 sperm candles, as against 17.4 corresponding quarter of last year; an increase of 0.41 sperm candles. The time had arrived when the committee felt it their duty to prepare for extending the plant. At present, with every retort in full working condition (and they could not all be depended upon), the maximum producing power was only 1,683,500 cubic feet per day; last winter the heaviest daily consumption was 1,594,000 cubic feet. This winter it had been 1,737,000 cubic feet; if next winter should increase at a similar rate, the heaviest day's consumption would be 1,892,000 cubic feet. Should there be three or four dark days, even with the Sunday stock to commence with, the town would be in darkness. The committee accordingly submitted a scheme, prepared by Mr. Carr, the manager, for extending and developing the gas-works. This had been affirmed by the committee, and provided for the production of 1,400,000 cubic feet of gas per day, in addition to the present power. The total capacity, with the proposed addition, would be 3,000,000 cubic feet per day.

The scheme was approved.

Mr. SHAW called attention to complaints as to cutting off gas services.

Alderman CROSSLEY said every precaution was taken by the Finance Committee to see that in no case was the gas cut off except where due application had been made for payment and the full time had elapsed. There might be one or two exceptional cases in which there had been an oversight, but the greatest pains were taken to avoid such.

Mr. SCARBOROUGH called attention to the serious neglect on the part of large numbers to pay their gas accounts. On the 25th of December, there were 5000 accounts unpaid. One gentleman in a principal street of the town had been waited upon several times, but he abused the man most abominably, and told him they might summon him or do what they liked. That gentleman had his gas cut off. He would treat all persons in that way who abused the officers of the corporation. The committee wanted the money, for they were owing to the bank something like £15,000 on the gas-works account.

The Mayor, in reply to Mr. Pollard, said it was not obligatory on the collectors to call a second time, though they frequently did call a second and a third time. It was stated distinctly on the note that if the account was not paid on delivery, it was to be paid at the town-hall. If the collectors were to be expected to go twice, the staff would certainly have to be increased.

THE SEWAGE QUESTION.

The Ninth Ordinary Meeting of the Institution of Civil Engineers, for the Session 1876-1877, was held on Tuesday, Feb. 6.—Mr. G. R. STEPHENSON, President, in the chair. The paper read was on "The Sewage Question," by Mr. C. Norman Bazalgette.

The object of this communication was stated to be twofold. First, to limit and define the proper application of the various systems introduced from time to time for dealing with the sewage of towns. Secondly, to direct attention to certain subordinate questions arising upon the practical operation of such systems. For the purposes of this paper the following classification had been adopted:—1. Treatment with chemicals; 2. Application of sewage to land, including irrigation and intermittent downward filtration; 3. The dry-earth system; 4. The Liernur or pneumatic system; and 5. Seaboard and tidal outfalls.

1. *Treatment with Chemicals.*—In this section of the paper, reference was made, in considerable detail, to the practical experience of the lime process at Leicester, Tottenham, Blackburn, and Birmingham; the A. B. C. process at Leicester, Leamington, Crossness, Hastings, Southampton, Bolton and Leeds; the sulphate of alumina process at Coventry; the phosphate of alumina process at Tottenham, Barking, and Hertford; Goodall's process at Leeds; Bird's process at Cheltenham and Stroud; Dugald Campbell's process at Battersea; and Whitbread's process at Tottenham. It was stated, generally, that the experience of these processes was more or less identical with that which had been derived from Holden's, Hill's, Lenks', Suvern's, Scott's, and, in fact, all other methods in which, by the admixture of chemicals, it was sought to effect the purification of sewage by the precipitation of the dissolved and suspended impurities, and the ultimate realization of the precipitate in the form of a manure. This experience, coupled with certain opinions of Professor Frankland, Mr. Krepp, and Dr. Corfield which were cited, was relied upon as establishing the following conclusions:—That no chemical process could efficiently deal single-handed with sewage, but must be assisted by subsequent natural or artificial filtration of the treated sewage, and therefore no chemical process, *per se*, should be adopted for the purification of town sewage. The principal objections to chemical processes, which appeared upon the experience of the places where they had been adopted, and upon which this conclusion was founded, were, inefficiency of treatment, cost of treatment, and difficulty of manipulating the accumulations of sewage sludge.

2. *Application of Sewage to Land.*—The author first considered whether sewage could be made to yield an agricultural profit. The parliamentary return of 1873 was referred to, and the financial position of the Warwick farm was specifically examined. The question was also raised, whether sewage possessed any fertilizing value beyond ordinary water for the purposes of irrigation, and the experience of the Barking farm having been appealed to upon this point, the conclusion was laid down, that no profit ought to be expected from the cultivation of crops by sewage irrigation. The next point discussed was whether any definite standard could be laid down as to the proportion population should bear to acreage in the practice of irrigation, the proportions exhibited by eleven towns being referred to, and it was determined that it was impossible to frame a specific rule. The theory of intermittent downward filtration was then investigated, as based upon the laboratory experiments of the Rivers Pollution Commissioners; and it was argued that the proportions which they had affirmed population might bear to acreage, ranging in the case of one acre drained 6 feet deep from 2000 to 3300 persons to the acre, were too high, and were not justified by the experiments. The practice of downward filtration at Merthyr was next referred to, and it was shown that the extent of its practical operation there had been exaggerated, and that the results confuted instead of confirming the proportions of the Rivers Pollution Commissioners. The experience of Walton and of Kendal was also reviewed, and the following general conclusion completed this section of the paper:—That where land could be acquired at a reasonable rate, irrigation was the best and most satisfactory known system for the disposal of sewage, but that intermittent downward filtration might be practised where the necessary surface area

for broad irrigation could not be obtained. Experience, however, showed that the permanent proportion of population to acreage, where land was drained 6 feet deep, should in no case exceed 500 or 600 persons to an acre.

3. *The Dry-Earth System.*—The applicability of this system to towns was next considered, and it was shown that it must be supplementary to, and not substitutive of, a water-carriage system, thus enormously increasing the cost of making sanitary provision for towns. The effect of its introduction into the Metropolis, as a test case, was illustrated by figures, to prove that it would be superfluous, costly, cumbrous, and impracticable. Indeed its applicability became diminished in the inverse ratio to the increase of the population to which it was proposed to apply it; and though it might be occasionally used with advantage in hamlets or detached buildings and institutions, it was unsuitable for the wants of towns.

4. *The Liernur or Pneumatic System.*—A description of the mechanical characteristics of this system was first given, and then the experience yielded by its operation at Leyden, Amsterdam, and Dordrecht was specifically analyzed. It was supplementary to, and not substitutive of, a water-carriage system, extremely costly, and its mechanism was complicated and liable to get out of order. The accumulation of sewage residuum in the central reservoir, and its subsequent decanting into barrels, were operations which could not fail to be objectionable and offensive. Its appliances were, therefore, not suitable for a high-class community, and no return from the manufacture of "poudrette" could be expected. In conclusion, it was urged that the system was of such a character that, though it might have a partial province in the tide-locked cities of the Hague, where no system of sewerage was available, it should never be imported into an English town.

5. *Seaboard and Tidal Outfalls.*—The first point considered was the return of the sewage of seaboard towns upon the beach; and it was maintained that where care had been taken to determine, by float observations, the force and set of the currents to which the sewage was to be committed, there was no difficulty in preventing such a result. The sea constituted the most natural and economical outfall for the sewage of towns situated upon it, and such means of outfall should be adopted. With regard to sewage outfalls upon the tidal portions and estuaries of rivers, there ought to be, arguing from the experience of the metropolitan outfalls, and assuming that proper precautions were taken in the selection of the outfall, and the exclusion of silt from the sewers, no danger of the silting up of the navigable channel.

PARTICK, HILLHEAD, AND MARYHILL GAS COMPANY.

FIFTH ANNUAL FESTIVAL OF EMPLOYÉES.

As mentioned in our "Trade Notes from Scotland" last week, this festival took place on the 9th inst.—JAMES HISLOP, Esq., in the chair. There was a large attendance, and on the platform Provost Shaw, Maryhill; Provost Cowan, Hillhead; Rev. J. M. Rae, Maryhill; Mr. Wilson, town-clerk of Hillhead; Mr. McGilchrist, Dumbarton; Mr. McLeod, Glasgow; and Mr. Crawford, Partick, &c.

The CHAIRMAN, in his opening address, said: It is now nearly five years and a quarter since I cut the first turf towards the formation of the company's works, and four years last Christmas we began to make and send out gas from them. While the erection of the works was being pressed forward, the laying of main-pipes was also prosecuted with the utmost vigour, and, by the time the works were ready for the production of gas, we had upwards of 32 miles of mains laid down. Now we have upwards of 70 miles of piping, of sizes varying from 2 inches to 30 inches diameter. At the outset of these our operations, many were the conjectures that emanated from the people far and near, and considerable interest was felt in the future success of the undertaking. I myself never entertained a single doubt as to the success of the company. With a staff of men acting unitedly, cordially, and perseveringly, as has been the case, the company could not, nor can they fail to rise; yet, possibly, not so rapidly as some of the shareholders would wish. "Slow, but sure," is a good maxim, or, in the words of the good old Scotch song by Mr. Balantyne, of Edinburgh, to the bairnie, "Creep before ye gang." It is now 60 years since gas was first supplied in Glasgow, and I do believe, from that time, no gas company could have had a worse start than this one. Gas coal was selling at three times the ordinary rates, and every other thing necessary for a gas-works in the same proportion. When the works were completed so far as to admit of gas being made, the company were very much in the position of a person opening a shop, who knew of only a few would-be customers; but quality and cheapness of the article offered to an enlightened public cannot fail to command, in every trade, pre-eminence, and that is the secret of this company's success. It is the determination of the directors to maintain a supply of pure gas of high quality. I say pure gas, free from sulphuret of carbon. This is a most important consideration, as, if it is allowed to be produced in the manufacture, it cannot be removed by purification, and sulphurous acid is generated during the combustion of the gas in dwellings; the atmosphere therein soon becomes loaded with it, and the result is sure to be an increased death-rate from pulmonary disease, more especially in densely-populated places, where crowds of human beings are huddled together in small compartments, with low ceilings and bad ventilation. Well, the result of our supplying a good, pure, and cheap gas is, that in four years time the business of the company has risen from zero to over 100 million cubic feet in the past year; and, as the rate of increase annually is now upwards of 20 per cent., we may expect that, within the next five years, the demands will be over 200 million cubic feet. When the works shall have been extended in accordance with the plans, having 400 retorts, and allowing 20 per cent. for reserve, the manufacturing power will be three million cubic feet in the 24 hours. Our main-pipes stretch over an area of over 4000 square acres, and should the building operations continue in the future as in the past, the time is not far distant when even this large productive power will be exhausted. Take for an example the Maryhill and New Kilpatrick districts, the goodwill of which the company took over with the old company's works, in June, 1872. The gas sales then amounted to only about 4½ millions in the year, while in the present year they are nearly four times that quantity, and in the course of three years will have doubled again. During the existence of this company, many schemes have been patented to supersede the ordinary process of gas-making—i.e., by some peculiar craft, it may be "witchcraft," to squeeze more gas out of a ton of coal than it in reality contains—such as Mr. Malam's and Dr. Eveleigh's patented processes. Yet another edition is going on nearer to us at the present moment, and the gas produced, as one party said, were it made any heavier it would not burn. Yet it is only 30-candle power. I am afraid they must be trying the plan suggested by a correspondent of the *Daily Mail*, some years ago—that of putting the candles into the gas, and the heavy wicks will be getting up into the jets. I look upon all these schemes as a farce, something like 20 shillings and 240 pence; what are they when compared to the standard? Only a pound. I believe our system is based upon sound principles; it inherits a firm constitution, and we may go on rejoicing without any fear of substitution. I trust all of you will endeavour to comport yourselves in a manly way, applying every effort, steadily and perseveringly, to duty, throughout this year as in the past years; or, in the words of one of Scotland's greatest heroes—Lord Clyde (who was born

at Glasgow in 1792, the year in which the first gas-works were erected)—to the "thin red line" on the heights of Kamora, before Balaklava: "Be steady men and do your duty," and shortly the company will rise up and rank with the first in the nation.

Addresses were also delivered by the Rev. Mr. Rae and others. The musical part of the programme was ably sustained by Mrs. R. Fraser, and Messrs. M. Hamilton, R. Bryan, R. Cunningham, and R. Fraser. The proceedings were most enjoyable throughout.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

It has just transpired that the Police Commissioners of Partick, one of the burghs in the suburbs of Glasgow, have got the sum of £100 16s. to pay as their share of the parliamentary expenses incurred in connexion with Sir Windham Anstruther's Gas Bill. This fact turns out to be rather a surprise to some of the Partick ratepayers.

At a police court held at Macduff last Wednesday, before Provost Martin and Messrs. Simpson and Bow, police magistrates, John Scott, architect, Macduff, was sentenced to pay a fine of £2, or undergo thirty days imprisonment, for stealing gas. He had made a connexion with the supply-pipe prior to its attachment with the meter.

The managing committee of the Gas Corporation of Arbroath met last Wednesday night, when there was brought under the consideration of the members the price charged to consumers for the use of meters. It was found to be unequal, and the meeting resolved to make a uniform charge of 7½ per cent, which is to begin with the financial year.

The last report by Mr. J. Falconer King, public analyst, on the illuminating power of the gas supplied by the Edinburgh Gas Company, sets it down at 30.32 candles, while that of the Leith Gas Company at the same time was 28.07 candles.

Grumbling regarding the quality of gas seems now to be showing itself at Helensburgh, and yet according to the annual report just issued by the West of Scotland Association of Gas Managers the illuminating power is not less than 30 candles.

Referring again to that report, I find that last year's make of gas was 6½ million cubic feet, while in the year 1873 it was only 5 million feet. Then, again, the leakage, or gas unaccounted-for, has been reduced from 30 per cent. to 10 per cent., and the price has fallen from 8s. 4d. to 5s. per 1000 cubic feet. Lastly, the meter-rent is now 1s. 6d. per annum, whereas in 1873 it ranged from 2s. upwards, according to size. The foregoing figures show that a most salutary change has taken place since the opposition company ceased to exist.

At a special meeting of the Grangemouth Burgh Commissioners, held last Friday, a letter was read from the Public Works Loan Commissioners agreeing to lend £11,200 for the completion of the new water-works, only £10,000 to be paid in the present financial year.

The Bonhill Local Authority met last Tuesday to consider the proposed water supply for Jamestown district, Vale of Leven, Dumbartonshire. A statement by Messrs. R. Young and Son, engineers, showed that the available supply would be from 18,000 to 20,000 gallons, and the cost fully £800, exclusive of compensation. The matter was remitted to a committee with full powers.

It has been resolved to impose three different water-rates in Cupar—viz.: (1) a rate on owners at 6d. in the pound of rental, yielding £400; (2) an occupation-rate for property other than dwelling-houses, at 1s. in the pound, yielding £300; and (3) a domestic rate of 1s. 10d. in the pound, yielding £916. It is expected that the rates will be reduced to 5d., 10d., and 1s. 6d. respectively next year, and that there may even be a further reduction in future years. The sum of £25,000 which was allowed by the Act of Parliament will, it is believed, cover all the expenses.

The Public Works Loan Commissioners have intimated to the Crief Police Commissioners that they are prepared to advance the sum of £3500 on the drainage works which it is proposed to execute in the burgh. The conditions are—3½ per cent. interest, or, including capital and interest, £4 17s. 5s. per cent., making in the latter case an annual payment of about £175 for 39 years, any remaining balance to be paid at the end of the fortieth year.

The pig iron market has been rather weak in tone during the past week. Business was done on Friday at 56s. 5d. and 56s. 4d. cash, the week thus closing with prices 3d. under the closing quotations of the preceding week. Shipping iron is getting into somewhat better demand. Manufactured iron is in good request, and the mills are generally well employed, but the order-books are not so well filled ahead as they were.

Owing to the increased mildness of the weather the demand for coal has lessened to such an extent, that some descriptions are almost at a standstill. Prices for immediate orders are easier. Wishaw Main coal, free on board at Glasgow Harbour cranes, is quoted at 6s. 9d. to 7s. 3d. per ton; house coal at 7s. 9d. to 10s.; splint coal at 8s. to 8s. 6d.; steam coal at 9s. to 10s. 3d.; and smithy coal at 14s.

WHITBY WATER-WORKS COMPANY.—At the meeting of shareholders on the 7th inst., a dividend of 9½ per cent. per annum on the paid-up capital of the company was declared.

REDUCTION IN THE PRICE OF GAS.—At the meeting of the Congleton Town Council on the 7th inst., the Gas Committee recommended, and the Corporation agreed to, a reduction in the price of gas from 4s. 6d. to 4s. 2d. per 1000 cubic feet.

GLASGOW WATER SUPPLY.—Dr. Mills, F.R.S., of the Andersonian University, Glasgow, reports that the water supplied to that city from Loch Katrine during January was "very pale brown, and decidedly ferruginous, and contained a considerable number of muddy articles and some fibres."

BIRMINGHAM WATER SUPPLY.—Dr. Hill, the Medical Officer of Health, reports that the water supplied to that town during last month was "turbid and yellowish, and contained an increased quantity of organic carbon and nitrogen." The late heavy rains are doubtless the chief cause of this greater organic pollution.

BASINGSTOKE WATER-WORKS COMPANY, LIMITED.—The annual meeting was held on the 5th inst. The report of the directors stated that the net profits for the year amounted to £365 2s., and after expending the sum of £30 8s. 1d. in laying new services, there was an available balance of £334 13s. 11d. The directors recommended that a dividend of 9 per cent. be declared, which would absorb £315, carrying the balance to the reserve-fund, which would amount to £75 19s. 9d. The report was adopted.

MELTON MOWBRAY GAS COMPANY.—The half-yearly meeting was held on the 10th inst., when a dividend of 20s. per share for the half year ending the 31st of December was declared. An extraordinary special meeting was held at the same time, at which it was decided to increase the capital of the company by creating 300 new shares to be called A shares, the first call to be made on the 1st of July in the present year. The resolution was unanimously agreed to, and the preliminary steps taken for putting the decision of the meeting into effect.

HULL GAS SUPPLY.—Mr. James Baynes reports that the gas sent into the district of Seacroft and Myton during the month of January by the

British Gas Company gave the following results, free ammonia and sulphuretted hydrogen being at no time present to the ordinary test:—

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16.70	15.50	16.01
Grains of sulphur per 100 feet	31.40	27.50	29.60
Mean barometer and temperature in experiment-room:—Bar., 29.65; temp., 53°.—In the east district, Mr. James Baynes, jun., reports that the gas supplied by the Sutton, Southcoates, and Drypool Gas Company during January gave the following results:—			
Illuminating power standard sperm candles	15.73	15.65	15.69
Grains of sulphur per 100 cubic feet	—	—	11.67
Grains of ammonia per 100 cubic feet	—	—	10.40
Mean barometer and temperature in experiment-room:—Bar., 29.85; temp., 55°.			

WASTE OF WATER AT WARWICK.—At the meeting of the Warwick Town Council on the 13th inst., an important report was read from Mr. Pritchard, the engineer, respecting the waste of water now going on in the town. He reported that the new supply of water had been given to the town during the past month for about 15 hours per day, and for about a week during the whole of the 24 hours. When the supply was for 15 hours the consumption was 310,000 gallons, being at the rate of 28 gallons per head per diem; and while it was on for 24 hours the consumption was 470,000 gallons, being at the rate of 42.7 gallons per head. This showed a total waste of 16,000 gallons per hour during the night time. Mr. Pritchard advised the council to take immediate steps to check this waste, as it was scarcely reasonable to expect the supply of water to be equal to a demand twice as large as was originally intended. To secure this result he recommended either an alteration in the fittings, or the fixing of a meter to every service in the town, the cost to be charged to the general district rate. If that were done, and the water sold out at the rate of 6d. per 1000 gallons, a very handsome revenue would be obtained. The report was referred to the Water-Works Committee for consideration.

BODMIN GAS CONSUMERS COMPANY.—The twelfth annual meeting was held in the Guildhall on Monday evening, Feb. 5, when the principal shareholders were present. The directors recommended, in their report, a dividend of 48 per cent. They had been enabled to make, they stated, a further reduction from 6s. to 5s. 9d. per 1000 feet, with the usual discount of 6d. per 1000 feet. Three years since the price was 6s. 6d., but it now stood at 5s. 3d. to those who made prompt payment, being a reduction of 1s. 3d. in four years, which they considered very satisfactory to their gas consumers. Two of their directors—Messrs. S. Hicks and J. Beswetherick—retired by rotation, but were eligible for re-election. Two auditors also—Messrs. E. T. Crabb and J. R. Collins—retired, and were eligible for re-election. The directors had received a communication from the War Department as to on what terms the company were prepared to supply the military department. Negotiations were now pending between them, and they ask for power to increase their capital by the issue of additional shares; in case they should find it necessary for that purpose. The balance of cash in their hands was £489 16s. 3d. The consumption of gas during the past year had been the greatest on record. The report was adopted, and the previous directors and auditors were re-elected. The quality of the gas during the past year, they said, had been exceedingly good on the whole; and great credit was due to the company's manager, Mr. Thomas, who had conducted the works with much ability. His suggestions had been considered in reference to the works, and most ably carried out by him. There had been an increase of between 400,000 and 500,000 feet during the past year over the previous year, and the waste had been the least on record of the company. A vote of thanks having been passed to the chairman (Mr. S. Hicks), the directors, and auditors, the proceedings closed.

LEICESTER GAS COMPANY.—A special meeting of this company was held on the 12th inst., to consider the provisions of the Bill promoted by the directors in the present session. The chairman (Mr. Hutchinson) explained that the object of the Bill was the establishment of additional works for the manufacture and supply of gas to the town. He thought he mentioned, at one of their meetings last year, that the directors had in contemplation the desirability of providing works to a larger extent than had been the case for many years past. The subject was seriously discussed by the directors last autumn, and they were unanimously of opinion that the time was come when they must provide on a larger scale for the ever increasing demands for gas in the town. There were three cardinal points to be considered in the establishment of gas-works. One was the suitability of the site as regarded levels, and its connexion with a railway and canal. They had found those requisites, as they believed, in the vicinity of the Aylestone Road. It was an eligible site with reference to levels, and it was also in close proximity to the Leicester and Burton Branch of the Midland Railway, and to the Union Canal. There was also another requisite to be considered, and that was that the site should be as far away from dwelling-houses as possible, and, in looking about the town they did not think they could find any land which would be less of a nuisance in that respect than the land which they had scheduled, near the Aylestone Road. The reason why they were obliged to go to another district to establish the new works was because the land they had available at the works near Belgrave Gate was almost entirely exhausted. In selecting a site they had to consider its suitability as regarded levels, and connexion with railway and canal. The subject had been carefully considered by the directors and the engineers, and they thought the site selected a suitable one. After replying to some inquiries by shareholders, the chairman moved that the Bill be approved, which was put and carried.

HALIFAX WATER SUPPLY.—The quarterly report of the Corporation Water-Works Committee states that "the quantity of water in store at the last fortnightly meeting of the committee, held on the 23rd of January, was 679,034,000 gallons, being 175,341,000 gallons more than the quantity reported at the first meeting of the committee, which was held in November last, and 42,428,000 gallons more than the quantity in store on the 23rd of January, 1876. The reservoirs may now be said to be practically full. The committee are happy to report that the agreement with the Clifton Water Supply Company, Limited, for a supply of water to a portion of the township of Hartshead-cum-Clifton has at length been settled, the following being the substance of the terms:—The price to be 9d. per 1000 gallons for a period of 20 years; a minimum of 85,000 gallons per week to be paid for by the company, whether used or not; the maximum quantity which the corporation are bound to supply is 210,000 gallons per week. The water will be measured by a meter fixed at Clifton Bridge. The committee are also happy to state that a settlement has been arrived at with the Rastrick Water-Works Company with regard to the amount in dispute for interest, &c., on the main-pipe between Hove Edge and the district of Rastrick, which is a 14-inch main, conveying water not only to Rastrick, but also to the Savile estates at Thornhill and Sotherhill. Consequent upon drainage operations, which the Board of Works Committee found it necessary to carry out in Spring Hall Lane, a portion of the stone conduit conveying pure water between Pellon and Victoria reservoir has fallen in. This circumstance led the committee to instruct Mr. Paskin, the water-works superintendent, to make a thorough examination of the

conduit between the before-mentioned points, and although his report thereon has not yet been laid before the committee, the probability is that it will be found necessary to reconstruct this work in order to prevent all risk of contamination of the water in its passage through a locality which is now becoming populous, and also to prevent loss of water."

BATLEY CORPORATION WATER-WORKS.—Mr. F. Bateman, C.E., has made the following report to the Water-Works Committee on the condition of the Riding Wood reservoir:—"On the 30th ult. I had the opportunity of examining the Riding Wood reservoir, which was then within 6 feet 6 inches of being full of water. In the course of the previous night there had been nearly 2 inches of rain, and every spring and stream was swollen in volume. Issues of water had for some time been observed to have occurred when water was contained in the reservoir, which was attributed to leakages from the reservoir. In order to ascertain this and other particulars, the reservoir, after being first nearly filled, was drawn down till the leakages disappeared. Gauges were put down at every spot where water issued, the reservoir was re-filled, and the quantity escaping carefully measured. The result is very satisfactory. There is no doubt that water does escape from the reservoir, but it is perfectly clear, and in no great quantity. No waste or mischief whatever is taking place, the escape does not take place through the artificial work of the embankment, but most probably through the fissures of a bed of rock on the left side of the valley, which crops out in the upper part of the reservoir, passes under the puddle trench, which has been filled with hydraulic concrete, and re-appears in the valley below the bank. The whole quantity escaping scarcely amounts to a considerable spring, and so long as it remains pure, as at present, not the slightest danger is to be apprehended. The leakage first appears when the water rises to within 26 feet of the top of the waste weir—it amounts to about 200,000 gallons per day when the water is about 17 feet below top level, and to about 300,000 gallons when within 5 or 6 feet. The whole of this may be rendered available either by being taken direct to Batley, or given in compensation to the river. The Yateholme reservoir was full, and water running over the waste weir. Both here and at Riding Wood the works in every part have been most substantially executed, and are in perfect condition, and I congratulate the corporation on what I consider the successful completion of so much of the undertaking as they have carried out."

EASTBOURNE GAS COMPANY.—The following is the report of the directors to be presented at the ordinary meeting of the company to be held on the 26th inst.:—"In presenting the accompanying accounts for the half year ending the 31st of December last, the directors are glad to be able to congratulate the shareholders upon the continued prosperity of the company. It will be seen that the sum of £1346 10s. 6d. has been expended during the past half year on the capital account, in the enlargement of the coal-stores, the building of a station-meter house, the purchase of weigh-bridges, and in the laying down of new mains, service-pipes, &c., and this outlay has exhausted the balance due at the date of the last balance-sheet, and leaves a deficiency on the capital account of £239 8s. 4d. The increase in the number of private consumers and of the public lamps has rendered it necessary for the directors to make provision for increased storage room; and they propose to obtain plans for, and to erect without delay, another gasholder and additional purifiers, and to extend the present retort-house. In order to be able to carry out these works, they will seek authority from the shareholders to raise a further sum of £5000, by the issue of 500 additional B shares of £10 each, under the provisions of the company's special Act of Parliament, and the Acts incorporated therewith, and these shares will be offered to the present shareholders *pro rata*. The notice of an extraordinary meeting of the company to give the directors the necessary powers accompanies this report. The revenue account preserves its elastic character; the receipts from consumers being largely in excess of those in the corresponding period of last year. The principal items of increase on the expenditure side of the accounts are for coals (a greater quantity having been received during the past six months), and for repairs and meters, the last account including a new station-meter just erected at the works, at a cost of £329. The directors have decided to sell all the residual products made at the works (except tar) by weight, instead of by measure, and have purchased the necessary weigh-bridges. The system came into operation on the 1st of January last, and they believe it will give greater satisfaction both to the purchasers and to the company. The assets and liabilities of the company to the 31st of December last having been taken into account, there is a balance of £3060 17s. 3d. available for dividend, and the directors recommend that a dividend at the rate of 7 per cent. per annum be declared and paid upon the £5000 capital in B shares, and a dividend at the rate of 10 per cent. per annum upon the £20,000 original capital of the company for the past half year, and a bonus of 5 per cent. upon the last-mentioned capital, on account of the deficiencies of the dividends paid in former

years since the incorporation of the company. These payments will leave a balance of £885 17s. 3d. to be carried forward."

BRISTOL NEW WATER-WORKS COMPANY.—A public meeting was held at the Grand Hotel, Bristol, on the 7th inst., for the purpose of hearing explanations by the engineer and the promoters of the Bristol District Water Bill. Mr. Paskin explained the general objects of the Bill, and read the following report of Mr. Bateman:—"I have had the opportunity of seeing the observations by Mr. Brooke on the quantity of water pumped extending from March, 1871, to November, 1873, and again from December, 1874, to October, 1875. The least quantity registered was in December, 1871, when it amounted to 1,050,000 gallons. The greatest quantity after steady pumping was in December, 1872, when 2,400,000 gallons per day were raised. On studying these registers, I am of opinion that 2 million gallons per day may be relied upon on the average of a year, provided a reservoir to contain 200 days supply of an average deficiency of 200,000 gallons per day be constructed. I have accordingly laid out a reservoir at Frampton Cotterell to contain this quantity. Into this reservoir the water from the mine will be pumped, for which the existing engines and pumps seem to be sufficient." The report then went on to state that the plans show two reservoirs in addition to that at Frampton, one at Frenchay for local supplies, one at Westbury, nearly the highest ground near Bristol, and arrangements were made for a head of pressure 19 feet above that at present supplied by the existing company's reservoir. The report further states that the water is reported by Dr. Frankland to be of excellent quality, and much better than that now supplied to the city of Bristol. The report then proceeds as follows:—"The total cost of new works from Frampton Cotterell to Westbury Park reservoir, including engines, pipes, reservoirs, land, and contingencies, and an ample allowance for rendering every reservoir water-tight, will be about £98,000. Two million gallons of water per day are sufficient for the domestic supply of about 100,000 persons; the cost of redistribution to this number of persons will be about £50,000, making a total of, say, £150,000. If two million gallons of water per day be sold at 6d. per 1000 gallons (which is a low price when distributed), the income would be £18,000 per annum. From this must be deducted the annual cost of pumping the water and other expenses, which will probably amount to £4000, leaving £14,000 as net revenue. In this estimate nothing is allowed for the capital already sunk in the shaft and pumping engines at Frampton Cotterell. Whatever may be considered a fair equivalent for this outlay will have to be added. The total quantity of water which the present well will yield is insufficient for the full supply of Bristol and its suburbs, but it will form a most valuable addition to the present supply, will make up for the notorious deficiency of the present company, is better water than is now supplied, and is probably the cheapest water that can be obtained. A company established for its supply can hardly fail of success." A discussion arose as to the relative prices to be charged by the new company and those charged by the existing company, and it was stated that the prices proposed to be charged would be considerably below the prices charged at present. Ultimately it was resolved—"That this meeting, having heard the explanations of the engineer and directors, are of opinion that the additional supply of water proposed to be given by the Bristol District Water Bill would be a valuable and necessary addition to the present water supply, and that the Bill should receive the support of the city and district proposed to be served."

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

- 523.—THOMAS, J. Aberdare, Glamorgan, "Improvements in direct-acting steam-pumps." Feb. 7, 1877.
 528.—PERRETT, E., Westminster, "Improvements in filters." Feb. 7, 1877.
 552.—BENNETT, H., and BOSTOCK, I., Rugeley, Stafford, "Improvements in pumps." Feb. 9, 1877.
 556.—LAKE, W. R., Southampton Buildings, London, "Improvements in water-engines and pumps." A communication. Feb. 9, 1877.
 601.—NAWROCK, G. W. von, Berlin, "Improvements in water-meters." A communication. Feb. 14, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3231.—PEEBLES, D. B., Edinburgh, "Improvements in apparatus for governing, or regulating, and adjusting, or otherwise acting on the flow or pressure of illuminating gas; a part of the said improvements being also applicable to two-way or multiple-way valves for other fluids." Aug. 16, 1876.
 3376.—SIEH, P., and SCHWARZ, T., Hamburg, Germany, "Improvements in gas regulating and saving apparatus." Aug. 28, 1876.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to Gwynne & Beale's Patent Improved Gas-Exhausters,

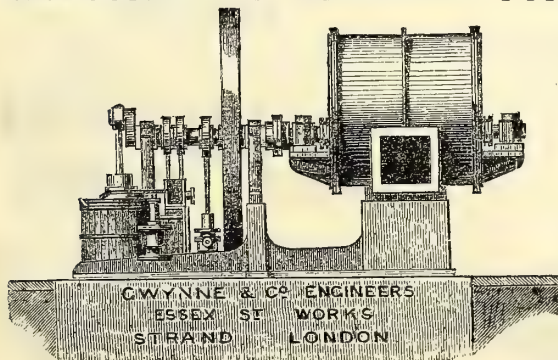


Fig. 224.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the most perfect system of action yet discovered. Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. Gwynne & Co. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement. Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES.

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 cubic feet Patent Gas Exhausters, and many of all sizes.

The BEST EXHAUSTERS
IN THE WORLD.

GWYNNE & CO.
HAVE MADE THE
LARGEST AND MOST
PERFECT
EXHAUSTING
MACHINERY

Ever produced, and the most
economical in working.

Prices and every information on
application.

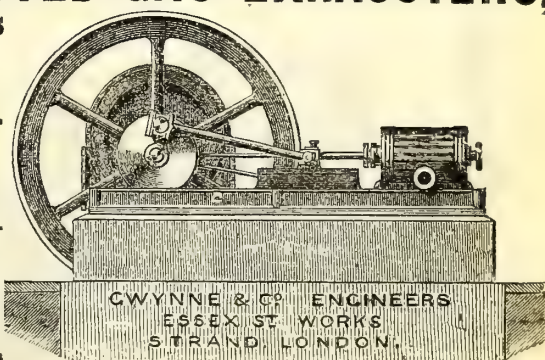


Fig. 225.

WANTED, a lease of Gas-Works.
Particulars to be sent to No. 348, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO STOKERS.
WANTED, a steady, efficient Stoker in
a country Gas-Work, making 7 millions per year.
Address, in own handwriting, No. 349, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a second-hand Exhauster to
pass 3000 feet per hour or less, with governor, throttle-valve, and all necessary connexions. Must be in good condition.
Apply to the MANAGER, Gas Company, MALVERN LINK.

CARNARVON CORPORATION GAS-WORKS.
WANTED, a thoroughly experienced
GAS-FITTER. Must be competent to undertake the repair of Wet Meters.
Apply, stating experience, wages required (58 hours), and references, to MR. I. PARSONS, Manager.

METER REPAIRER.
WANTED, at the Reading Gas-Works,
a steady and experienced METER REPAIRER. Used to both Wet and Dry Meters. The situation is a permanent one.
Apply, stating age, experience, and wages required, to MR. E. BAKER, Engineer.

WANTED, by the Advertiser, a situation
as WORKING MANAGER of a medium-sized Gas-Work. Good testimonials from present and last employers. Only reason for advertising is wanting to improve his position.
Address No. 346, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO CARBONIZING FOREMEN.
WANTED, Two Foremen Stokers, who
will be required to take night and day shifts alternately. Must be thoroughly competent, energetic, and steady. Annual make about 130 millions.
Applications, with testimonials, to be addressed to Mr. JOSEPH HALL, Manager, Gas-Works, St. Helen's, LANCs.

GAS ENGINEER AND MANAGER.
WANTED immediately, a thoroughly
practical ENGINEER and MANAGER for a large Gas-Work in South America.
The commencing salary will be £600 sterling per year. Copies only of testimonials and references to be forwarded to No. 347, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED to Freight.—Two Screw
Steamships will be required by the London Gas-light Company to freight, running continuously, for a term of Five or Seven years, and delivering Coals in the Thames at the Company's Wharf, Nine Elms. They must each deliver not less than 800 tons per voyage.
The Ships will have to be specially constructed for passing through the bridges crossing the Thames, to the above point. The depth of water provided at the Wharf will be 13 feet at high water, neap tides.
Further particulars may be obtained by application at the Company's Offices, 26, Southampton Street, Strand, London.
By order,
A. J. DOVE, Secretary.
Feb. 1, 1877.

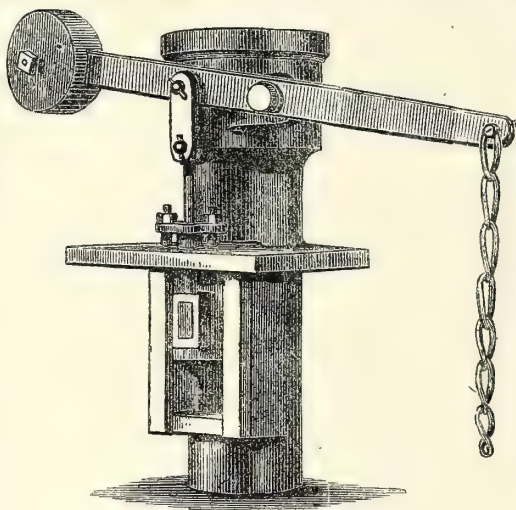
FOR SALE, a Set of 6-in. Vertical
CONDENSERS, with tar-box and all connexions complete.
May be seen, and price obtained, on application to the Southbank and Normanby Gaslight and Coke Company, Limited, Southbank, YORKSHIRE.

THE Swansea Gaslight Company have
for immediate SALE, the following Plant:—
A 6-h.p. Patent Trunk Engine. (Beale.)
Exhauster to pass 15,000 feet per hour. (Beale.)
An 8-h.p. Grasshopper Engine. (Easton and Amos.)
Exhauster, 20,000 ft. per hour. (Beale.)
Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.
Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.
A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.
May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.
Further particulars may be obtained on application to MR. THORNTON ANDREWS, SWANSEA.

THE Committee of the Wareham Coal
Gas Company invite TENDERS for the supply of from 300 to 350 tons of Pelaw Main GAS COALS (best quality), to be delivered, free of charge, into lighters at Russell Quay. 100 tons to be delivered by the 1st of May next, the remainder by the 1st of September next.
Payment will be made four months after delivery.
Tenders to be sent in, addressed to me, on or before Monday, the 5th of March next.
F. FILLITER, Secretary.
Wareham, Dorset, Feb. 16, 1877.

HEBDEN BRIDGE GAS COMPANY.
THE Directors of the above Company are
prepared to receive TENDERS for the construction and erection of Scrubber, Condensers, Engine, Exhauster, &c., and connexions for same.
Plans may be seen and all particulars obtained from Mr. Blackburn, Manager, Gas-Works.
Sealed tenders, endorsed "Tender for Scrubber, &c.," to be sent in not later than March 7th, and addressed to the Chairman, Gas-Works, Hebden Bridge.
The Directors do not bind themselves to accept the lowest or any tender.
By order,
THOMAS HONSFALL, Secretary.
Gas-Works, Hebden Bridge, Feb. 16, 1877.

MOORE'S PATENT DIP-PIPE.



THE advantages of this Dip will be seen from the engraving. It is thoroughly effectual in its working, removing the whole of the pressure of the hydraulic main from the retort, thus causing a great saving in gas. It is very easy of manipulation, requiring little care and attention; it cannot get out of order, and, when shut, works as an ordinary Dip-Pipe. No accumulation of carbon in retort. Can be fixed to existing H-pipes.

In ordering the Dip, the distance from top side of hydraulic main to water-level should be stated; also the Dip at which it is required to work when the valve is shut.

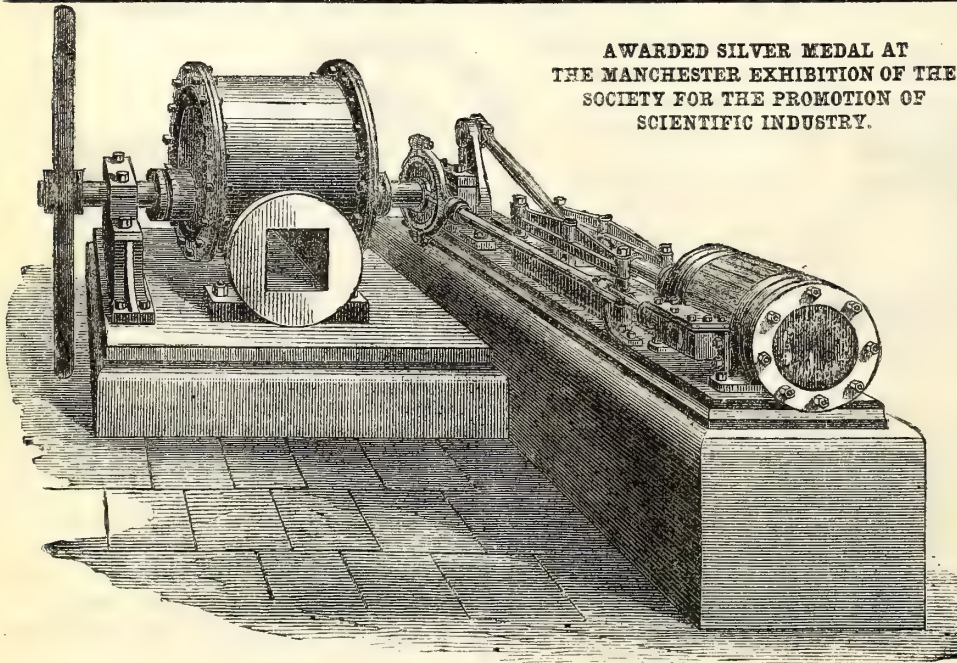
PRICES—3-in., 35s.; 4-in., 42s.; 5-in., 48s.

SOLE AGENT: J. GILL, GAS-WORKS, BRIDGENORTH,
To whom all communications should be addressed.

MAKERS: THE COALBROOKDALE COMPANY, SHROPSHIRE.

D. BRUCE PEEBLES & CO.,
ENGINEERS,
FOUNTAINBRIDGE WORKS, EDINBURGH,
MANUFACTURERS OF WET AND DRY GAS-METERS;
Patentees and Sole Manufacturers of "PEEBLES' GAS-GOVERNORS,"
FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS,
OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.

"These Lamp-Governors are so superior that they are likely to supplant all others."—Dr. Wm. Wallace, F.R.S.E., F.C.S.



AWARDED SILVER MEDAL AT
THE MANCHESTER EXHIBITION OF THE
SOCIETY FOR THE PROMOTION OF
SCIENTIFIC INDUSTRY.

BEALE'S
Improved Patent
GAS-EXHAUSTERS
WITH
ENGINES COMBINED.

Sole Makers,
GEORGE WALLER & CO.

Makers of
ENGINES, EXHAUSTERS,
INDEX and DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, and other PUMPS,
SCRUBBERS and PURIFIERS,
CONDENSERS, BOILERS, &c.

PHENIX ENGINEERING WORKS,
HOLLAND STREET, S.E.,
AND
STROUD, GLOUCESTERSHIRE.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

H. E. SADLER, New Haven, Conn.—The report of lecture on "The Volumetric Determination of Sulphur and Ammonia in Illuminating Gas, with a Description of the Apparatus Employed," is to hand, and we hope to find space for it at an early date. The numbers of JOURNAL required have been forwarded.

JNO. CHEW, Blackpool.—Your note on "Internal Gas-Fittings" next week.

Reports and accounts of the Brighton, South Shields, Reading, Wakefield, Redhill, Kirkby-Lonsdale, Sutton-in-Ashfield Gas, Sunderland, Rochester and Chatham, Leicester, South Staffordshire, Newcastle and Gateshead Water, Chesterfield Water and Gas, and other companies, are to hand, but their publication is unavoidably postponed.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 27, 1877.

Circular to Gas Companies.

THE development and progress of gas industry is well shown in the Bills annually presented to Parliament. This year it will be seen that, in all, thirty-six measures having connexion with gas matters, will be introduced. Of these, twenty-two are promoted by Gas Companies, either for incorporation with statutory powers, or to obtain additional powers. The share capital it is proposed to raise under the authority of these Bills, amounts to no less a sum than £1,184,910, and the sum to be raised by way of loan is £381,150. The measures promoted by Local Authorities will sanction the borrowing of money for gas purposes to the amount of £1,268,000, and beyond this there are three Bills by which Local Authorities seek power to raise as much money as may be required to effect their object. Of course, all these measures will not pass, for some are antagonistic; but those which, after consideration, we deem safe to become law, will add, at least, two and a half millions to the amount already invested in gas undertakings. This sum, it must be borne in mind, is required for extensions and additions, and, therefore, represents progress, and, looked at in that light, it is significant of much. It means, of course, national progress, as well as the development of the gas industry.

Of the Bills not certain to pass, we may instance that of the Corporation of Hanley, who propose to raise £150,000 for gas

purposes. The mention in the Bill of a specific sum to be paid as a consideration for the undertaking of the British Gas Company, led us to suppose that an arrangement had been come to by the Corporation and the Company. This, however, we learn, is not the case, and the Bill will be resisted to the last extremity. Now that we know that terms have not been settled, we may say that the price proposed by the Corporation of Hanley is altogether inadequate. The undertaking supplies a constantly improving district, and its value increases every year. It seems, then, absurd to suppose that the Directors of the British Company would part with it on the terms offered by the Hanley Corporation. We have yet to ascertain the temper and disposition of the Committees who will this year sit to consider Gas Bills. It is useless, however, to attempt to disguise the fact that there is an increasing disposition on the part of Parliamentary Committees to favour the transference of Gas and Water Undertakings from Companies to Local Authorities. Regret it as we may—and from more than one point of view we regard it as a serious evil—there is no use in closing our eyes to a patent fact. The British Company, we are certain, will make a good fight. There is nothing to be alleged against them. Their gas supply in the Potteries district is good and cheap, and the district would not be in the least degree benefited if this undertaking passed into the hands of the Corporation of Hanley.

The reports of the half-yearly meetings of Gas Companies, which we print to-day, reveal a highly satisfactory state of affairs. The Liverpool United Company are, of course, prosperous, and able to pay full dividends, carrying, we have no doubt, although no accounts are given this half year, a good sum to the reserve-fund. It is with great satisfaction that we publish the resolution of the Directors, to pay, in the future, interest on money deposited as security. Considering the large sum the Company hold, it has been regarded as a sort of scandal, that, while most other undertakings in the kingdom are required by law to pay interest, none was obtainable from the Liverpool Company. The concession now made by the Directors will remove a source of great irritation, and although it may not satisfy Dr. Cross, it will go a long way to make the great body of consumers contented. It will be remembered that, long before the Gas-Works Clauses Act of 1871 was passed, we advocated a more general exaction of deposits, and the payment of interest. We did so on the ground that it made the consumer a sort of co-partner in the concern. A deposit with a Gas Company at five per cent. is better than one in a savings bank at three per cent. We should be glad to see more opportunities given to consumers of all grades to contribute to the loan capital of Gas Companies. If such were offered, we think it might, at the expense of a little extra book-keeping, be doing something towards counter-acting the prevailing passion for transferring gas undertakings to local authorities.

The report of the meeting of the Ipswich Gas Company will be perused with a great deal of interest. It will be seen that a shareholder considered it a grievance that the Directors refused to sell the undertaking to the Corporation of Ipswich for guaranteed maximum dividends, and that the same gentleman subsequently defeated the Directors in their proposal to offer a new issue of shares by auction, on the ground that it would deprive him of the premiums realizable on the shares which would be allotted to him. We fail to understand this gentleman. He is either a philosopher and a patriot, or something else. If the undertaking were sold to the Corporation, his right to new shares and his chance of obtaining premiums would vanish for ever. The sale of shares in the Ipswich Company, we may remark, is not compulsory, and if the Directors had carried their resolution, we think that any shareholder might have successfully moved the Court of Chancery to restrain the Directors from selling shares by auction. We are not now arguing against auction clauses, which we may say, however, are not so much in favour as Mr. Goddard supposes. There is but one Gas Bill before Parliament this year which makes mention of an auction, and that will only give Directors permission to offer shares in that way when they have been declined by existing shareholders. In the case of the Reading Gas Company, the sale of new shares by auction is compulsory, and it is gratifying to see that shares so offered command increasing premiums. Frankly speaking, we do not like auction clauses, for they deprive shareholders of a vested right which Parliament has, in past times, conferred on them. Nevertheless, the success of these sales may be quoted as a strong argument in favour of keeping gas undertakings in the hands of commercial companies. Local Authorities go to the Bank of England, or to an Insurance Office, and raise large sums at from three-and-a-half to four per cent. Somebody, of course, gets the benefit of the interest. But these sales of shares by auction show that small investors are

content with almost as low a rate, for the prices given can hardly, at the best, command more than five per cent. The difference is but small. Opposed as we are to the sale of gas undertakings to Local Authorities, we wish to see Companies constituted on the widest possible basis. Earl Redesdale, we have always considered, did a great wrong to small investors, when he refused to allow shares of less nominal value than ten pounds. A real Consumers Company is now out of the question; but something, we think, might be done to popularize Gas Companies, if debenture bonds for small amounts were offered to consumers.

There was, as our readers will remember, some objection made to the payment of back dividends by the Wakefield Gas Company. The point raised, however, was easily disposed of, and at the half-yearly meeting on the 19th instant, together with the maximum dividends, another of nine-and-a-half per cent. was declared on account of arrears, all free of income-tax. The shareholders may be heartily congratulated.

The Redhill Gas Company, also, while paying full dividends for the past half year, make the small contribution of one per cent. towards the discharge of arrears. They do more and better. They reduce the price of gas from 5s. 6d. to 5s. per 1000 feet.

The circumstances of the Barnet District Company continue to improve. The accounts to be submitted to the meeting held to-day show an increased gas rental of £329 over the corresponding half year of 1875. The dividends proposed are four-and-a-half per cent. on the A shares and stock, and three-and-a-half on the B stock, leaving a small balance to be carried forward.

Equal in interest to the coming parliamentary contest between the British Gas Company and the Corporation of Hanley will be that between the Isle of Thanet Gas Company and the Ramsgate Local Board. The Bills promoted by the two authorities are unmistakeably measures of confiscation, and will be resisted, as we have said, to the last extremity. Margate, as every one must know, is as much interested in the Bill of the Thanet Gas Company as Ramsgate, yet at a special meeting of the Town Council of Margate, convened to consider the propriety of opposing the Bill of the Gas Company, the necessary majority in the Council could not be found to sanction the preliminary stages of opposition. The Bill of the Company was severely criticized, and the proposal to capitalize the £48,000 of expended profits was, of course, condemned by those who would adopt precisely the same course. Nothing can be more just and equitable than the capitalization of expended profits at a low rate of interest. The gas consumers in Margate and Ramsgate have gained considerably by what we regard as the mistaken policy of the Company in not going to Parliament years ago for power to raise further capital. It is acknowledged in Margate that the Gas Company have dealt fairly with the town. Objection is made to the maximum price of 5s. 6d. per 1000 feet proposed by the Company; but, as we have said before, this price may be altered in committee. A resolution to oppose the Bill of the Ramsgate Local Board in a "friendly" way was carried by an absolute majority in the Council; whether or not the ratepayers of Margate will understand what is meant by "friendly" opposition, remains to be seen.

The gas accounts of the Corporation of Birmingham, which we print in another place, are certain to attract attention. Corporation management of commercial undertakings is always closely watched, and sometimes severely criticized. In this case, however, it is clear that the management is all that could be desired. The accounts are rendered in much the same form as that prescribed by the Board of Trade for the Metropolitan Gas Companies, and which has been adopted by the Corporation of Nottingham. We miss, however, the account which ought to show the quantity of gas made, sold, used at works, and unaccounted for. It will be seen, however, that the quantity of gas sold in the past year was just about eight thousand cubic feet per ton of coal carbonized or used, which, seeing that only a small amount of cannel was employed, and that the gas had an average illuminating power of over seventeen candles, must be accepted as a very good result. It will be well in future accounts to fill up this *hiatus*.

The discussion in the Council on the presentation of the Committee's report is of much interest to us. We are sorry that the gas consumer has not more friends in the Council, but we may fairly anticipate that, before many years have passed, some change of opinion may take place among the members.

It will, we fear, be found in Birmingham that, notwithstanding the possession of the gas undertaking, and the appropriation of profits to the Borough Fund, rates will continue to increase in amount, and presently the consumer will ask for cheap gas as a relief. The £30,000, which the Council have just transferred to the Fund, is equal, we are told, to a rate of 7½d. in the pound; and this is paid by only half the ratepayers, who may be roughly said to

be rated to double that amount. We were quite prepared to see reproduced the old argument, that as the ratepayer is responsible for any losses, he is justly entitled to any profits. There is a certain speciousness about this argument which makes it popular. The Borough Fund is, of course, pledged for the Annuities. But let us suppose for a moment that the gas undertaking failed to meet its liabilities with gas at the maximum price—what would happen? Why, the Corporation would immediately apply to Parliament for an advanced maximum, which would certainly be granted, and thus the consumer would, practically, be made responsible for the solvency of the concern.

We are not surprised to see that the small amount appropriated to the reserve-fund has provoked comment. It was the first duty of the Gas Committee to add to this fund as largely as they possibly could. It is a fund of equal importance to the ratepayer and consumer, but the latter alone contributes to it. It is a guarantee against any call upon the rates, on account of loss by accident, &c., and for that reason should, as soon as possible, be made up to an amount sufficient to provide for all contingencies. We hope the time will soon come when sounder economic principles will be entertained in the Birmingham Town Council.

At the half-yearly meeting of the Cork Consumers Gas Company a dividend of eight per cent. was declared. The reserve-fund of this Company now amounts to £7000—a sum by no means too large; but some of the shareholders are wishful that a portion of this modest amount should be distributed by way of bonus, or as payment for arrears of dividend during the period of the coal famine. The Directors, we think very properly, for the present at all events, decline to accede to this request; but hopes are held out that if the present prosperous condition of the Company is maintained, a bonus may hereafter be paid.

We learn that the Corporation of Wigan have appointed two most competent engineers to make an investigation of the matters in dispute between the Corporation and some of the gas consumers, to which we recently referred. These are Mr. Littlewood, of the Manchester Gas-Works, and Mr. T. Newbigging, whose name is well known to our readers. We shall wait with interest for the result of their inquiries, which, we understand, will be commenced this week.

Water and Sanitary Notes.

WE give, to-day, a list of the Water Bills presented to Parliament this session. It will be seen that they number twenty-three, of which fourteen are promoted by Companies, and nine by Local Authorities. The aggregate amount of share capital which the Bills promoted by Companies propose to raise is £1,001,000, with borrowing power to the extent of £254,750. The sum which Local Authorities propose to raise for water purposes is no less than £1,685,000. Here again, however, we have to remark that all these measures cannot pass. There are, for example, three newly-formed Companies who compete for the supply of one district. Of the three Bills promoted by them, it is clear that only one can become law. Again, there are other antagonistic measures proposed, like those of the Ramsgate Water Company and the Ramsgate Local Board; but, after a review of all the circumstances, we come to the conclusion that at the end of the session it will be found that authority has been granted for the expenditure of about two and a half millions on water undertakings. The larger proportion of this sum—probably one and a half millions—will be expended by Local Authorities, whose debt will be augmented to that extent. This, however, need not create alarm, for water undertakings always pay, if they are not very profitable.

The Metropolitan Board of Works are once more greatly exercised on the Water Supply of the Metropolis. They have waited, they seem to say, for years to see effected that complete municipal organization of London, which would constitute a body who might be safely entrusted with the management of the water supply; but as this has been so long delayed, and is likely to be still further postponed, the Board present themselves as the Metropolitan Authority proper to take the matter in hand. They are about to prepare a Bill to effect a compulsory purchase of the London Water Companies, and when they have done this, they propose to go to the Government and ask their aid in the enterprise. They first sought the co-operation of the Corporation of London; but that wary body stand aloof. They do not care about hunting in couples. Perhaps one reason for the present move is the fact that the Duke of Richmond, now in the Cabinet, was, in 1869, the Chairman of the Royal Commission who inquired into the Water Supply of the Metropolis, and recommended, in rather emphatic terms, that the supply should be managed by a compact responsible public body, and not by several private Companies.

(We may drop the remark, in passing, that it has often struck us as odd that the idea of amalgamating never seems to have occurred to the Water Companies.) Granting, for the moment, the desirability of carrying out the recommendation of the Royal Commission of 1869, we may ask whether the Metropolitan Board, as at present constituted, is a body fit to be entrusted with the management of the water supply. We say, emphatically, "No;" and we think we may safely predict that they will evasively be told as much, at that coming interview with the Home Secretary. We are not now arguing either for or against the broad proposition put by the Royal Commissioners. We are simply speaking of the chances of the present Metropolitan Board. Since the Board have waited so long for a municipal organization, they might have waited another year, to learn the result of Earl Camperdown's well-intentioned effort to bring about a reform in the constitution of their body—a reform which, if effected, may produce a Board worthy of public confidence, which Vestry delegates will never command. Let the Board take our advice, and petition in favour of Lord Camperdown's Bill before they take any further action on the water question.

We shall not notice at any length the debate—perhaps as vapid as any ever heard in Spring Gardens—but of which we, nevertheless, give a full report. It will be sufficient to notice the reasons given for the proposed action of the Board. First, it is alleged that it is necessary to make the supply secure. Now, the supply furnished by the Companies has never failed, except in one small district soon to be effectually provided for. Then it is urged that a constant and copious supply is necessary. Well, as regards the latter, the Companies distribute about thirty gallons per head of population per day, and if that is not a copious supply, we should like to know what would be. That the whole Metropolis has not to-day a constant supply, is simply owing to the obstructiveness of the Metropolitan Board, who, if they should get the undertakings into their hands, will make regulations much more stringent than those proposed by the Water Companies. Lastly, the Board profess a desire to cheapen the cost of water to the consumer. They propose a lower domestic rate, but would seek power to levy a public rate, the two together amounting to just about the same rate as is now levied by the Companies, who supply the water used in extinguishing fires for nothing. It will be seen that the Board were not quite unanimous in adopting the hasty proposal of the committee, and that the opposition was of a rather influential character.

Very little was said about the quality of the water at present supplied; but one innocent speaker did announce his belief that the metropolitan public would not much longer endure the existing supply, and suggested that if the Companies are purchased, the estimated cost of bringing water from other sources should be deducted from the purchase-money. The Royal Commission of 1869, it will be remembered, reported strongly in favour of the present sources of supply, which may, and must, soon be supplemented, but, in our opinion, will never be superseded. On this question of quality, we print, to-day, a report made by Dr. Tidy to the Society of Medical Officers of Health. He is a young man, but he is in as good a position to form an opinion on the matter as one much older. The plain fact is, that, if only the one-hundredth part of what is alleged against Metropolitan Water was true, London would long since have become a waste, howling wilderness, instead of being, as it is, the healthiest large city in the world.

WATER BILLS FOR 1877.

The following Bills are to incorporate Water Companies, and confer the usual statutory powers.

The *Bristol District Water Bill* is promoted by a new Company, who seek to compete with the existing Bristol Water-Works Company. The share capital proposed is £200,000, carrying the usual borrowing power. The Bill, of course, will be strongly opposed, and probably we shall not be far wrong in prophesying that it will be rejected.

The *Bromsgrove, Droitwich, and Redditch Water Bill* is to incorporate a new Company, formed for the supply of the places named, and adjacent localities. The capital proposed is £60,000, with the usual borrowing power. The supply of water is to be obtained by impounding springs and streams on lands described. The water-rate proposed is six per cent. on annual rack-rent, or gross rateable value, with the usual extra charges for baths and closets; or, if the supply be by meter, 1s. 6d. per 1000 for the first 50,000 gallons, and beyond this 1s. for the same quantity. There are no unusual provisions in the Bill.

The *Carnforth District Water-Works Bill* is to incorporate a newly formed Company, with powers to supply the district named. The share capital proposed is £15,000, with the usual borrowing power. The water is to be obtained by impounding

springs and streams on lands described. The rates and extra charges proposed are about as usual. Power is sought to make regulations for the prevention of waste, and also to deal in fittings, and do plumbers work.

The *East Worcestershire Water Bill* is to incorporate a rival Company to the last but one mentioned above. The districts which this Company propose to supply are practically the same as those named in the Bromsgrove, &c., Bill. If the East Worcestershire scheme should be carried, the supply of water will be derived from wells to be sunk in the parish of Bromsgrove. The rival companies ask for the same rates and extra charges. The Bill now under notice proposes a share capital of £80,000, carrying borrowing powers to the extent of £19,500.

The *North-East Worcestershire Bill* is promoted by a third Company seeking power to supply water within the same limits. In this case, a capital of £80,000 is proposed, with the usual borrowing power. The source of the water is apparently the same as that proposed in the last-mentioned Bill; the rates are also the same, and the general provisions of the three measures closely resemble each other.

The *Sevenoaks and West Kent Water Bill* is to incorporate a company with power to supply water to Sevenoaks, and a considerable district in Kent. The source of the water is to be a well in the parish of Sevenoaks. The capital proposed is £100,000, carrying the usual borrowing power. The water-rates mentioned are rather high, being eight per cent. on annual rack-rent or gross rateable value, with the usual extras, and no house or cottage will be supplied for less than threepence per week.

The *Sunningdale District Water Bill* is to incorporate a Company with power to supply water within rather extensive limits, comprised in the counties of Berks, Middlesex, and Surrey. The source of the water is to be a well or wells in the parish of Windlesham (Surrey). The capital proposed is £100,000, with the usual borrowing power. The rate mentioned in the Bill is seven-and-a-half per cent. on gross annual rent, with the usual extra charges, and no house will be supplied for less than twopence per week.

It is hardly necessary to say that in all these Bills, provisions are inserted conferring the usual statutory powers.

The next group we notice are Bills promoted by Companies already possessing statutory, to obtain further, powers.

The *Falmouth Water-Works Bill* is to enable the Falmouth Water-Works Company to raise additional capital to the amount of £15,000, and to borrow to the usual extent, for the purpose of acquiring land and constructing additional works. Beyond this the Bill seeks only some ordinary powers.

The *Heywood Water Bill* is to empower the Heywood Water Company to raise £50,000 additional capital, and borrow to the usual extent, for the purpose of constructing new works. The main provisions of the Bill simply relate to compensation water, and are only of local interest.

The *Kent Water-Works Bill* is to extend the limits of supply of the Kent Water-Works Company, and to empower them to raise additional capital to the amount of £160,000, carrying the usual borrowing power. New works are proposed in the shape of a well or wells in the parish of Beckenham, with aqueducts and the necessary reservoir at Farnborough (Kent).

The *Lowestoft Water, Gas, and Market Bill* is to enable the Company named to raise further capital to the amount of £80,000, and to borrow accordingly, for the purpose of constructing additional service reservoirs.

The *Newcastle and Gateshead Water Bill* is promoted by the Company to obtain authority to abandon certain works, for the construction of which they obtained power last session, and to substitute others considered more suitable. No additional capital is asked for.

The *North Cheshire Water Bill* is promoted by the Company to obtain authority to raise £30,000 additional capital, and to borrow £9000 for the purposes of the undertaking. In this, as in all other cases, the dividend on the new capital is limited to the usual rate—seven per cent. per annum.

The *Ramsgate Water Bill* has already been noticed in our columns. The objects, briefly stated, are to authorize the Water Company to capitalize expended profits to the amount of £19,000, under the name of Improvement Stock, the dividend on which is limited to six per cent., to raise additional capital to the amount of £20,000, and to borrow to the usual extent in respect of both new capital and Improvement Stock. Power is also sought to acquire some land by agreement, and to enforce some ordinary regulations, set forth in a schedule, for the prevention of waste and misuse of water.

The *Stamford Water Bill* is to enable the Marquis of Exeter to give a constant supply of water to the borough of Stamford, by empowering him to make and enforce regulations necessary to prevent waste, when a constant supply is provided.

The *West Surrey Water Bill* is to extend the limits of the West Surrey Water Company over districts which are also claimed by the Sunningdale Company mentioned above. It further seeks power to raise additional capital to the amount of £25,000, with the usual borrowing power.

The following Bills are promoted by Local Authorities to obtain various powers relating to the supply of water:—

The *Bridgwater Corporation Water Bill* is to authorize the Corporation to start a water undertaking, and for the purpose to borrow £40,000. The Bill is to confer all the powers usually granted in connexion with water undertakings. The supply will be obtained by collecting and impounding the water of several small streams. The rates and extra charges mentioned are those usually proposed by water companies.

The *Perth Water Bill* is, first of all, to incorporate a new body of Commissioners, to be called "The Water-Works Commissioners of Perth," who will take over the water undertaking of the existing Commissioners. It is also to authorize the newly-formed body to purchase a small undertaking belonging to the Bridgend Perth Water Company, Limited, and another, the property of the Earl of Kinnoull. It will further give the Commissioners power to construct additional works, and for all these purposes to borrow £35,000. The rates will be regulated by annual expenditure, and provision for sinking-fund. There will be a public and a private rate, and as regards the latter, it is provided that the rate leviable on shops, warehouses, offices, &c., shall be only two-thirds of the rate per pound levied on dwelling-houses.

The *Ramsgate Local Board Bill* is promoted to obtain power, among other things, to make a compulsory purchase of the Ramsgate Water Company, and to borrow £60,000 for water purposes.

The *Wakefield Improvement Bill* is, *inter alia*, to purchase, by agreement, the undertaking of the Wakefield Water Company, and to borrow £250,000 for water purposes. The Company's Act will be transferred to the Corporation, so there are no special provisions relating to water supply in this Bill.

The last group we have to notice consists of Bills promoted by Local Authorities, already possessing water undertakings, to obtain further powers in connexion with them.

The *Blackburn Borough Bill*, before noticed, is to authorize the Corporation to abandon the construction of certain water-works, and make and maintain others, and to borrow £500,000 for water purposes.

The *Bolton Improvement Act* is, *inter alia*, to extend the water limits of the Corporation, and to authorize the borrowing of £85,000 for water purposes.

The *Dublin Improvement Acts Amendment Bill* will, *inter alia*, give the Corporation power to make additions to their water undertaking.

The *Edinburgh and District Water Bill* is simply to authorize the Water Trustees to construct some additional works.

The *Glasgow Corporation Water Bill* is to authorize the Water Commissioners to make considerable additions to their water undertaking. The preamble recites that the Commissioners have already borrowed for water purposes the sum of £1,358,812 14s. 7d., and this Bill is to enable them to raise the further amount of £450,000.

The *Leeds Improvement Bill* is, *inter alia*, to empower the Corporation to borrow £250,000 for the extension and improvement of their water-works.

The *Rotherham Corporation Bill* is, among other things, to extend the time fixed for the completion of works authorized by an Act passed in 1863. The Bill proposes a further period of ten years for the completion of the "Dalton" reservoir, and works connected therewith.

The *Tunbridge Wells Water Bill* is to enable the Improvement Commissioners to make certain additions to their water-works, and to raise £40,000 for the purpose.

WOTTON-UNDER-EDGE GAS COMPANY.—The directors report for the past year has been issued, and a dividend of 7 per cent. declared, leaving a balance of £81 14s. 1d. to be carried to the reserve-fund.

NEATH CORPORATION GAS-WORKS.—At the meeting of the Neath Town Council, on the 19th inst., it was stated that the result of the last half year's working of the gas undertaking was most satisfactory, there being a very favourable balance to the credit of the corporation. This fact was due to the excellent management of Mr. Ellery. Although the price of gas was reduced in October last 6d. per 1000 cubic feet, a credit balance amounting to £967 7s. 7d. had been realized.

REDUCTIONS IN THE PRICE OF GAS.—The directors of the Redhill (Surrey) Gas Company announce a reduction from 5s. 6d. to 5s., to take effect from the 1st ult. At Honley the price has been reduced from 6s. 3d. to 6s. At the meeting of the Huddersfield Town Council on the 21st inst., it was resolved, on the recommendation of the Gas Committee, to reduce the price from 3s. 4d. to 3s. per 1000 cubic feet. At Chorley, the Commissioners to whom the works belong, have agreed to the following alteration in the price of gas affecting large consumers:—Not exceeding 200,000, to be 4s. per 1000 cubic feet; not exceeding 300,000, at 3s. 9d.; and exceeding 300,000, at 3s. 6d.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXX.

MAIN-LAYING (continued).

When laying mains, from the line of which the gas is not excluded, the bladder-valve, invented by Mr. George Lowe, is an indispensable appliance. This is represented in fig. 52, and consists simply of a bladder, in the neck of which a piece of $\frac{3}{8}$ -inch brass tube, 6 or 8 inches long, threaded at one end, and having a stopcock at the other, is inserted; being firmly secured thereto with a piece of fine copper wire. A $\frac{3}{4}$ -inch hole is drilled in the completed portion of the main, at a distance of a few yards from the end.



FIG. 52.

The bladder is inserted through this hole to within about two inches of the neck, and when in that position is inflated, filling up the diameter of the main, and the stopcock is then closed. By the use of this expedient, the passage of the gas is temporarily prevented, and the work of laying the mains can be proceeded with, not only without loss of gas, but without the inconvenience and danger of the escaping gas to the men employed. For pipes of greater diameter than 6 inches, the india-rubber gas-bag, fig. 53, is used, and these are made of any required size. Accidents are occasionally caused by gas escaping past the valve, and mixing with the air in the newly laid length of main.



FIG. 53.

The mixture, being explosive, has at times been accidentally ignited, with disastrous results. To obviate this, the valve should be removed daily, to a point as near to the end of the completed length of main as possible; and care should be taken to ensure that the bladder or bag is sufficient in size, and that the inflation is perfect.

The use of an instrument resembling an ordinary pressure-gauge, fig. 54, charged with quicksilver instead of water, is recommended.

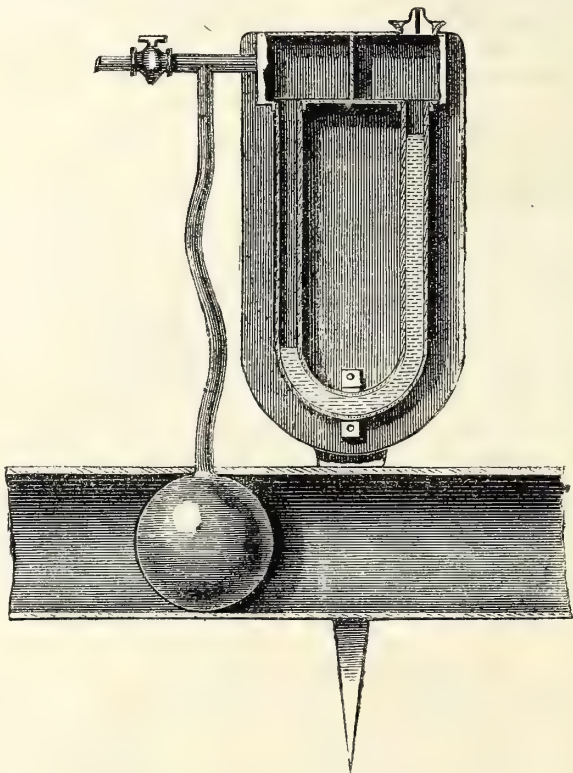


FIG. 54.

by Mr. G. Goldsmith, of Leicester, as a safeguard against accidents of the kind mentioned. When the bag is distended, and the cock closed, the column of mercury will be raised to a height indicating the pressure, and an observation of the instrument will at once show whether the inflation is maintained. Any contraction or expansion of air from sudden changes of temperature is also compensated by the rise or fall of the mercury within the tubes. The boxes at the top prevent the escape of the mercury, if driven up by any sudden expansion or contraction. Attached to the instrument is a spike for fixing it in the ground.

An ingenious contrivance, which answers the purpose of the bladder-valve, and dispenses with the drilling of the main, besides diminishing the risk of explosion, is that of the moveable elastic plug. This consists of a bag made of strong canvas, varnished, and stuffed with some suitable material, the more elastic the better. An iron pin passes through the centre of the bag, and is bolted to a wooden disc behind, all being made perfectly gas-tight. To the front end of the bolt or pin a loose iron ring is attached, and to this again a rope is fastened, fig. 55. The canvas plug, being well greased round the sides, is inserted into the first pipe, and, before connecting the next, the rope is threaded through it by means of a rod. On the con-

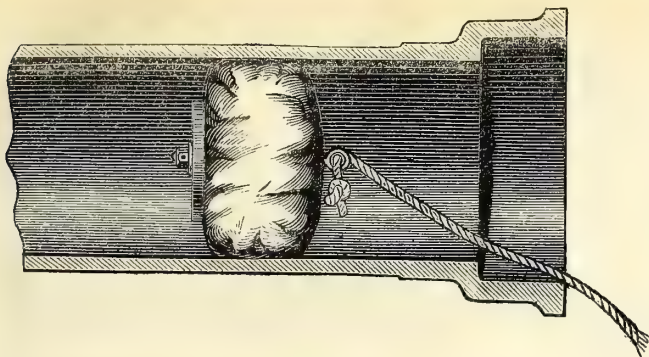


FIG. 55.

nexion being completed, the plug is drawn forward two thirds of the length of the pipe, and the process is repeated with each succeeding pipe until the whole are laid. The only objection to the moveable plug is its liability to rapid wear, owing to the friction against the pipe sides.

The open end of the last pipe, as soon as it has been driven up, should be plugged, to prevent any possible escape of gas, or the accidental entrance of soil or stones from the cutting. A wooden plug is generally used. A very handy apparatus, devised by Mr. Edwin Addenbrooke, of South Hackney, may be recommended for that purpose. It is superior to the ordinary wood plug, inasmuch as it needs no driving, it adapts itself better to any irregularities in the pipe, and does not set fast. The apparatus, fig. 56, consists of a disc of vulcanized india-rubber, A; a handle, B; and

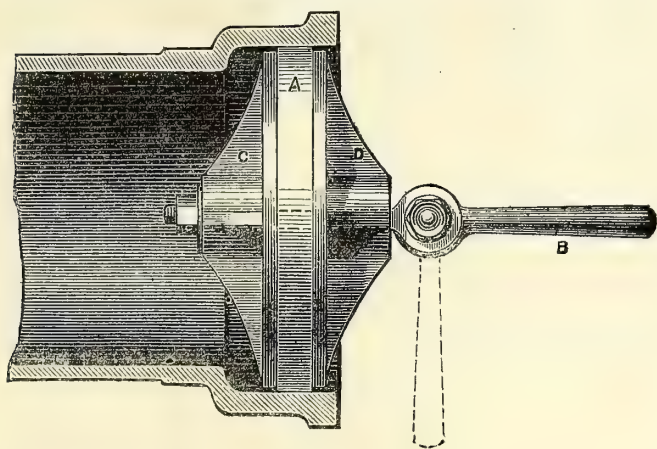


FIG. 56.

two plates, C and D. The handle has a cam action, and, when lowered into the position dotted, the rubber disc is compressed between the plates, closing the space, and adapting itself to any variations in the diameter of the pipe. In the diagram the apparatus is shown as being fixed in the socket end of the pipe; but it is, of course, equally applicable to the spigot end.

(To be continued.)

Correspondence.

QUANTITY OF BRICKWORK IN RETORT-SETTINGS.

SIR,—As a remark I made on brickwork in retort-settings, at the last meeting of the American Gaslight Association, has been the unimportant means of originating, I am gratified to find, an important discussion of the question in the JOURNAL, I may, perhaps, be permitted the privilege of adding "just one word more."

Having had my innings in a communication that, through your indulgence, may be blushing in all the glory of print before this comes to hand, I would have been "content to rest and be thankful," especially as my ideas on the subject are so much in consonance with all the right-minded of your correspondents, had it not been for the letter of "G. E. S.," in your issue of the 9th ult. Oh, that there were an Attorney-general of the gas commonwealth! I am sure an action would lie, and I am equally sure that that is more than gas managers ever do about their workings, or the quality of their gas—particularly when it is regularly tested against them by official inspectors.

The idea of this unpatriotic and seditious "scrubber"—that, I believe, is the correct word in designating anybody who dares to differ from one in newspaper controversies—unblushingly asserting that frog-eating moosoes and dirthy furriners "have given this subject much more study than has been devoted to it by English managers, and have, consequently, more definitely settled the principles upon which retort-setting should be constructed!" Why, it is enough to make the Nelson-column lions stick their tails out as stiffly as that of their late neighbor over the way on the top of Northumberland House, and turn as red as the ancient animal of Brentford.

Among my school copy-book headings, which commendably aimed at the double-barrelled utility of imparting sound moral aphorisms, expressed in elegant examples of hair strokes and body strokes, was one that I recollect was frequently laid under contribution, and which was to the effect that "evil communications corrupt good manners." The wisdom of this proverb was, I fear, but hazy to the youthful understanding; but we must all, since our school days, have seen many instances of its

truthfulness, and it does appear that "G. E. S." is a melancholy case in point. He not only admits, but seemingly glories in having managed gas-works on the Continent. Need more be said? Indeed, it would not be surprising to hear, that in addition to having had his good (insular) manners corrupted by contact with outlandish, and consequently evil, communications, he even affects baggy breeches and a fluffy hat, which, of course, would be sufficient to fairly put him out of court.

But having recovered from the first shock of "G. E. S.'s" modestly expressed dictum of the superiority of the continental precepts and practice in respect of the question at issue, one is somewhat comforted with the reflection that, after all, the thing is not so serious as it at first appears, and that perfidious Albions may yet hold up their heads—a little. Belgium being "on the Continent," "G. E. S.'s" instincts have evidently impelled him to rush to the rescue of the retort-makers of that interesting country, by imparting the valuable information that two of them exhibited their goods at the Vienna Exhibition of 1873, and that they "were unquestionably the best and cheapest exhibited."

My experience of retorts, and I apprehend it is in accordance with that of others who have not been on the Continent, has been but a confirmation of the homely English saying, that "the proof of a pudding is in the eating of it;" and one can but stand by and admire the presence of the Belgian jury who could tell the worth of a retort by merely looking at it; but then, we do not all wear spectacles. It reminds one of the immortal Rabbie's "Dr. Hornbook"—my brither Scots will know the story.

"G. E. S." conjures up a terrible phantom of his own imagination, of English settings "with cross-walls usually set with only 9-inch spaces," resulting in the "tearing asunder of the retorts lengthwise, which invariably occurs in consequence of the unequal expansion and contraction which ensue, if the retorts are built in by numerous cross-walls," and then proceeds to demolish his man of straw (to his own satisfaction) with the unanswerable argument (?) that the plan is universally condemned amongst continental engineers.

Really one almost loses patience to hear this stuff repeated, parrot-like, *ad nauseam*, and I think it may be safely affirmed that all this "tearing asunder lengthwise" nonsense is not founded on the practical experience of "G. E. S.," or G.-anybody-else who knows his business.

It is difficult to understand what kind of setting "G. E. S." approves, and it is to be hoped he understands it himself. He does not appear to believe in the retorts being supported at their ends only. He "damns with faint praise" the plan brought before the last meeting in London of the British Association of Gas Managers, which, though, in his opinion, it was "a step in the right direction," yet "very poorly represented continental practice in this particular" (although it was identical in its main features with what, in another paragraph, he seems to recommend); and he equally objects to cross-walls. As brother Jonathan would say, What in thunder *does* he believe in?

The only information he vouchsafes of this wonderful "continental practice," is that, "the system followed is that of supporting the retorts thoroughly from beneath, while avoiding as much as possible to pile up weight on the top of them, and of leaving the sides of the retorts, as far as practicable, free, thus ensuring the uniform (?) distribution of heat in the setting." Well, now, if this is not just what has before been recommended, I must respectfully beg "G. E. S." to rise and explain. If it means anything at all, it means that the middle retort on each side of the furnace, in a bed of six, has to carry all the weight of the top one "on its back," and that the bottom one has to support the weight of both those above, *plus* the brickwork between them; so that having to bear this crushing-in weight, without the counterpoise of side supports, they would be apt, I fancy, like Mr. Disraeli's franchise, to be extended "laterally." And this is the patent plan to prevent retorts "tearing asunder lengthwise!" If "G. E. S." does not like this plain way of putting it, let him explain by what mysterious process all the retorts in a setting can be supported "thoroughly from beneath," without those below having to bear the weight of those above, in the way indicated. Either this must be so, or they are individually supported by independent walls, as beds of irons used to be set, by which more brickwork is required than in the settings objected to. There is the dilemma; choose which horn you like, my little dears. The utility of a moderate quantity of brickwork in retort-settings, as it appears to me, I have previously explained, and it need not, therefore, be here repeated.

Our critical friend tells how he found no difficulty in obtaining 5000 feet per mouthpiece "when abroad," but he refrains from adding what his fuel account was, or the life of his retorts. If the retorts abroad do not crack either "lengthwise" or crosswise, the assumption is that they should last indefinitely, but as to this we are left in the dark. He, however, disclaims any knowledge of even Belgian retorts lasting two or three years, when supported only at the extremities. But he is sceptical as to English or Scotch retorts producing 5000 to 6000 feet per mouthpiece with under 20 per cent. of fuel, and thinks 4000 feet and 26 per cent. of fuel about the best results obtainable.

Let me assure "G. E. S." that I have, "year in and year out," when using good Newcastle coals, produced an average of 5500 feet per mouthpiece, from 21 inch by 15 inch oval retorts, with a consumption of fuel under 15 per cent. It is true all coke sold was measured; but supposing 5 per cent. be added, which is surely liberal enough for a fair comparison with others perhaps a little less rigid in that respect, there would still be an example of a production of between 5000 and 6000 feet, with a fuel account of under 20 per cent., and with a life of retorts of about 750 days actual working. And were I in England instead of being "abroad," I would be happy—for a consideration—to produce the same results for him or "any other man."

Montreal, Feb. 1, 1877.

E. S. CATHELS.

REGULATION OF GAS-FITTINGS.

SIR,—In your last publication you give me credit for being the first to introduce into a Bill, bye-laws for the regulation of gas-fitting. Will you kindly permit me to say that I have simply copied the bye-laws of the Wallasey Commissioners, for which they obtained parliamentary sanction under an Act dated 1868? I presume, therefore, that the credit for the initiative must be given to my friend, Mr. E. H. Harris, the engineer to that board.

Leeds, Feb. 24, 1877.

HENRY WOODALL.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, FEB. 19, 1877.

The Blackburn Borough Gas, Water, and Extension Bill was read a second time.

THURSDAY, FEB. 22.

The Lord Chancellor acquainted the House that the further Standing Orders applicable to the Lowestoft Water, Gas, and Market Bill have been complied with.

The Examiners certificate of non-compliance with the Standing Orders in respect of the Bromsgrove, Droitwich, and Redditch Water Bill was referred to the Standing Orders Committee.

Petitions were presented against the Blackburn Borough Gas, Water, and Extension Bill from (1) Lancashire and Yorkshire Railway Company, (2) Blackburn Gaslight Company; and against the East Worcestershire Water Bill from the Local Board and Town Commissioners of Bromsgrove.

FRIDAY, FEB. 23.

The Lord Chancellor acquainted the House that the further Standing Orders applicable to the Londonderry Gas Bill have been complied with.

Petitions were presented against the Blackburn Borough Gas, Water, and Extension Bill from Rev. T. Porter and others; against the East Worcestershire Water Bill from (1) the Earl of Shrewsbury and Talbot, (2) the Lady Mary S. L. Windsor Clive, as guardian of her son, the Lord Windsor, (3) Midland Railway Company, (4) Promoters of the Bromsgrove, Droitwich, and Redditch Water Bill, (5) Sharpness New Docks and Gloucester and Birmingham Navigation Company, (6) Inhabitants of Droitwich, (7) Rev. Charles Allen Dickens and other, (8) Henry Taylor and the Trustees of the Birmingham and Midland Counties Sanatorium; and against the North-East Worcestershire Water Bill from the Lady Mary S. L. Windsor Clive, as guardian of her son, the Lord Windsor.

HOUSE OF COMMONS.

MONDAY, FEB. 19, 1877.

The following Bills were read a second time and committed:—Ashton-under-Lyne Improvement; Bolton Improvement; Dukinfield and Denton Local Boards of Health; Dundee Gas; Edinburgh and District Water; Glasgow Corporation Water; Hanley Corporation Gas; Leeds Improvement; London Corporation; Longton Corporation; Maryport District and Harbour (Gas); Middlesbrough Corporation; Perth Water; Ramsgate Local Board; Rotherham Corporation; Stamford Water; Sunningdale District Water; Tudhoe and Sunderland Bridge Gas; Tunbridge Wells Water; Wakefield Improvement.

A petition for additional provision in the Bolton Improvement Bill was referred to the Examiners.

Reports from the Examiners presented that the further Standing Orders applicable to the following Bills have been complied with:—Coatbridge Gas; Christchurch Gas; Bishop Auckland District Gas; Falmouth Water; Ashton-under-Lyne Gas; Streteford Gas; Thanet Gas; Ramsgate Water; West Surrey Water; Alliance and Dublin Consumers Gas (Bray Supply); Croydon Commercial Gas; Carshalton Gas.

Petitions were presented against the Newcastle and Gateshead Water Bill from Corporation of Newcastle-upon-Tyne; and against the Newcastle-under-Lyme Borough Extension and Improvement Bill from (1) Inhabitants of Wolstanton (in vestry assembled), (2) Guardians of the Poor of Wolstanton and Burslem, (3) Owners, &c., of Wolstanton.

TUESDAY, FEB. 20.

The following Bills were read a second time, and committed:—Bridgewater (Corporation) Water; Bristol District Water; Carnforth District Water; Sittingbourne Gas; Burslem Local Board.

Reports from the Examiners presented that the further Standing Orders applicable to the Leicester Gas and the Louth Gas Bills have been complied with.

A petition against the Hanley Corporation Gas Bill was presented from the British Gaslight Company.

Mr. Alexander Brown's motion, in reference to the Water Supply of Villages and Rural Districts, was deferred to Friday, Feb. 23.

PROPOSED SEWAGE FARM ON MITCHAM COMMON.

Mr. FAWCETT asked the President of the Local Government Board whether if, as reported in the public journals, the local authorities of Croydon had decided to apply for permission to convert 100 acres of Mitcham Common into a sewage farm, he would promise either to refuse the application, or not to grant it until the House had had an opportunity of expressing an opinion upon the proposed conversion to such a purpose of a considerable portion of a valuable open space near the Metropolis.

Mr. SCLATER-BOTH said that no official communication had been made to him to the effect suggested by the question. He had, however, seen in a newspaper a statement that the Rural Sanitary Authority at Croydon had it in contemplation to make such an application for 100 acres of Mitcham Common. It appeared by the same report that the consent of more than 100 persons would have to be obtained before such an application could be entertained, and it would be impossible, whatever his views might be on the matter, for him to make any order on the subject without Parliament having ample opportunity of expressing an opinion on the proposal.

WEDNESDAY, FEB. 21.

The Limerick Gas and the Newcastle-under-Lyme Borough Extension and Improvement Bills were read a second time and committed.

Petitions against the following Bills were presented:—Ashton-under-Lyne Gas and Ashton-under-Lyne Improvement Bills, from Stalybridge Gas Company; Bolton Improvement Bill from (1) Richard Henry Ainsworth, (2) Thomas Heaton and Joseph Heaton, (3) John Adams Walker and others, as trustees of the will of Robert Walker deceased, (4) Rural Sanitary Authority of the Bolton Union District; Heywood Water Bill from Earl of Derby; Sunningdale District Water Bill from Staines, Wokingham, and Woking Railway Company; Perth Water Bill from Guildry Incorporation of Perth (petitioners not praying to be heard).

THURSDAY, FEB. 22.

Examiner's reports presented, that the further Standing Order applicable to the Kent Water, the Wakefield Gas, and the Warrington Corporation Gas Bills has been complied with.

Petitions against the following Bills were presented:—Ashton-under-Lyne Gas Bill from Corporation of Ashton-under-Lyne; Ashton-under-Lyne Improvement Bill from (1) Lancashire and Yorkshire Railway Company, (2) Dukinfield Gas Company; Bishop Auckland District Gas Bill from Bishop Auckland Local Board of Health; Bolton Improvement Bill from (1) Messrs. Holt and M'Adam, (2) Lancashire and Yorkshire Railway Company, (3) Radcliffe and Pilkington Gas Company, (4) Duke of Bridgewater's Trustees, (5) Sarah Ann Rostron, (6) Messrs. Callender, Callender, and Dawson, (7) Owners, &c., of property and ratepayers of Tongue-with-

Haugh; Bristol District Water Bill from Lawford's Gate District Highway Board; Christchurch Gas Bill from Owners, &c., and ratepayers of Christchurch; Dukinfield and Denton Local Boards of Health Bill from (1) Hyde Gas Company, (2) Dukinfield Gas Company; Hanley Corporation Gas Bill from Tunstall Local Board of Health; Heywood Water Bill from Lord Egerton of Tatton; Leeds Improvement Bill from (1) Fire insurance companies, (2) Owners of houses, &c., in Leeds, (3) Trustees of the White Cloth Hall at Leeds, (4) Trustees of the Coloured Cloth Hall in Leeds; Longton Corporation Bill from Inhabitants of Blurton and other places; Newcastle and Gateshead Water Bill from John Giffard Riddell; Perth Water Bill from (1) North British Railway Company, (2) Feuars of the Earl of Kinnoull; Tunbridge Wells Water Bill from the Rev. Robert Stammers Tabor; Wakefield Improvement Bill from Lancashire and Yorkshire Railway Company.

FRIDAY, FEB. 23.

The Examiner's report—"That the Standing Orders have not been complied with in the case of the petition for additional provision in the Bolton Improvement Bill"—was referred to the Select Committee on Standing Orders.

Petitions against the following Bills were presented:—Alliance and Dublin Consumers Gas (Bray Supply) Bill from (1) Corporation of Dublin, (2) Dublin, Wicklow, and Wexford Railway Company; Ashton-under-Lyne Gas Bill from Earl of Stamford and Warrington; Ashton-under-Lyne Improvement Bill from (1) Earl of Stamford and Warrington, (2) Dukinfield and Denton Local Boards; Bolton Improvement Bill from (1) Henry Sykes Thornton and Henry Gerrard Hoare, (2) Arthur Bailey, (3) William Hampson, (4) John Fogg Elliot, (5) James Fogg, (6) Sir Charles Henry Tempest, baronet, (7) Thomas Cross and Company, (8) John Knowles and others, (9) William Hargreaves and Charles Wolfenden, as trustees under the will of William Jackson Kideout, deceased, (10) William Ford Hulston, (11) Owners, &c., Township of Turton, (12) Owners, &c., Township of Great Lever, (13) John Hesketh, (14) George Slater, (15) Earl of Bradford; Bridgewater (Corporation) Water Bill from Great Western Railway Company; Bristol District Water Bill from (1) Great Western Railway Company, (2) Corporation of Bristol, (3) Bristol Water-Works Company, (4) William Tanner; Bristol United Gas Bill from Great Western Railway Company; Carnforth District Water Bill from (1) Corporation of Lancaster, (2) London and North-Western Railway Company; Epsom and Ewell Gas Bill from (1) Gas consumers at Epsom, (2) Gas consumers at Ewell, (3) Sutton Gas Company; Gaslight and Coke Company Bill from Corporation of London; Heywood Water Bill from (1) Blackpits Cotton Spinning and Manufacturing Company, Limited, (2) Robert Hopwood Hutchinson and Mary Susan Hutchinson, (3) William Stott and Elizabeth Stott, (4) Alice Haworth and others; Leeds Improvement Bill from (1) Lord Stourton, (2) George Lane Fox, (3) Lancashire and Yorkshire Railway Company; Leicester Gas Bill from Corporation of Leicester; Middlesbrough Corporation Bill from North-Eastern Railway Company; Newcastle-under-Lyme Borough Extension and Improvement Bill from Guardians of the Poor, Churchwardens, &c., of Stoke-upon-Trent, in vestry assembled; Perth Water Bill from (1) Earl of Kinnoull, (2) Inhabitants and ratepayers of Perth, (3) Perth Water Commissioners; Ramsgate Local Board Bill from (1) Ramsgate Water-Works Company, (2) Isle of Thanet Gaslight and Coke Company; Rotherham Corporation Bill from Corporation of Doncaster; Wakefield Improvement Bill from Justices of the Peace for the West Riding of the County of York; Warrington Corporation Gas Bill from (1) Property owners and ratepayers of Warrington, (2) London and North-Western Railway Company; Waterford Gas Bill from Corporation of Waterford; West Surrey Water Bill from Staines Local Board.

Mr. Alexander Brown's motion was further postponed to Friday, March 16.

PRIVATE BILL LEGISLATION.

Mr. CAWLEY gave notice that on Tuesday, Feb. 27, he would call attention to the Private Bill Legislation of this House; and move the following resolutions:—

1. That it is desirable to extend the system of legislating by Provisional Order, especially in the following particulars:—

- That applications to the Department granting Orders should be made at any period after public notice and notice to parties interested;
- When any memorial is presented to the Department against the granting of such Order, a local inquiry should be held;
- The Department to present Bills to Parliament for confirming Provisional Orders as early as convenient;
- The Gas and Water Facilities Act to be amended so as to enable local authorities to apply for Provisional Orders;
- That Provisional Orders should apply to railway companies requiring additional land or additional capital;
- That similar rules of procedure should apply to each Department granting Provisional Orders;
- In cases where any petition shall be presented against the confirmation of a Provisional Order, the Department should report to the Commissioners the facts on which the Order was granted, and no opponent should be permitted to give evidence on any point not raised at the local inquiry;
- Where Provisional Orders apply, direct application to Parliament not to be allowed;

2. That where any Provisional Order or Private Bill containing a provision inconsistent with the general law, the fact and the reasons which render the alteration advisable should be reported to the House.

SATURDAY, FEB. 24.

Petitions against the following Bills were presented:—Ashton-under-Lyne Gas Bill from Owners and occupiers of property in Ashton-under-Lyne; Ashton-under-Lyne Improvement Bill from (1) Consumers of gas in Ashton-under-Lyne, (2) Ashton Gas Company, (3) London and North-Western Railway Company; Bolton Improvement Bill from (1) West-houghton Local Board, (2) Westhoughton Consumers Gas Company, (3) Henry Gerard Hoare and Henry Seymour Hoare, (4) London and North-Western Railway Company; Bridgewater (Corporation) Water Bill from the Earl of Bessborough and others; Bristol District Water Bill from Midland Railway Company; Bristol United Gas Bill from Joseph Roach and others; Crystal Palace District Gas Bill from Metropolitan Board of Works; Dukinfield and Denton Local Boards of Health Bill from (1) Corporation of Ashton-under-Lyne, (2) Consumers of gas and ratepayers in Dukinfield, (3) London and North-Western Railway Company; Gaslight and Coke Company Bill from Metropolitan Board of Works; Glasgow Corporation Water Bill from Caledonian and Glasgow and South-Western Railway Companies and others; Heywood Water Bill from (1) Messrs. Kelsall and Kemp and others, (2) Joseph Fenton and others, (3) James Wrigley and Sons and others, (4) Heywood Local Board; Kent Water Bill from (1) London, Chatham, and Dover Railway Company, (2) South-Eastern Railway Company; Leeds Improvement Bill from (1) Aire and Calder Navigation Company, (2) Low Moor Company, (3) Edward Horner Reynard and Thomas Greenwood Teale, as trustees of the settled estates of the co-heiresses of the late John Smyth, (4) Midland Railway Company,

(5) Earl Cowper, (6) Earl of Harewood, (7) North-Eastern and London and North-Western Railway Companies, (8) Rothwell Local Board, (9) Leeds and Liverpool Canal Company, (10) Great Northern Railway Company; Limerick Gas Bill from Corporation of Limerick; Longton Corporation Bill from the Duke of Sutherland; Newport (Monmouthshire) Gas Bill from Corporation of Newport; Perth Water Bill from (1) Caledonian Railway Company, (2) Perth General Station Committee, (3) Bridgend of Perth Water Company, Limited; Ramsgate Local Board Bill from (1) Corporation of Margate, (2) London, Chatham, and Dover Railway Company, (3) Owners and occupiers of St. Lawrence; Ramsgate Water Bill from (1) Ramsgate Local Board, (2) Ratepayers, &c., of St. Lawrence; Sunningdale District Water Bill from London and South-Western Railway Company; Thanet Gas Bill from (1) Broadstairs Gas Company, (2) Ramsgate Local Board, (3) Ratepayers, &c., of St. Lawrence; Tunbridge Wells Water Bill from (1) Benden Sharvell Hassell, (2) Guardians of the Poor of Tunbridge Union, (3) Inhabitants of Pembury, in vestry assembled, (4) Inhabitants and ratepayers of Tunbridge Wells, (5) Viscountess Falmouth; United General Gas Company (Limerick) Bill from Corporation of Limerick; Wakefield Gas Bill from Corporation of Wakefield; Wakefield Improvement Bill from Aire and Calder Navigation Company; Woolwich, Plumstead, and Charlton Consumers Gas Bill from the Metropolitan Board of Works.

A petition against the Bristol District Water Bill (the petitioners not praying to be heard) was presented from Citizens and ratepayers of Bristol.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, FEB. 22.

(Before Vice-Chancellor BACON.)

ATTORNEY-GENERAL V. BURSLEM LOCAL BOARD OF HEALTH.

Mr. KAY, Q.C., on behalf of the informant, the Duke of Sutherland, moved for an injunction against the Burslem Local Board of Health, to restrain them from fouling a stream running into the river Trent, above Trentham Hall. He said the present was one of a series of suits which the duke had instituted against the local authorities. In several cases he had obtained an injunction, and his lordship was prepared to carry out his present system of proceedings until he succeeded in getting the river Trent into a wholesome condition. He (Mr. Kay) was instructed that the Local Board of Health did not intend to contest the matter, and they consented to treat the present motion as the hearing of the action, and that judgment should be given for the plaintiff in the following terms:—A perpetual injunction against the defendants to restrain them, their servants and agents, from causing or permitting the sewage or filthy water in their district to flow or pass through their main sewer and its respective outfalls into the brook or river Trent without its being first purified or deodorized, so as not to create a nuisance. The duke, in order to show that he was not at all desirous of putting the parties to unnecessary inconvenience, had consented that the injunction so awarded should not be put in force until after the expiration of two years from the present date. The defendants were to pay the costs of the duke after taxation, and there would be liberty to apply. Therefore, the matter would be set down *pro forma*, and the judgment given, in the terms arranged, for the plaintiff.

Mr. WILLIS appeared for the defendants, and consented to the arrangement.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

METROPOLITAN BOARD OF WORKS.

The usual Weekly Meeting was held on Friday last—Sir J. Hogg, M.P., in the chair.

The Works and General Purposes Committee presented the following report:—

Your committee have proceeded upon the resolution of the Board of the 2nd inst., referring to them for consideration and report the whole subject of the water supply of the Metropolis, especially as to the advisability of introducing a Bill into Parliament to authorize the Board to purchase the interests of the several water companies.

It is scarcely necessary to remind the Board of the long and anxious consideration which this question has already received at its hands, both before and since the passing of the Metropolis Water Act of 1871. It may, however, be well to refer to a report which was made by your committee on Feb. 7, 1873, upon the regulations made under the provisions of that Act, and as to the steps to be taken by the Board, in which they expressed an opinion that, having regard to the imperfect state of legislation, by which no real and effective constant supply was secured; the exclusion of the Board from any jurisdiction which could be exercised in favour of the consumers, the great cost which the regulations would impose upon the owners of property, and the almost unlimited authority placed in the hands of the water companies, the Board should at that time take no steps with a view to giving notice for a constant supply of water in any of the districts of London.

Your committee further stated that in all probability the attention of Parliament would be directed to the working of the Act and the probable need of its amendment, so that by some more satisfactory legislation a sound system of well-regulated water supply, independent of the views and commercial interests of companies acting for separate districts differently organized, might be secured, and they recommended that the question should be referred back to them with authority to make a representation to Her Majesty's Government thereon.

That report was adopted, and your committee subsequently endeavoured to obtain an interview with Mr. Gladstone, who was then Prime Minister, but owing to the pressure of public business he was unable to receive the proposed deputation. The subject, however, continued to occupy the constant attention of the Board, with reference not only to the supply of water for domestic and general use, but also for the extinction of fires, and on the 25th of February in last year, upon a report presented by the Parliamentary Committee, the Board adopted a resolution that the most effective mode of dealing with the question would be to obtain power to carry out the recommendation of the Royal Commission of 1869, presided over by the Duke of Richmond, the present Lord President of the Council, that the supply should be in the hands of the responsible public authorities; and the matter was referred back to the Parliamentary Committee, with instructions to confer further with a committee of the Corporation of London, with whom they had already, under the authority of the Board, been in deliberation.

The committee, on the 2nd inst., reported that they had for some time been awaiting a communication as to the course which the Corporation proposed to take, and as no communication had been received, they recommended that the reference to them should be discharged, which was accordingly done.

Your committee having briefly referred to the previous action of the Board upon this question, have now to report the conclusion to which, after careful deliberation upon the present reference, they are led, and this is that the time has arrived when effect should be given to the Report of the Royal Commission of 1869, so far as the same refers to the water supply of the Metropolis being placed under the control of a responsible public body.

They recommend, having regard to this opinion, that the subject be referred back to them with instructions to prepare a Bill empowering the Board to take under their control the water supply of the Metropolis, with power to purchase the existing companies and extend existing works, and that the committee be authorized to confer with Her Majesty's Government and report the draft Bill to the Board.

Mr. ROCHE, chairman of the committee, moved the adoption of the report. He said the whole question of the water supply of London was a question that for many years had been under the consideration of the

Board. Ever since the year 1869, he thought, this question had been more or less before them. It had been reported on from time to time, and the Board had over and over again expressed their opinion with regard to it. He thought it impossible that any question could come before the Board, or that the Board could deliberate upon any question, of more vital importance to the health of the four millions of inhabitants of this great Metropolis, than the water supply of London. In considering the question now, the Board had this advantage, that the most complete information was before them. The subject had been exhausted so far as inquiry went. There was nothing more to learn so far as evidence could give them information upon the subject, and there was only one thing now remaining to be done in connexion with it, and that was action. The reference to the committee was passed on. The matter had been most carefully considered by the committee, who now brought up the recommendation set out on the paper—true, not quite unanimously, but by so large a majority that he thought that there was little doubt but that the Board would sanction that which the committee recommended. The recommendation of the committee was that effect should be given to the resolutions of the Royal Commission on Water Supply. That Commission was held in 1869; and the most eminent engineers were examined before that Commission. They took evidence as to the supply of water to all the large towns in the United Kingdom, and also extensive evidence as to the sources of supply, and, as he had said, the evidence taken before that Commission really exhausted the whole question, so far as evidence was concerned, as to what ought to be done relative to the future supply of London. They recommended that the supply of water to the Metropolis should be in the hands of the public municipal authority, and they stated very distinctly their opinion that it was one of the principal functions of all municipal authorities to supply that great necessary of life—water—to the inhabitants; that it was a municipal concern, and that the introduction of private companies for the supply of water to large towns was a new practice, but that it was a fundamental error. Numerous towns throughout the country were formerly supplied by private companies, but they had all reverted back, in accordance with what the Commissioners termed the ancient and sound principle, to the municipal authorities, and they pointed out that the supply of water for all sanitary purposes, for the extinguishing of fires, for the cleansing of streets, for the flushing of sewers, and the supply of a sufficient quantity to the poorer classes of the inhabitants, were questions which affected the inhabitants so largely that it was essentially a municipal concern, and that no private commercial company could be expected satisfactorily to carry out the supply of such a necessary of life. Those were the conclusions to which the Commission came after a most careful inquiry. They then proceeded to recommend that the supply of water should be in the hands of the responsible public authorities. That being so, the question arose as to what should be the public authority to take up the question in the Metropolis. They had been waiting some length of time, having been threatened from time to time and from year to year that there was to be some kind of reorganization of the government of London, and that when the proposed new body was constituted, that body would be sufficiently powerful to carry out the recommendations of the Royal Commission. Well, they had waited patiently for those gentlemen who were going to bring about that great change. It was many years since the idea was first promulgated, and he had no doubt that many years would yet elapse before the Government would be prepared to take into consideration this very difficult and most important question. But pending any such change, he trusted the members of the Metropolitan Board of Works had made up their minds that there should be no further delay in this matter, and that, so far as the Board were concerned, they were prepared to carry out the recommendations of the Royal Commission, if the Government were prepared to support them in their determination to do so. His friend (Sir W. Codrington) entertained a somewhat peculiar idea upon one important part of this subject, and, therefore, he would refer further very shortly to the recommendation of the Commission, and he thought the gallant general would see that what they recommended with reference to the constant supply system was not what he would be likely to object to if the supply were in the hands of the Board, and not in the hands of private trading companies. He hoped it would not be misunderstood for a moment that one of the great objects of the Board was to obtain a constant supply of water throughout the length and breadth of the Metropolis; but the Commissioners pointed out the great difficulties that would have to be encountered in introducing that system so long as the supply was allowed to remain in the hands of private companies, and until it was vested in some public body. They stated that in most distinct terms, and, if proof was wanted, they had the most abundant testimony in what had been done since 1869. Lord Aberdare, in 1870 or 1871, brought in a Bill for the purpose of vesting in the Board the power of purchasing up the water companies; but the interests of the companies at that time were too strong even for the Government, for he believed shortly after the Government went out of office. The present Government, however, were quite strong enough to set aside the vested interests of the companies, and to support the Board. Referring further to the previous legislation on this subject, he asked what had been the result. It had been found utterly impossible to carry out the constant supply system under the Act of 1871, and, as he had said, it was laid down by the Royal Commission that there was no chance of its being carried out so long as the supply remained in the hands of private companies. That view, as he had pointed out, had been amply and fully confirmed. But there was another reason why the supply should be in the hands of the public authorities, and it consisted in the fact that by levying a small general rate all over the metropolitan area, they would be enabled to give, in the course of a very few years, a constant supply to every part of the Metropolis. Then it was pointed out that one of the necessary results of such a transfer would be that there would be a compulsory supply to the poorer classes of the community, and when they looked at the character of the rookeries they had recently inspected, when dealing with the proposed schemes under the Artizans Dwellings Act, they could form an idea of the value of an efficient supply of water in such a direction. After alluding to one or two other points, the Commission referred to the necessity for a constant supply for extinguishing fire. Upon this question most positive evidence had been given before the Fire Brigade Select Committee of the House of Commons, that so long as the supply remained in the hands of private companies, and the pressure was continued as at present, it would be a perfect waste of money to place hydrants in the streets of London, as was done in other large towns, and that until there was a municipal authority having charge of the supply of water, whereby a constant and proper pressure could be secured, it would be utterly useless to go to the expense of laying down those hydrants which general opinion seemed to think necessary for the proper protection of the Metropolis from fire. Then as to the financial question, which was regarded by the Commission as so important, to him it appeared the least important of all. He was not about to go into figures on the present occasion, but, taking a broad and comprehensive view of the matter, he felt justified in saying that he believed the Board would be able to purchase the interests of the companies, and to supply water to the consumers hereafter at a less total cost than it was

now being supplied at, and even to effect a considerable saving. Indeed, financially, there was no difficulty whatever; and that being so, they had only, as he thought, to ask the Corporation of the City of London to give them their cordial support in carrying out this great measure, which was so essential to the inhabitants of the Metropolis at large. The committee of the Board had had the pleasure of meeting a committee of the Corporation and discussing this matter many times, and he might state that they were unanimously of opinion as to the necessity of placing the water supply of London under municipal control, and that if there was to be any remedy for the evils arising out of the present state of things, it must be by the transfer of the undertakings of the several companies to the authorities. He had no doubt, therefore, that in the proposition now before the Board they would have the cordial co-operation of the Corporation. Referring again to the financial question, he would remind the Board that by the transfer of the companies they would get rid of a very large amount of the present expenditure connected with the supply of water, arising from the necessity of different boards of directors, and the numerous officers employed by the various companies, as well as the other charges incident to the existence of so many separate centres of action. He thought it not at all improbable that the amount of money which would be so saved might be calculated at £100,000 a year, which sum could be employed in the erection of hydrants throughout the Metropolis, so that in a very few years London would be in a position, as to the means of extinguishing fires, second to no town in England. The four great objects proposed by adopting the resolution of the committee were these:—First of all they were satisfied that they could obtain greater purity of supply. This was absolutely essential, and there was no difficulty in securing it, providing it were attempted by those who had the interests of their constituents at heart, and not by private companies, who had only their own interests to serve. The second object was a constant and a copious supply, and also a compulsory supply to the poorer districts of the Metropolis. They would propose, also, to give greater facilities for the supply of water for extinguishing fires, cleansing streets, and flushing sewers. The water now used for the purpose of extinguishing fires was not paid for by the Metropolis at large, but by the consumers of water. What could be more unfair than that water used for municipal purposes—for the cleansing of streets, flushing of sewers, and extinguishing fires—should be charged upon those who consumed water, and not upon the public at large, who had the benefit of the water so used? The result of the altered state of things would be that, if paid for by a public rate, the charge upon the consumers would be less than at present. The last object proposed by the resolution was that the Board would be enabled to supply water to the consumers at a less cost than it was now supplied by the companies. These were the objects the committee had in view in recommending the report to the adoption of the Board, and he trusted the Board would see their way to carry out the proposition by a large majority. Indeed, he was not aware that there would be any opposition to it; but if there was, he was sure the Board would listen with all attention to what might be urged on the other side. If the motion was carried, he trusted the committee would take the matter up with a firm determination to do their duty to the utmost of their power, and having prepared a Bill, would then see the Home Secretary, and ask whether the Government were willing to support the measure. Of course, the Bill would not be introduced into Parliament this year, but in the meantime there would be much work to be done in preparing the scheme. When the matter was brought before the Home Secretary, it would be for him to say whether he was prepared to assist the Board in their endeavours to acquire the undertakings of the companies. Whether he would or not, it was impossible to speak with certainty; “sufficient unto the day is the evil thereof;” but he (Mr. Roche) thought that, considering the motto of the present Government was “*Sanitas sanitatum*,” the Home Secretary would not be likely to “throw cold water” upon a scheme so calculated to benefit the inhabitants of the Metropolis at large, and more especially the poorer classes, for whom the right honourable gentleman had laboured hard in carrying out his Artizans Dwelling Act.

Mr. WALKER seconded the motion, and said he believed every vestry in the Metropolis would approve the course which it was recommended to the Board to take. The feeling of discontent out of doors with the present state of things was becoming greater than ever, owing to the advances made in the water-rates, and so strong was the feeling, that it was felt to be imperative that the exclusive privileges of the companies should be rescinded. He attached great importance to the flushing of the sewers and the cleansing of the streets, and these things could not be efficiently done until the Board had the control of the water supply. He believed the Government would assist in the movement.

Mr. FOWLER said he did not rise to offer any objections to the recommendations of the committee, but he thought the Board ought to have before them more ample details of the financial operation involved in it. Certainly no such details of the proposition, which the mover said was easy of accomplishment, had yet been furnished. In the year 1870 the Board took this matter into their consideration, and at that time a very full debate took place upon it. They were then favoured by the accountant of the Board with a statement of the position of the several companies, and an estimate of the cost of buying up their respective works, and also of what would be the probable sinking-fund required to reduce or extinguish in the course of years the original cost of the purchase and transfer. At that time it was put forward as a very feasible matter to be aimed at by the Board, with the view not only of decreasing the charge to the consumers, but also eventually of reducing the capital sum required in the transaction. But since that time a very great change had taken place in the circumstances of the case. First of all, the Valuation Act had come into operation, and this had resulted in a very large increase in the water-rates to be paid by the consumers. Supposing the companies had now to be bought up, they would have to be bought up on the basis of the increased rates they were able to levy. This, of course, would disturb very seriously the calculations which were the basis of the arrangements then proposed to be made, and which it was thought made it desirable for the Board to acquire the undertakings. In addition to that—and it was no use blinking the fact, although, perhaps, the opinion was not universally entertained—there was a strong impression that the Board would have to depart from the recommendation of the Royal Commission in 1869, which was founded upon a continuation of the source of supply from the Thames. It would not be considered by many for the public advantage, and at all events, certainly not as a proper settlement of the question that the Board should rely upon a Thames supply for the future requirements of the Metropolis. The report of the Commissioners was very conclusive on that point; but there were two sides to the question, and many persons thought the Thames was not a proper source, and that the supply should be drawn from springs outside London, or that it should be taken from the chalk; while others thought they ought to go to the Cumberland or Welsh Lakes for a supply. This was an important ingredient in the consideration of the question now before the Board, and, therefore, when the vice-chairman (Mr. Roche) told them that if the Board took the matter into their own hands, the public would be furnished with water at a cheaper rate, he ought to have told them in distinct terms, and upon a carefully prepared financial statement, how he

made it out. It must have been a mere speculation on his part. Mr. Roche could not state distinctly that the public would be satisfied with the Thames as a source of supply in the future, and, therefore, his conclusions as to a cheaper rate were not supported. There was no doubt that the question now submitted to the Board had been brought prominently before the public, in consequence of the higher water-rates imposed upon consumers since the Valuation Act had come into operation, and, in consequence of the great anomalies which existed with regard to the assessment of those rates. The Royal Commissioners of 1869 laid down the best basis for such an assessment, so that the burden should not press so heavily upon the poorer classes. Another difficulty in the public mind was that surrounding the question of a constant water supply. One of the main recommendations insisted upon by the Commissioners was the necessity of giving a constant supply—not only a constant, but also a copious supply—in order to relieve the distress such as had occurred at Bermondsey, and some of the poorer districts. He (Mr. Fowler) believed that if the Board at that time had taken up the question they would have achieved a great success, and no doubt it ought then to have been undertaken. He did not oppose the recommendation of the Works Committee, but he felt that, before pledging themselves to anything, the Board ought to look at the question all round, and that at the present moment they stood in need of more information. He would like to have the matter referred to the engineer, for he must state that, with all respect for the talents of the vice-chairman, that gentleman had not given him such satisfaction as would justify him in recording his vote for the motion. Everything, as yet, seemed to be founded upon surmise, without any figures at all. At the same time he agreed in the principle that the water supply of the Metropolis should be in the hands of the municipal authority; indeed, that was a proposition which he thought no one could dispute. But he was of opinion that the Board ought not to come to a decision on the matter that day, nor to pledge themselves to a certain course without having a statement of figures before them as to the cost of the proposed transfer, and without having satisfied themselves as to the future source of water supply, and without some notion of what the rates to be charged hereafter would be. He would not propose any amendment, but he was reluctantly in the position of not being able to vote for the motion. He would rather that the question was adjourned until the Board were in possession of further and more definite information.

Mr. RICHARDSON thought the only reasonable conclusion they could come to, with the information in their possession, was that they ought to affirm the principle that the Board were the proper authority in whom the water supply should be vested. As to the financial question, he believed they would make a profit and not a loss by the transfer of the undertakings of the companies. Taking the most extravagant view of the matter—viz., that they would have to give 25 years purchase of profits, that would be only 4 per cent., and the Board could borrow money at $3\frac{1}{2}$ per cent. It must be remembered, also, that the supply given by the companies was not of the very best kind. The consideration of the source of their supply was the main basis upon which the Board would compensate the companies for their interest, and if that was not a permanent source, it would be so much in favour of the Board. He did not suppose they would have to go to Cumberland or Wales for a supply; that could not be entertained for a moment; there was plenty of water within the area of the Metropolis—good, pure water—to be obtained, and he ventured to say that, if the question was referred to the officers of the Board, they would soon discover it. He concurred in the recommendation of the committee, and trusted it would receive the almost unanimous support of the Board.

Mr. ROGERS thought it was admitted that the Metropolis required to have a better supply of water, and that it was better the control of that supply should be in the hands of the Board, and not in those of a number of private companies. It was said that the Thames was not good water, but he believed it was fairly good; still, if it was proved not to be so, he did not see why the Board, as the local authority, should not be the body to obtain water from other sources. The fact that this would cost more money was no answer to him, and no reason why he should not support the motion. It was well known that in Manchester and other large towns corporations did take upon themselves the supply, and if some of them did not make a profit, that was no argument against the adoption of a similar course in the Metropolis. Water was a prime necessity, and ought to be supplied to the community irrespective of considerations of profit. On financial grounds, the recommendation of the committee was perfectly unanswerable. The Board were not asked to buy something that would be a burden upon the rates, but a going concern, out of which a large profit would be made for the consumers. Still, as he said before, the important point to his mind was the necessity for furnishing the public with a supply of good water, and in considering that matter the Board must not be discouraged because some persons were ready to carp at the price to be paid for it. He believed, however, they would not be incurring any serious liability; they would be buying a going concern, merely changing the holders of the capital in the undertakings. He was surprised at the observations made by Mr. Fowler, who on the gas question had shown himself a thorough reformer. Mr. Fowler asked for more information; during the course of the year he would have every opportunity for obtaining it. His own impression at first was that before preparing a Bill the Works Committee should have gone to the Home Secretary and ascertained whether the Government would support such a proposition, but since they had had the boldness to come before the Board with the proposition in their report, he was not at all inclined to oppose them. He was glad they had the courage to do so, and hoped there would be no carping about the financial question.

Sir W. COWINGTON said the subject before the Board was a large one, and he felt that it had not had sufficient attention given to its details to enable them, as yet, to come to a decision upon it. Here they had a report brought up from the Works Committee, which pledged the Board to give effect to the recommendations of the Royal Commission; i.e., the Board were to purchase the undertakings of the water companies, and to carry on throughout the whole of London a system of constant supply. This was a question, in the first instance, of some £15,000,000 or £16,000,000—some had even mentioned £20,000,000—and this question had been decided, as far as he remembered, at one discussion of one committee. He thought, therefore, he was justified in saying that the question was brought before the Board without the full consideration it ought to have had. He would move as an amendment—“That the question be referred back to the committee for further consideration and report.” He would not enter into the question as to the advisability of the water supply being in the hands of the municipal authority. There could be no abstract objection to the proposition; probably the supply in such hands could be better controlled, supposing the area of supply was not so large as to be unmanageable. In Manchester, Liverpool, and Birmingham it was done with great facility; but he apprehended a different state of things obtained in London, and it might be found impracticable to adopt the same plan there. He noticed that there was a difference in the notice of the committee's report on the agenda and the report of the commissioners to which it referred. The agenda stated that the committee proposed to place the water supply in the hands of the Board; but the report of the

Royal Commissioners recommended the adoption of the system of constant supply, which was not mentioned in the *agenda*. Before deciding, therefore, to give effect to the report of the Royal Commissioners, the Board ought to go into the question of "constant supply," and understand what it meant. He did not suppose that any one in London would object to a real constant supply. People generally imagined that a constant supply meant such a supply that by merely turning a tap they would get as much water as they wanted. Now that was an entire misunderstanding, and did not at all represent what would be the state of things under such a system. It would be a constant limited supply, and no one knew better about that than the directors of the companies themselves. What was the view placed before the committee in 1871? The water companies really wanted to have a key ferrule adopted in connexion with the "constant supply," the effect of which would be that it would take a housemaid half an hour to fill a pail with water. And what was now the law? The law was that the consumers should only have a $\frac{1}{2}$ -inch supply-pipe. That was not what he should call a constant supply, but rather a very limited supply. Besides all this, there was the immense interference which would take place with the fittings of every private house. The most inquisitorial arrangements would be necessary if a constant service was adopted. Let honourable members refer to the Regulations Act, 1871, if they wanted to understand what pleasant little interferences would take place in every house in London. Were the Board prepared to pledge themselves to a system involving such an amount of supervision? There were about 490,000 houses in London, about one-third of which were rented under £20 a year. At least, therefore, two-thirds of those houses would probably have cisterns in them—cisterns adapted to what was called the intermittent system. Now, the first idea of the water companies and of the Royal Commission was that there should be no cisterns at all in the houses. But that was found to be impracticable; it was absolutely necessary there should be cisterns. What, then, were the arrangements to which consumers would be liable under a constant water supply? In the first place, every lead pipe in the houses would have to be altered; the public would be given over to the tender mercies of an army of plumbers. Every house from, say, £30 a year up to £300 or £400 would be liable to these alterations, and taking the average, and adopting the opinion of engineers and others acquainted with the subject, the cost would be £12 a house. This would amount to about £4,000,000, an expenditure which would be thrown upon the private consumers before what was called a constant supply (but which he called a limited supply) could be carried out. And what were the little penalties attached to breaches of these regulations? It must be borne in mind that any water company if they thought fit, or if so required by the Board of Trade, could arbitrarily alter any of these regulations, or make new regulations. He would ask whether this did not involve a nice little interference with the insides of houses? Every occupier on receipt of two months notice must positively alter all his fittings, or have the water suppliers come in and do it for him; and if, after being done, any occupier allowed his fittings to get out of order, he was liable to a £5 penalty, while the absence of the prescribed fittings in a house constituted a nuisance under the Nuisances Removal Act. It surely must be apparent, therefore, that the introduction of the so-called constant service in London was by no means an unmixed good. He regretted having to enter upon these matters, but he had been compelled to do so because the report, if adopted, pledged the Board to carry out the system. Under all the circumstances, he thought the report should go back to the committee for further consideration.

Mr. MUNRO seconded the amendment. He was not opposed to the recommendation in the report, but he thought as yet the Committee had not given proper consideration to the question. He believed they would all agree that the control of the water supply should be in the hands of a central authority, and for the East-end of London, he could say that the public had been long enough tyrannized over by a body of directors whose chief object was to make their receipts and dividends as large as possible, while they made their supply of water as small as possible. At the same time, he thought the Board should not hurriedly come to a conclusion on so important a question as that submitted by the committee, and he hoped before they came to a decision there would be reports on the subject before them both from the engineer and the accountant.

Mr. FREEMAN said he was much obliged to the last speaker. The speech which he had made was decidedly in favour of the proposition of the committee, because he had shown very clearly the great injustice under which the public now suffered. The sooner that injustice was put an end to the better. He was quite with those who wished to consider the matter fully, and agreed that the Bill should be made a good one. What was the best mode of considering the matter? If they went on debating it at the Board they would never get anything definite; what they should do was to prepare the Bill at once, and then discuss that Bill clause by clause, with the information obtainable from their officers and from other sources at their command. When they had fully matured their scheme they would have something tangible and practicable to take up to the Home Secretary. He could not agree with Mr. Richardson, who seemed to think that if the question hereafter went to arbitration the arbitrator would take into consideration, in valuing the property of the companies, that the Board might have to go to new sources of supply, and thus have two capitals to pay upon. The arbitrator would take into account the actual incomes of the companies, and make his award thereon at 25 or 30 years purchase. For his own part, he (Mr. Freeman) wanted to avoid that state of things, and, therefore, he desired that the business should be done in such a manner as would be fair to all parties.

Mr. CUFFLIN said the time for discussing the details of the scheme would be when the Bill was prepared and brought before them. He did not agree with those who thought that this matter was being unduly hurried forward. It had been before the Board and the public of the Metropolis for a great many years, and they had all arrived at the conclusion that the supply of water ought no longer to remain in the hands of the companies. It was time the Board adopted some resolution on the question. With reference to the regulations in connexion with a constant supply, the best answer that could be given was that if the resolution was carried, and the Bill passed, the matter would be in the hands of the Board to adopt what regulations they pleased. He was not a professed economist, but he confessed he was not at all frightened at the large sum of money which the transfer of the water-works to the Board would require. He rather regretted that they would have to buy up some of the worthless plant and impure sources of supply belonging to the companies, but he looked upon that as a necessity, and as a sort of compensation to those who had hitherto come forward to meet the wants of the inhabitants of the Metropolis. Supposing it did cost £20,000,000, he thought the Board would have a good return for their investment, and rather than not carry out the scheme he would give twice £20,000,000, because he felt convinced that the supply should be in the hands of the authorities. Some people would say that in buying the companies they would buy an impure source of supply. But supposing they did not buy up the companies, would it not still be their duty to say that the present source of supply—the Thames—was impure, and to compel the companies to go to a different source? And if they did so, who would have to pay for it? Why, however extravagantly the companies set about the work, the consumers of the Metropolis would have to pay the expense. Surely, then, it would be

better that the matter should be in the hands of the Board. He was certain that some one would have to take up the question as representing the consumers, and he thought it was quite time for the Board to step forward in their interests and say, "We agree with you; you have good reason to complain, and we are ready to take upon ourselves that which will be for your interest and benefit." In taking such a step he was satisfied that the Board would receive every support.

Mr. RUNTZ said this question occupied the attention of the Board seven years ago, and at that time all were agreed it was not right that the supply of a necessary of life like water should be in the hands of a body whose first consideration was profit, but that it should be under the management of those who represented the interests of the inhabitants at large. If upon that point they were all agreed, why, then, was it not in the hands of this Board? Because the Legislature had said they must wait until the new government of London was organized. Seven years had passed away; several persons had endeavoured to tinker up the municipal government of the Metropolis, but none had succeeded. If Londoners had to wait for a reform in their water supply arrangements until the government of the Metropolis was remodelled, they would have to wait for another generation to pass away. It was his own deliberate opinion that the supply of water should be in the hands of a disinterested public body; but then he thought also that the Board, in proposing to take up the matter, should fully satisfy themselves that what they were about to do was really for the benefit of those they desired to serve. While prepared to vote for the resolution now before them, it must be on the distinct understanding that they did not pledge themselves to bring in a Bill. It might be true in the abstract that it was right to have a necessary of life like water in the hands of the municipal authority, yet from the peculiar circumstances of London it might turn out that, in this special case, it might not be for the benefit of the ratepayers, and until the Board had satisfied themselves upon that point, he for one was not prepared to pledge himself to the promotion of a Bill in Parliament. They required to make further inquiries, and, therefore, he considered that all they were doing that day was assenting to a reference to the Committee to examine the question in all its bearings, and only if they should come to the conclusion that it would be to the advantage of the ratepayers, should they report in favour of the introduction of a Bill to acquire the undertakings of the companies. He hoped that if, as the result of further inquiry, they should not arrive at that conclusion, they would be bold enough to come back to the Board and say that the present circumstances were not favourable to such a proceeding as was recommended in the report now before them. Speaking of the quality of the present supply of water to London, he said he had received a copy of a paper submitted by Dr. Tidy to the Society of Medical Officers of Health upon "The Composition and Character of the Water supplied to London during 1876." As he presumed every other member of the Board had seen this paper, he would only call attention to the last paragraph, in which Dr. Tidy remarked—

"Lastly, I am of opinion that my analyses prove that London enjoys a watersupply of very considerable purity, and I am further convinced that, from a medical point of view, no substantial objection can be urged against its wholesomeness for dietetic and culinary purposes."

Now, if this was true, one very important reason which had been urged for the interference of the Board was taken away, and it might be possible that, under all the circumstances of the case, the Board would not be able to show that interference on their part would be to the advantage of the consumers. He quite assented to the proposition in the abstract, that the supply should be in the hands of the local authorities; but then London was not like an ordinary city, it was a province. Things had grown up in the Metropolis which ought never to have grown up at all, but the Board must deal with matters as they found them, with all their surrounding circumstances, and not as though all things were entirely new. He believed they would be able to show that the course now proposed was in the interests of the public, but until this was incontestably proved he was not disposed to vote in favour of taking up the question as recommended by the committee.

Mr. LLOYD said a small portion of the district which he represented (Lewisham) had been under constant supply for some time, and he was bound, in justice to the water company by whom it was furnished (the Kent Company), to state that, in consequence of their not insisting upon all the stringent regulations referred to, the supply had been ample, the expense moderate, all parties being satisfied. What could be done in one place could be done in all.

Mr. LEGG said he was disposed, to a certain extent, to agree in the recommendations of the committee, that it would be better that the whole or a portion of the water supply of the Metropolis should be in the hands of a responsible body. But he could not agree in that portion of the report which said the time had now arrived for promoting a Bill in Parliament. Surely the Board had enough Bills in Parliament already, and he thought if they asked for another they would defeat their own object. He was disposed also to think that the origination of a measure for transferring the water-works from the companies to the public authority should not be with the Board, but with the Government of the country, although the Board might intimate their willingness to carry out such a measure if Parliament would sanction it. He altogether differed with the chairman of the committee, who said if the supply were in the hands of the Board it could be furnished at a less cost than by the companies. He did not believe it would, nor did he think the quality of the supply would be improved. The emulation which existed between the companies to furnish the purest supply, at the least possible cost, would not exist when the transfer of their works was made to the Board. Considering, as he did, that the Board had not sufficient materials before them at present to justify them in coming to a decision on this important question, he would vote that the matter go back to the committee for reconsideration.

Mr. H. L. TAYLOR said it appeared to him that the Board were not pursuing a right course, and that they would be losing much time in the end if they should come to a resolution without some prior information on the subject. He was not averse to the Board entertaining so large a question, but when the committee recommended that they should be authorized to prepare a Bill containing certain clauses, and should then see the Home Secretary about it, it seemed to him that they were putting the cart before the horse. It occurred to his mind that if they desired to succeed without incurring any large expenditure or loss of time, the proper course would be to see the Home Secretary in the first instance; and that at the present time it would be sufficient for the Board to pass a declaratory resolution to the effect that they were willing to take charge of the management of the supply of water to the Metropolis, and that in the event of obtaining the support of the Government they would be prepared to submit a Bill to Parliament. It was most desirable to obtain the views of the Home Secretary on the question, for they certainly would not succeed without Government support. It was always advisable that a public body, desirous of discharging a public duty, should, if possible, act in accord with the Government of the day. He would go further than Sir W. Codrington, and not merely refer the question back to the committee. If Sir William's amendment was negatived, he would propose a second amendment to this effect—"That the report be printed, and that the further consideration of the question be adjourned until the committee

have had the opportunity of ascertaining the views of the Home Secretary as to the support which the Government would be disposed to give to the measure under consideration, and that it be referred back to the committee to confer with the Home Secretary on the subject." This was not the time for going into details, but he might say there was a much larger question involved in this matter than was supposed. The chairman of the committee said he calculated upon the support of the Corporation. Now the matter had been considered by a committee of the Corporation, and they felt that there were difficulties surrounding it. It had not been before the Common Council, but of course it was a question in which the City of London was concerned as well as the rest of the Metropolis, and no doubt, in whatever was deemed the best course to be pursued, the Board would have the support of the Corporation. There had been assertions made as to the cheapness with which water could be sold if the supply got into the hands of the authorities; but that was only a surmise, though probably it was correct to suppose the public would not then have to pay so much as while in the hands of companies, who had dividends to make for their shareholders. If they were beginning *de novo*, there would probably be nothing better than for a public body like this to undertake the water supply; but he apprehended that, with all his research, the chairman of the committee could not find an instance of a municipality initiating a supply. It was said that in Manchester and other large towns the supply was in the hands of the authorities, but in those cases it had been brought about by the corporations buying up the companies, and not by instituting the supply themselves. It seemed now to be considered that it was the duty of the municipal bodies to take the supply of water into their own hands, instead of leaving it in the hands of companies to make a profit by it; but whether Parliament would accept a proposal, that old companies, some of whom had been established for centuries, should be bought up in the way proposed, must be left for it to determine. Something had been said about the quality of the London water. Now, Dr. Tidy seemed to have gone very fully into that question, and he had given a minute description of the quality of that supplied by the companies; and certainly if his conclusions were correct, the water was much better than he (Mr. Taylor) had supposed it to be. It appeared from the report that the Kent water, which was drawn from the chalk, was the purest of all, and he could not help thinking that better sources of supply than the Thames might be found by the other companies.

Mr. FELL feared that, whether the motion or the amendment was carried, a large amount of expenditure would be incurred. To go to the Home Secretary before preparing a Bill, embodying the proposed scheme of the Board, to lay before him, would be a great mistake.

Mr. LESLIE said he very much approved of all the Board had done during the last seven years in connexion with this subject, and on this ground, that they had only talked, which had cost the ratepayers nothing. But now they were going to begin to put their hands into the ratepayers pockets, which was a different matter. The chairman of the committee had told the Board something about the Royal Commission of 1869, but he had not told them all. He had left out the most important part of their report—purposely left it out, for he could not have missed it—it stood staring him in the face. It was as follows:—"Summary of Conclusions and Recommendations. We are of opinion that Mr. Bateman's scheme is, in an engineering point of view, feasible and practicable, and that by it a large supply of water might be obtained for the Metropolis; but that experience warrants great caution in judging of the sufficiency of a gravitation scheme of such magnitude." Turning back to Mr. Bateman's scheme, he found that it was not proposed by him to go to the Thames for a water supply. "First on the list (said the Commissioners) is that of Mr. J. F. Bateman, F.R.S., C.E., who has constructed some of the largest works in the kingdom. The plan proposed by this gentleman for supplying the Metropolis was first published by him in a pamphlet bearing date November, 1865." Well, now he proposed to collect the water in reservoirs to be formed in the mountainous districts of North Wales. Why did not the honourable member mention that? He forgot it; but that was the conclusion of the Commission. But Mr. Richardson knew it, for he said as to going out of the London district it was all rodomontade, as most of his speeches were. Now he (Mr. Leslie) objected to the Board going any further in this matter in the way proposed. He insisted, the last time the question was before them, that in a thing of this magnitude they ought, first of all, to go to the Government and know whether they would support them in any measure proposed. They ought also to go to their constituents, the vestries, and ask them whether they approved. Dr. Tidy's paper indicated that the Kent Water Company's supply was the best, and Major Bolton, who had just reported to the Government, said the West Middlesex water was the best in London. Now the West Middlesex Company drew the whole of their supply from the Thames, but then they had

a peculiar mode of filtration, which seemed to have answered up to Major Bolton's idea of purity. With reference to the course proposed to be adopted by the Board, they were just going on in the old way. Here was a solicitor moving in the matter—it seemed there was "nothing like leather," and soon they would have Mr. Cripps, Q.C., and Mr. O'Hara, and the Lord knows who, called in to help the committee in drawing up a Bill. Now this was just what was done in reference to the gas question, and a most tremendous mess they made of it. The gas companies beat the Board hollow, and the Board hadn't a chance with them. Nor would they have a chance with the water-companies when the directors of railway companies, gas companies, and water companies confronted them in the House of Commons. If ever their Bill got there, the Lord have mercy upon the ratepayers. His advice to the Board was to let the companies alone until the Government themselves moved in the matter. At the present moment the Board did not know enough to be in a position to act, and their duty clearly was to go to the Home Secretary and ask whether he considered the Board was a proper body to be entrusted with so large a question, in addition to the immense quantity of work they already had on hand, and which required them to sit almost every day.

Mr. ROCHE replied. He said there was nothing in the proposal which he submitted that pledged the committee to prepare a Bill and have every clause ready before going to the Home Secretary. It was perfectly competent for the committee to go to the Government at any time, but they should not do so until they had something tangible to go with. It was their duty to express their opinion independently of the Government, and if they were not fit to do so, they were not fit to be the governing body of the Metropolis. On the question of finance, although he had not gone into the subject in introducing the report, he was not acting on any surmise. The committee had had before them full figures from the accountant, but it was not considered wise to discuss them at the Board. But upon that point he reminded them that in the report of the Royal Commissioners it was stated that at one time the undertakings of the companies might have been purchased for five millions, and at the time the report was made they could have been obtained for twelve millions. It was certain they must be purchased at some time or other, and the longer the matter was delayed the larger would be the amount to be paid.

The amendment was then put and negatived, and a division being demanded there appeared—

For the amendment	9
Against it	27
Majority against	18

Mr. H. L. TAYLOR said he would not now ask the Board to approve the amendment which he shadowed forth in his speech, but would move that the following words be added to the original motion:—"But that before taking any action the Works and General Purposes Committee do seek a conference with the Home Secretary on the subject."

Mr. WATKINS seconded the amendment, which was put and negatived. The motion for the adoption of the committee's report was carried, on a division, by 26 to 6.

THE COMPOSITION AND CHARACTER OF THE WATER SUPPLIED TO LONDON DURING 1876, BEING A REPORT SUBMITTED TO THE SOCIETY OF MEDICAL OFFICERS OF HEALTH.

By CHARLES MEYMOTT TIDY, M.B., F.C.S., &c.
Gentlemen,—On the death of my colleague, Dr. Letheby, I undertook, at your request, to continue the monthly analyses of the London waters, and it is now my duty to report generally on the several analyses I have submitted to you month by month during 1876. Let me say that these analyses are put forward with no other desire than to elucidate facts—certainly in no spirit of opposition, or with the view of sustaining preconceived opinions. I could most earnestly have wished that the suggestion of the Society, that the several samples examined by me should be duplicates of those submitted to Dr. Frankland, could have been carried into effect; it is only right, therefore, inasmuch as the Society left this matter in my hands, that I should say it was no fault of mine that objection was taken to the proposal. I have, under the circumstances, thought it advisable to collect the samples myself every month from the various stand-pipes supplied by the several companies, without the companies having any knowledge of the day when, or time at which, the collection is made. In this way, I have secured, as far as possible, a fair sample of the water for analysis.
In the following table I have tabulated the averages of the analyses of the samples of water thus taken from stand-pipes supplied by the several companies during the past year.

Average Composition and Quality of the Metropolitan Waters during the Year 1876.

The quantities of the several constituents are stated in grains, and calculated in 70,000 grains of water, or one imperial gallon.	Ammonia.		Nitrogen as Nitrates, &c.	Oxygen used to Oxidize Organic Matter.	Total Solids.	Lime.	Magnesia.	Chlorine.	Sulphuric Anhydride.	Hardness on Clark's Scale.	
	Saline.	Organic.								Before Boiling.	After Boiling.
<i>Thames Water Companies.</i>	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Degrees.	Degrees.
Grand Junction	0.000	0.006	0.130	0.066	20.026	7.825	0.450	0.989	1.501	13.98	3.25
West Middlesex	0.001	0.007	0.131	0.058	19.881	8.330	0.459	0.958	1.471	14.0	3.1
Southwark and Vauxhall	0.001	0.007	0.122	0.065	19.716	8.176	0.468	0.944	1.432	14.23	3.15
Chelsea	0.001	0.007	0.126	0.070	19.701	8.063	0.477	1.194	1.526	13.96	3.22
Lambeth	0.001	0.006	0.132	0.064	20.033	8.037	0.461	1.012	1.564	14.13	3.22
<i>Other Companies.</i>											
Kent	0.000	0.002	0.287	0.008	27.201	10.278	0.738	1.386	2.824	19.38	5.12
New River	0.000	0.004	0.134	0.035	19.435	7.896	0.423	0.918	1.059	14.18	3.11
East London	0.001	0.005	0.129	0.042	20.439	8.348	0.529	1.086	1.599	14.5	3.28

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

GRAND JUNCTION.—The total solid matter, obtained by evaporation to dryness, ranged from 17.02 grains per gallon in September, to 22.53 grains in January; the nitrogen as nitrates, from 0.090 grain in July, to 0.172 grain in February. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon, was in September 0.032 grain, and the maximum in December 0.128 grain.

The samples collected in January, February, March, April, May, July, September, and December, contained a slight trace of suspended matter. In the other months the water was clear.

WEST MIDDLESEX.—The total solid matter ranged from 17.50 grains per gallon in August, to 22.61 grains in December; the nitrogen as nitrates from 0.090 grain in August, to 0.165 grain in November and December. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon, was in June and September 0.032 grain, and the maximum in December 0.1 grain.

The samples collected in May, August, and September, contained a slight trace of matter in suspension. In the other months the water was clear.

SOUTHWARK AND VAUXHALL.—The total solid matter ranged from 17.60 grains per gallon in August, to 22.23 grains in January; the nitrogen as nitrates from 0.098 grain in September, to 0.170 grain in February. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon, was in August 0.039 grain, and the maximum in December 0.114 grain.

The samples collected in January, February, April, May, August, October, and December, contained a trace of suspended matter. In the other months the water was clear.

CHELSEA.—The total solid matter ranged from 18.0 grains in September, to 22.07 grains in January; the nitrogen as nitrates from 0.075 grain in April, to 0.168 grain in October. The minimum amount of oxygen needed

to oxidize the organic and other matter per gallon, was in September 0.085 grain, and the *maximum* in December 0.132 grain.

The samples collected in January, February, March, April, May, November, and December, contained a trace of suspended matters. In the other months the water was clear.

LAMBETH.—The *total solid* matter ranged from 18.90 grains per gallon in August, to 22.13 grains in February; the *nitrogen as nitrates* from 0.102 grain in August, to 0.180 grain in November. The *minimum* amount of oxygen needed to oxidize the organic and other matters per gallon, was in November 0.088 grain, and the *maximum* in December 0.110 grain.

The samples collected in April, May, July, November, and December, contained a trace of suspended matter. In the other months the water was clear.

KENT.—The *total solid* matter ranged from 24.24 grains per gallon in October, to 28.3 grains in June; the *nitrogen as nitrates* from 0.180 grain in August, to 0.409 grain in February. The *minimum* amount of oxygen needed to oxidize the organic and other matters per gallon, was in April and September 0.003 grain, and the *maximum* in November 0.014 grain.

The samples were uniformly bright and clear.

NEW RIVER.—The *total solid* matter ranged from 16.43 grains per gallon in September, to 21.60 grains in February; the *nitrogen as nitrates* from 0.088 grain in September, to 0.174 grain in February.

The *minimum* amount of oxygen needed to oxidize the organic and other matters per gallon, was in November 0.014 grain, and the *maximum* in December 0.092 grain.

The samples were, without exception, bright and clear.

EAST LONDON.—The *total solid* matter ranged from 16.22 grains per gallon in September, to 23.21 grains in December; the *nitrogen as nitrates* from 0.090 grain in August, to 0.192 grain in March. The *minimum* amount of oxygen needed to oxidize the organic and other matters per gallon, was in June 0.024 grain, and the *maximum* in January 0.056 grain.

The samples collected in July and December, contained a trace of suspended matter. In the other months the water was perfectly clear.

Respecting the *occasional turbidity*, I would note that the presence of matters in suspension is determined by examining a body of the water in a glass tube 2 feet in length. The suspended matter is, in the main, finely divided clay, and occasionally a few filaments of fungoid or coniferoid growths are also present. It has always been in far too small a quantity to estimate, and its removal may be effected by subsidence and filtration. Its effect on the appearance of the water is that of a slight dimness, never amounting to opacity.

Of the *total solid* matter, I would remark, that about 8 grains is lime, and 0.5 grains magnesia in the water derived from the Thames, Lea, and New River; and about 10 grains is lime and 0.75 grain magnesia in the water, pumped from the deep chalk wells, supplied by the Kent Company. The existence of lime and magnesia salts in water used for drinking purposes, regarding it from a sanitary and dietetic standpoint, is, I consider, not merely not unwholesome, but of great advantage and importance. The truth of this observation is fully confirmed by the returns of the Registrar-General.

The quantity of *ammonia* present has been uniformly small; it has never exceeded 0.002 of a grain per gallon, and very often (more especially in the waters of the Kent, New River, and Grand Junction Companies) has been entirely absent.

I place before you, in a tabular diagram, the *quantity of oxygen* needed month by month to *oxidize the oxidizable matters* as estimated by a standard potassic permanganate solution acting for three hours. Without placing a too exalted value on the test (for I am well aware that all qualitative methods are on principal liable to be objected to), I would point out the uniformity of the results obtained by it. On this matter I purpose speaking on another occasion at greater length, with the object of showing that a general conformity of the results obtainable by this process and by quantitative analysis really exists.

The following table exhibits the quantity of water supplied daily to the Metropolis:—

Average Daily Supply to the Metropolis during 1876.

1876.	Gallons per Diem.	Houses Supplied.	Gallons per Head daily including Waste.
January	112,034,444	523,487	32.5
February	110,394,788	523,801	32.4
March	110,441,128	524,183	29.4
April	114,316,265	524,669	30.4
May	121,146,297	525,183	32.3
June	123,192,994	525,841	32.8
July	137,135,102	526,577	36.3
August	134,139,552	527,321	35.7
September	121,622,500	527,949	32.3
October	117,228,394	529,022	31.2
November	112,638,531	530,030	30.0
December	110,454,197	530,209	29.4
Average	118,728,681	526,530	32.0

Note.—It is believed these quantities are given upon the gross capacities of the pumps, and that they are consequently subject to a deduction of about 10 per cent. to arrive at the net quantities.

It will be seen that the proportion supplied for each individual has been on an average 32 gallons per day. The *minimum* supply was in March, 110,441,128 gallons, and the *maximum* in July, 137,135,102 gallons. One fact is patent—that the waste of water at the present time is very great, inasmuch as that the quantity delivered on the intermittent system, still in use in London, is largely in excess of the quantity delivered in large provincial cities in which the system of constant service obtains. About one-half the supply was derived from the Thames, one-third from the Lea and New River, and the rest from deep chalk wells.

Lastly, I am of opinion that my analyses prove that London enjoys a water supply of very considerable purity; and I am further convinced that, from a medical point of view, no substantial objection can be urged against its wholesomeness for dietetic and culinary purposes.

I am, your obedient servant,

C. MEYNOTT TIDY, M.B.

48, Queen Anne Street, Cavendish Square, W., Feb., 1877.

To the President, Council, and Members of the Society of Medical Officers of Health.

UNITED GENERAL GASLIGHT COMPANY.—A special meeting of this company was held at the offices, Jeffrey Square, London, on the 20th inst.—Mr. R. Hudson in the chair—when it was unanimously resolved—"That the Bill now submitted to this meeting, intitled 'A Bill to dissolve the United General Gaslight Company, and to re-incorporate the members thereof with further powers for the supply of gas at Limerick and for other purposes' be approved and consented to, subject to such additions, alterations, and variations as the directors may approve and Parliament may think fit to make therein."

MANCHESTER CORPORATION WATER-WORKS.

At the Meeting of the Manchester City Council on the 8th inst., the Annual Report of the Water-Works Committee was presented.

The committee recommended the council to make and order a public water-rate of 3d. in the pound, and a domestic water-rate of 9d. in the pound, to be made and levied on all property assessed thereto, for the purpose of raising the amount required for the payment of the expenses connected with the supply of water within the city during the year commencing on the 1st day of January, 1877.

The report went on to say:—

The amount of estimated available rates outstanding on the 30th of December last, out of a gross sum of £48,303 15s. 3d., was £52 11s. 9d.; and of rentals, £57 8s. 6d., out of a gross sum of £112,135 4s. 3d.; no arrears on account of rates or rentals for any previous year are outstanding.

Your committee continue to extend the supply of water by meter for trading purposes, being the mode of supply most equitable for all parties, and by which also great waste is prevented. The testing and stamping of water-fittings continues to progress satisfactorily. During the year 47,568 water-fittings have been examined and tested, of which 45,487 have been passed and stamped, and, on inspection, the whole of such fittings have been subsequently proved to have successfully stood the pressure of water. During the year the internal water-fittings in 38,137 houses, warehouses, and other premises have been inspected, and waste therein prevented where necessary, by putting the fittings into proper repair, in accordance with the regulations of the corporation. 5100 cases of inspection of rates, and 5572 cases of rentals have been examined by the inspector and his assistants during the year, and have subsequently been dealt with by the Sale and Supply Sub-Committee. During the year upwards of 5 miles of new iron piping have been laid in place of old piping, on renewals account. Upwards of 11 miles of iron piping have been laid in extensions in various townships during the past year, and your committee have made connexions to 6745 additional houses and other premises by means of upwards of 5½ miles of lead piping, at an expense of £1475 3s. 7d. During the year the full quantity required by the Act of Parliament has been delivered to the millowners on the river Etherow, and a continuous and uninterrupted supply has been provided for all purposes within the district supplied by the corporation.

During the past year your committee have again paid out of revenue the whole of the interest accruing upon the further cost incurred for the new works being executed in the Valley of Longendale, and also the expenditure which has been incurred in the works at Woodhead reservoir. Your committee have again set apart a sum in the revenue account for the renewal of old mains and service-mains for the present year.

The works of the new embankment of Woodhead reservoir are now practically completed, and the water was held to top water-level for the first time on the 14th inst., it having been for some two or three weeks previously within about 2 feet of that level. All the works are reported by the engineer to be quite satisfactory. Although the construction of the works of this reservoir began in Sept., 1848, it has never been filled with water till the present month, owing to the character of the ground and the difficulties encountered in the construction of the first embankment. Very careful and prolonged investigations enabled Mr. Bateman to recommend the site upon which the new embankment has been constructed, and on this site the foundation of the main puddle wall is 160 feet below top bank level. The new embankment, with the discharge tunnel and works connected with it, have occupied about eight years, and are of a most substantial character. The difficulties attending the formation of an embankment of this height, in such a situation, have required the greatest care and consideration. Much additional work has been executed this year, involving considerable extra expenditure in connexion with this reservoir, such as the reconstruction and arrangement of the tunnel at the head of the spring watercourse; the repairing and grouting of the old waste weir below the embankment, which has now come into use for the first time; the pitching and beaching of the slopes of the reservoir where the rise in the water was cutting away the ground and endangering the watercourse round the reservoir, and other smaller matters. It was, however, considered desirable and more economical to do this work before the removal of the plant. The banks of the reservoir will occasionally, and for some time to come, require protecting by pitching.

The Bottoms reservoir has been in full use during the past year, and has been repeatedly at top level, and for considerable periods. Some of the work on the arm puddle on the Derbyshire side of the valley, and on the end of the embankment, still remains to be done. The character of the work has prevented it being pushed forward with greater speed. All the masonry in connexion with the waste weir and flood watercourse at this embankment is now finished, and the temporary timber troughs have been removed.

The lining of the Tintwistle tunnel is completed, and the inlet masonry for the sluices at its commencement on the Hollingworth Brook is now in progress, and will be completed during the spring.

The gauge basin at Godley reservoir has been cleansed during the past year, and all the masonry—both here and at the straining well on the embankment—examined and repaired.

The road diversion in connexion with the Denton extensions has been let to Messrs. Worthington, and the works of the sewer for the diversion of the foul water from the Gorton reservoirs, intended to be executed by the corporation, will shortly be commenced; plant set at liberty by the completion of various works in Longendale is now being delivered on the ground.

The cleansing of Lower Gorton reservoir and the stone beaching of its slopes have been completed, and the water was again supplied to the city from this reservoir in June, 1876.

Upper Gorton reservoir cannot be used for the storage of water from Longendale until the foul drainage can be diverted by the new sewer. The work of cleansing and stone-beaching is, however, well advanced, and will be arranged to be finished by the time the new sewer is ready.

On the motion of Alderman GRAVE, a resolution was adopted imposing a water-rate as recommended by the committee.

WARRINGTON GAS-WORKS PURCHASE.—An action for assault arising out of the recent gas agitation in Warrington was tried before the County Court judge in that town, on Thursday last, and excited a large amount of interest. The plaintiff, Mr. Lea, the secretary of the Opposition to Purchase Committee, sought to recover from Mr. John Davies, the son of Alderman Davies, the sum of £50 as damages and compensation for injuries received through an assault of which the defendant had been guilty. The hearing of the case occupied six hours, but the short facts were that, at a meeting in the Temperance Mission Room, on the 12th ult., to oppose the Town Council, there was a great row, and the defendant, believing that plaintiff had called his father a liar, retaliated by applying the same epithet with a profane embellishment to the plaintiff himself; thereupon a scuffle ensued, and plaintiff's coat was torn, and, as he alleged, he received a severe blow. In the result, the jury awarded the plaintiff one farthing damages.

BIRMINGHAM CORPORATION GAS-WORKS.

On Tuesday, Feb. 20, a Meeting of the Birmingham Town Council was held—the Mayor (Alderman Baker) in the chair.

The report of the Gas Committee was read. It stated that a contract had been entered into with Messrs. Hilton and Co. for the construction of a tank at Windsor Street, for the sum of £22,000. The cost of new mains and all charges in laying the same were charged to capital, and the labour in taking up old mains and cost of relaying old mains elsewhere were charged to revenue, as were also all side connexions to new mains. The material of old mains relaid was debited neither to capital nor revenue. When old mains were taken up and put into stock at the works, they were never valued in stock-taking. The sum of £6278 10s. 3d. had been carried to the debit of capital account for distribution, for the year ending Dec. 31, 1876, and £18,219 13s. had been charged to revenue, which included the cost of re-arrangement of mains, estimated at about £8000. When any of the apparatus on the works was enlarged, the value of the enlargement was charged to capital, but the cost of taking down and re-erecting the old portion of the apparatus was charged to the revenue. The entire cost of any of the apparatus, which was wholly renewed, was debited to revenue, and revenue credited with any amount realized by the sale of the old materials. The gas sold for the year ending Dec. 31 was 2,655,517,000 feet, compared with 2,576,644,000 in 1875, showing an increase of 78,873,000, equal to 2·97 per cent. The average quality of the gas, as certified by the official tester, since last report, was 17·57 candles, being 2·57 candles in excess of the parliamentary standard. The committee hoped to be able to carry £25,000 to the credit of the improvement rate, as the result of trading for the year 1877. A memorial, signed by 179 persons, had been received from the inhabitants of Sutton Coldfield, applying for an extension of the mains, and as the mains were already in the parish, the committee had decided to make the extension, at a cost of about £6000. With reference to the Acts of Parliament obtained by the local authorities of Smethwick, Oldbury, Tipton, and West Bromwich, the committee reported that notice had been given to each of the local and sanitary authorities within

the limits of the corporation gas supply, of the intention of the holding of the arbitration provided for by section 40 of the Birmingham Corporation Gas Act. The first meeting of the arbitrators would be held on the 17th of March in the Council Chamber. A resolution had been received from the Balsall Heath Local Board, stating that they did not intend to promote a Bill for the purchase of the mains in their district. The committee had obtained, for £750, the lease of the house and land belonging to Mr. Sharp, of Nechells Place, in consequence of a claim for compensation having been made, through the property being affected by excavations in connexion with the construction of the new tank at Nechells. With a view to the more effectual insurance of the buildings at the various works, an arrangement had been made with the Imperial and County Fire Offices to insure for the sum of £27,300 on favourable terms, considerably under the rate paid by the late gas companies. The number of new services supplied during the quarter ending the 31st of December was 1092, the total number for the year being 2881. The committee recommended the council to comply with the request from the churchwardens of St. Martin's, and the clockwardens of St. Paul's, for a free supply of gas to the illuminated clocks in the towers of the two churches. The estimated cost at St Martin's would be about £20, and at St. Paul's £10 per annum. The balance-sheet and accounts for the year had been audited, and showed a net profit for the year of £34,122 5s. 7d., which was exclusive of £4000 carried to depreciation-fund account; and the amount of sinking-fund, for redemption of loans and annuities, was £3832 11s. 6d.; £25,000 was paid over to the borough treasurer on June 29, 1876. The further sum of £5000 would be paid to him in accordance with the revised estimate approved at the last meeting of the council, leaving £4122 5s. 7d., which the committee proposed to carry to the reserve-fund account, making that fund £28,511 2s. 2d. The committee believed that the council, taking into consideration the bad state of trade in Birmingham and the district, would consider this a not unsatisfactory result.

The balance-sheet for the past year, submitted with the report of the committee, was as follows:—

STATEMENT OF ACCOUNTS OF THE GAS DEPARTMENT FOR THE YEAR ENDED DEC. 31, 1876.
A.—STATEMENT OF LOAN CAPITAL.

Description of Loan. (Mortgage, Bond, Debenture Stock, &c.)	Rate per Cent. of Interest.	Total Amounts borrowed at Dec. 31, 1876.	Remaining to be Borrowed.	Total Amount Authorized.
Mortgages	<div>4½</div> <div>4½</div> <div>3½</div> <div>3½</div> <div>3</div> <div>4</div> <div>..</div>	<div>£16,800 0 0</div> <div>1,100 0 0</div> <div>544,650 0 0</div> <div>29,250 0 0</div> <div>25,550 0 0</div> <div>40,000 0 0</div> <div>48,650 0 0</div> <div>1,406,686 5 0</div>	<div>£168,651 0 0</div>	<div>£2,000,000 (calculating the annuities at 20 years purchase; at 25 years purchase the amount would be £2,291,337 5s.)</div>
Debenture stock				
Annuities (capitalized at 25 years purchase)				

Dr.				B.—CAPITAL ACCOUNT.		Cr.			
		Expenditure to Dec. 31, 1875.	Expended this Year.	Total to Dec. 31, 1876.		Certified Recpts. Dec. 31, 1875.	Received during Year.	Total Receipts to Dec. 31, 1876.	
		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	
To Expenditure to Dec. 31, 1875	Since that date—	2,000,931 3 0	..	2,000,931 3 0	By Debenture stock	48,650 0 0	..	48,650 0 0	
Lands acquired, including law charges . . . . .	..	..	45,337 9 1	..	Mortgage and bonds	569,625 0 0	87,725 0 0	657,350 0 0	
New buildings, manufacturing plant, machines, storage works, and other structures connected with manufacture . . . . .	..	..	51,171 13 5	..	Annuities (capitalized at 25 years purchase*)	1,457,250 0 0	..	1,406,686 5 0	
New mains and service-pipes (not being in place of old ones), including laying same, paving, and other works connected with distribution . . . . .	..	..	6,278 10 3	..	* Annuities of the value of £50,563 15s. have been extinguished during the year.				
New meters (not in place of old ones) . . . . .	..	..	4,172 17 11	..					
Less proceeds of land, buildings, &c., sold, and transfer to stock			106,960 10 8	83,599 4 8					
			23,361 6 0	28,155 17 4					
Total expenditure				2,084,530 7 8					
Balance of capital account				2,112,686 5 0				2,112,686 5 0	

C.—REVENUE ACCOUNT.									
		£ s. d.	£ s. d.			£ s. d.	£ s. d.		
To Manufacture of gas—				By Sale of gas—					
Coals, including carriage, unloading, and all other expenses of depositing same on works		211,598 17 2		Cubic Feet.	Per 1000				
Purifying materials and wages		3,975 5 10		Common gas, 7,556,500	Cubic Feet.	4s. 3d.	1,605 15 1		
Salaries of engineers, superintendents, and officers at works		2,628 3 4		Ditto 6,445,600		4s. 1d.	1,315 19 9		
Wages at works		38,927 10 10		Ditto 4,853,100		3s. 11d.	950 8 1		
Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour; less old materials sold		23,781 12 2	280,911 9 4	Ditto 2,169,000		3s. 9d.	406 13 6		
Distribution of gas—				Ditto 626,519,000		3s. 3d.	101,809 9 5		
Salaries of chief inspector, inspectors, assistant inspectors, and clerks in light office		7,425 17 4		Ditto 452,469,800		3s. 1d.	69,755 16 0		
Repairs, maintenance and renewal of mains and of service-pipes, including materials, laying and paving, and labour		18,219 13 0		Ditto 541,936,900		2s. 11d.	79,032 10 3		
Public lamps—				Ditto 614,758,100		2s. 9d.	84,529 2 4		
Lighting and repairing . . . . .		..	32,100 11 10	Adjustment for stock, &c.			719 4 7		
Rents, rates, and taxes—			3,268 8 7	Public lighting and under contracts			19,584 15 10		
Rents		749 2 6		Less discounts and adjustments			359,709 14 10		
Rates and taxes		11,133 6 8					15,565 12 4		
Management—			11,882 9 2	Residual products—				344,144 2 6	
Salaries of secretary, accountant, and clerks		1,620 15 2		Coke, less labour and cartage			70,790 4 5		
Collectors commissions and salaries		3,622 12 0		Breeze			31,164 16 8		
Stationery and printing		841 18 4		Tar			16,271 2 3		
General establishment charges and incidentals		3,375 15 0		Ammoniacal liquor			455 17 7		
Auditor		68 5 0		Sundry residual products				118,682 0 11	
Law and parliamentary charges—			9,529 5 6	Rents				1,411 5 0	
Law		282 10 7		Fittings				4,352 0 5	
Parliamentary (oppositions)		262 12 10		Discounts on purchases				1,004 18 10	
Depreciation-fund, for works on leasehold lands			545 3 5	Transfer fees				10 12 0	
Bad debts			4,000 0 0						
Expenses on loans			3,804 11 7						
Bank charges			205 3 0						
			75 15 5						
Total expenditure			346,322 17 10						
Balance carried to profit and loss account (D)			123,282 1 10						
			£469,604 19 8					£469,604 19 8	

Dr.			D.—PROFIT AND LOSS ACCOUNT.			Cr.		
			£	s.	d.	£	s.	d.
To Amount carried to reserve-fund account from profits			24,388	15	11	By Balance of net profit brought from last account.		
Amount voted to officers of the corporation by Council Minute 10,265.			950	0	0	Balance brought from revenue account (C), being profit for the year to Dec. 31, 1876		
						123,282 1 10		
Interest on temporary loans			25,338 15 11					
Interest on mortgages and bonds, accrued to Dec. 31, 1876			3,425 12 1					
Interest on debenture stock to Dec. 31, 1876			23,672 16 2					
Annuities			1,959 5 6					
Sinking-fund, for redemption of loans and annuities			56,269 11 0					
Balance, being net profit for the year			3,832 11 6					
			34,122 5 7					
			£148,620 17 9			£148,620 17 9		

E.—RESERVE-FUND ACCOUNT.		
To Amount of balance to be carried to next account	£24,388 15 11	By Balance brought from profit and loss account (D).
		£24,388 15 11

F.—DEPRECIATION-FUND ACCOUNT.		
To Amount of balance to be carried to next account	£4,000 0 0	By Amount brought from revenue account (C).
		£4,000 0 0

G.—SINKING-FUND ACCOUNT.		
To Amount of balance to be carried to next account	£3,832 11 6	By Amount brought from profit and loss account (D)
		£3,832 11 6

H.—GENERAL BALANCE-SHEET.		
To Capital account—	£	s. d.
Balance at credit thereof (Account B)	28,155	17 4
Profit and loss account—		
Balance at credit thereof (Account D)	34,122	5 7
Reserve-fund—		
Balance at credit thereof (Account E)	24,388	15 11
Depreciation-fund—		
Balance at credit thereof (Account F)	4,000	0 0
Sinking-fund—		
Balance at credit thereof (Account G)	3,832	11 6
Interest accrued and unpaid on mortgages, bonds, and debenture stock, and other loans to Dec. 31, 1876	12,718	2 5
Annuities payable Dec. 31, 1876	27,784	9 1
Sundry tradesmen and others, for amounts due for coals, stores, &c., to Dec. 31, 1876	54,573	6 6
Amount due to bankers, less cash in hand	56,683	6 5
	£246,258	14 9
By Coals, for stock on hand, Dec. 31, 1876	£	s. d.
Coke and breeze	25,507	18 9
Tar and other products	11,574	8 0
Sundry stores	1,215	2 0
	26,746	7 4
Gas and fittings rental, balance of this account due to the corporation on Dec. 31, 1876, less deposits, prepayments, and reserve	139,863	13 7
Coke and other residuals	16,002	16 10
Sundry accounts	348	8 3
Amount paid to borough treasurer on account of borough improvement-fund		25,000 0 0
		£246,258 14 9

Feb. 16, 1877.

Examined and found correct,
HOWARD S. SMITH, Auditor.

I.—STATEMENT OF COALS, &c.				
Description of Coal.	In Store, Dec. 31, 1875.		Received during Year.	
	Tons.	Cwt.	Tons.	Cwt.
Common	34,105	5	322,240	18
Cannel	1,744	5	4,733	8
			Carbonized or Used during Year.	
			Tons.	Cwt.
			315,124	18
			5,864	4
			In Store, Dec. 31, 1876.	
			Tons.	Cwt.
			41,221	5
			613	9

J.—STATEMENT OF RESIDUAL PRODUCTS.					
Description of Residual.	In Store, Dec. 31, 1875. Estimated.		Made during Year. Estimated.		In Store, Dec. 31, 1876.
Coke—common, chaldrons of 36 bushels	34,640		344,152	78,538	45,761
Breeze—ditto	2,196		22,437	5,988	4,364
Tar—gallons	82,740		3,315,387	1,041	80,200
Ammoniacal liquor—butts of 108 gallons.	1,470		92,954	92,261	2,163

Mr. MARRIS, in the absence of Alderman Chamberlain, moved that the report be approved. In doing so, he said the amount of capital on Jan. 1, 1876, was £2,000,931 3s. They had added on lands purchased £45,337; they had expended for new buildings, manufacturing plant, machines, storage, and other works, connected with the manufacture, £51,171; on new mains and service-pipes (not including renewals), £6278; and for new meters, £4172. They had sold land, buildings, &c., making a total, including a small sum transferred to expenditure, of £23,361, leaving the gross addition to capital during the year of £83,599, and making a total expenditure upon capital account, to the 31st of December last, of £2,084,530 7s. 8d. On the revenue account for manufacture they had paid for coals, £211,598 17s. 2d.; for purifying materials and for wages, £3975; salaries and wages at works, £41,555; repairs and maintenance of works, £23,781. For distribution of gas, the salaries of inspectors, &c., amounted to £7425; repairs, maintenance, and renewals of mains and service-pipes, £18,219; repairing and fixing of meters, £6455. On the management, the total establishment charges, including salaries of secretary, accountant, clerks, stationery, printing, and auditing, the sum was £9529. They had lost by bad debts £3804; they had received for the sale of gas, less discounts, £344,144; for coke and breeze, £70,790; for other residuals, £47,890. They had made a profit in the fittings department of £4352. The profit and loss account showed that the total gross profit on the trading of the year was £123,282 1s. 10d. Out of that sum they had paid for interest £85,327. They had set aside for depreciation-fund on the Fazeley Street works £4000; for sinking-fund for the redemption of loans and annuities, £3832 11s. 6d.; leaving a balance of net profit for the year of £34,122 5s. 7d. Of that they had already paid to the borough treasurer £25,000, and they would make a further payment to him of £5000, and they proposed to carry the balance of £4122 5s. 7d. to the reserve-fund account, making that fund £28,511 2s. 2d. In coming to a comparison, they would see that it was difficult to institute a perfectly rigid comparison between the expenditure of this year and the last, because one company's undertaking only came into their hands on the 1st of July, and the other on the 1st of September. The sale of gas for 1875 was £389,176, and for 1876, £359,709, showing a decrease in the amount received of £29,467. If the price had been the same as in 1875, the total amount received would have been increased by about £31,000. Of course, there had been a considerable increase in the consumption; but it was very much below what they expected, owing undoubtedly to the badness of trade and economy in the consumption. Therefore, instead of having to report an increase of 5 per cent., they had to be contented with 2·97 per cent. The amount received for coke was about £17,000 less than last year. The price for coke was considerably lower, and they had great difficulty in selling it. With

regard to new works, he stated that at Windsor Street they had a tank for a new gasholder to hold 2 million cubic feet. The meter-shops had been extended, and a test gasholder erected for the meter inspector. A large mess-room had been provided for the accommodation of the stokers, and a new governor-house had been erected, and a new boiler fixed, while foundations had been laid for new purifiers. Ten retort-beds had been rebuilt so as to economize the working. A portion of the offices at Adderley Street had been converted into a residence for the superintendent, who formerly resided off the works. The committee hoped to be able to arrange for a railway siding from the London and North-Western Railway Company to Windsor Street, so as to get rid of the cost of haulage from the stations at Lawley Street and Vauxhall, and they hoped to save something like £4000 a year in the cost of haulage alone. The Nechells new works were an extension of the Saltley works, and there a new gasholder to hold 2 million cubic feet was in progress. At Saltley works proper, several new works had been arranged, and some important alterations and additions had been made. The retort-house commenced by the Staffordshire Company in the year 1873 had been greatly enlarged, and would, when complete, contain an addition of 648 mouthpieces, being an increase of more than 50 per cent. upon the present manufacturing power of these works. In connexion with the retort-house, a dock basin, 145 feet long and 25 feet wide, had been constructed, by which the expense of removing the coke into the boats would be greatly reduced. The committee hoped to have the greater part of this work completed for use next winter. They had sanctioned the purchase of a locomotive to reduce the haulage and shunting charges. Great improvements were being made in the present apparatus for revivifying the purifying materials, and hydraulic lifts were being erected for the purpose of reducing the manual labour. About one-half of this work had already been completed. The governor for regulating the pressure through the town had been replaced by a much larger one. Ample provision had been made for the future extension of the works, consisting of a purifying-house in one block, 235 feet long by 90 feet wide and 30 feet high with four purifiers, provided with hydraulic apparatus. Two tower scrubbers, condensers, and tar and liquor stores of ample capacity were also being provided. The whole of the foregoing works the committee hoped to have ready for next winter's requirements. No considerable works had been executed either at West Bromwich, Fazeley Street, or Adderley Street. The old gasholders in Gas Street would shortly be removed. With regard to redistribution, he might say it was a most anxious, difficult, and important matter, and it had taxed the works considerably during the year. In the greater number of the streets mains were laid down in a fearful and wonderful manner, and in some streets they had three and four, and, in one case, five courses

of mains laid down, and it was evident that if they were to escape great leakage they must bring those mains into something like an organized system. The re-arrangement of the mains had received great attention during the year, and had made considerable progress; 46,179 yards of various sizes had been taken up, of which 28,317 yards had been relaid, and about 18,000 yards of entirely new mains had been laid. The mileage of streets newly occupied during the year was about 12½, and notwithstanding that, there had been a reduction of nearly 14½ miles, which the committee trusted would have the effect of greatly reducing the amount of leakage; 2521 new services had been laid on during the year, 5297 had been enlarged or repaired, and about 2137 services had been removed. The total number of meters received and repaired at the Windsor Street works had been 6571. The attention of the committee had been particularly directed to two or three points. They were anxious to produce gas at the lowest possible price, consistent with the utmost purity and the highest standard of illuminating power. They were fortunate in having made favourable contracts for coal—contracts which, upon the whole, had been fairly completed by the contractors; but it would be unwise to hazard a prediction for the future. The illuminating power averaged, during the latter half year of 1875, 15·76 candles, and for last year, 17·33; and this was his answer to the lamentations which they still, though not so often, heard as to the deplorable quality of the gas which the corporation supplied. To get that illuminating power they had had to use a considerable quantity of expensive coal, which left behind a very inferior coke, which they could hardly sell at all. Another fact was that they not only had to pay for making gas at that high standard, but the consumers burnt less in consequence; so that the better the article the less they required—a state of things unparalleled in any other manufacture. The difference between the illuminating power required by the Act, and the illuminating power obtained, amounted to a cost to them of £10,000, and they had given the consumers in the borough and the district at least £40,000. They had reduced the price of gas, as from the 1st of January last, 3d. per 1000 feet, and had given the public an article worth £10,000 more than that they previously had. Referring to the item of interest, he remarked that if the companies had raised additional capital they could have charged at least 7½ per cent., whereas the corporation had raised their money at 4 per cent. In the second place, the committee had considerably diminished the cost of management. On directors fees they had saved £1800; in the secretary's office, £1200; in general office expenditure, for clerks and collection, £3000; rent and taxes, £5000. They had considerable difficulty in so organizing the offices that things should go on pleasantly. Their bad debts proper were really only £2804, and a large proportion of that item was a legacy left them by their predecessors. Referring to the price of gas, he said he had a return showing the charges made in twenty-five large towns of the country. In eighteen instances of corporations from which he had returns, the highest charges to large consumers were at Macclesfield, Rochdale, and Salford, where the charge was 3s. 11d. The lowest charge, with one exception, amongst the eighteen towns, where the gas undertaking was under corporate management, was Birmingham, where it stood at 2s. 7½d. The exception of which he had spoken was Walsall, where the charge was 2s. 1d.; but, on referring to the Walsall balance-sheet, it was clear that the corporation had hardly anything to pay for interest, and there was the other fact that, being wise in their generation, they purchased their works at a favourable time. He submitted that, considering the outside districts—the inhabitants of which were good enough to burn the gas of the Birmingham Corporation—took no share in the risk of the enormous undertaking, and no part whatever in the management of it, and that they could have no claim to the saving effected by the amalgamation, they had no cause for complaint, but were treated on better terms than previously, and supplied at a lower price by nearly 7d. per 1000 feet than the thirty-eight large towns, the list of which he had before him. He could only hope that, when the day came for them to shake hands and wish them good-bye, the consumers in the outside districts would be able to produce 20-candle gas at something like 2s. 1d. per 1000. Speaking of the future prospects of the undertaking, he said that although they had lost a considerable sum by leakage during the various processes he had indicated, they hoped in the future to effect a very great saving on that account. They hoped, by means of machinery, to secure a saving in the working expenses, gradually to increase the sale of gas—if trade should improve—and there was every prospect that the profit from residuals would greatly increase, so that he confidently claimed the right to look forward to a brighter season. The corporation had a grand property, and its condition, arrangements, and working had not fallen below, but rather exceeded the estimate. They had a property now of something like 116 acres of freehold land of the most valuable kind—land which must increase in value. In conclusion, he called attention to the resolution moved in the council on the 13th of January, 1874, viz.—“That, in the opinion of this council, it is desirable that the manufacture, supply, and sale of gas in the borough should be under the control of the corporation.” He thought the report which he had just presented would cause the council to feel that they had acted wisely in passing that resolution. He would allude to one statement made on that occasion by Alderman Chamberlain—whose “sagacious audacity” had been matter of comment—viz., “Looking back to the past, I find that if this matter had only been before the council on similar terms, and in the same shape, fifteen years ago, at this moment we should be saving £15,000 a year, to say the least. I see no reason for supposing that fifteen years hence we may not have to congratulate ourselves upon a like or even a greater saving.” At the next meeting of the council, Alderman Chamberlain reported that the arrangement had been made, and added—“Reviewing the whole matter once more, I consider that without these speculative items the corporation may rely upon making £15,000 to £20,000 the first year, and in a few years they must of necessity make something like £25,000 per annum.” They had removed from the consumer, since they took possession of the works, £30,000 in the reduction of price, £10,000 in illuminating power; they had paid over 7d. in the pound to the borough improvement rate—equal to one-fourth of that rate; they had carried to the sinking-fund £3832; there was £4000 in respect of Fazeley Street; and they had placed to their credit the amount of £24,388 for the reserve-fund. The consumer had received £40,000, and the ratepayer had been relieved, or would be relieved, to the extent of £62,220.

Alderman MANTON, in seconding the motion, said he hoped Mr. Marris would state to the council what additional storage was contemplated.

Mr. BEARD said it was impossible fully to criticize figures which were only just laid before the council; but there were many items in the balance-sheet to which he should have been pleased to refer, if he had had the opportunity of examining them. Having addressed the council many times during the past year on this question, he feared an impression had been made that he had been personally opposed to the committee, and that he had been doing everything he possibly could to annoy them. He could assure every member of the council that that had been the last of his thoughts. He had always proceeded upon the presumption that national, municipal, and local councils had established a custom that honesty of purpose was the first law to be recognized, and that questions of a personal character were never dreamt of. He could only say that the

thanks of the council were due to the committee for the amount of work they had undertaken, and which they had so well performed; but while agreeing upon that, he differed with them upon details. Mr. Marris had endeavoured to show that the Gas Committee had made £34,000 profit during the year. What he asked was, what proportion of that profit was due to the actual savings effected by the corporation management, and what amount of it was due to the lesser amount of interest which the corporation would have to pay for the acquiring of those works? Having ascertained those two things, he said that that, and that alone, was the amount the corporation were entitled to transfer to the benefit of the ratepayers. He granted that there was no condition in the Act of Parliament providing that that only should be considered, but they had the promise of members of the council that that should be the condition upon which the profits would be considered, and he had before him the speech of Mr. Chamberlain in the town-hall on April 13, 1874, in confirmation of his (Mr. Beard's) contention. Mr. Chamberlain said:

In the first place, let me assure you that those gentlemen are wrong who have written letters to the papers and assumed that this amount of profit will only be obtained at the expense of the gas consumers—(A Voice: Will you guarantee that?) Yes, I will; most certainly I will. To make a profit in such a way as that would be a mere juggle, merely paltering with the ratepayers. It would be merely taking out of one pocket and putting into another—a proceeding with which I should be thoroughly ashamed to be connected. I give you my word that the whole of this calculation is based upon the assumption that we shall continue to charge precisely the same rates for the gas as the companies would have charged if they had gone on as separate undertakings.

He asked, had the corporation done that? He was bound to say that there was no evidence to prove that it was so. The corporation said to him as a consumer, and to every consumer in Birmingham, that the whole of the profit made by their transactions they appropriated for the benefit of the rates, and that was where he and they were at issue. The consumer had a right to be considered, and as he was the party who found the money, he ought to be considered upon the question. Nothing had been adduced to show that the £30,000 had been made without prejudicing the position of the consumer, to the difference between the actual saving effected and the amount which had been transferred. He unhesitatingly said that day that the illuminating power of the gas, although very much better than it had been for a long time, was not so good as the companies gave before negotiations were opened up for the purchase, and he could prove it by undisputable evidence. In considering the interests of the gas consumers, he was considering the goose that laid the golden eggs. In supplying gas to the manufactories and workshops at as low a price as they could, they would be assisting the industry of the town.

Alderman AVERY, having expressed his satisfaction at the way in which Mr. Marris had laid the affairs of the Gas Committee before the council, said it was also very gratifying to find that there was a surplus on the gas undertaking of £34,000. Mr. Beard joined issue upon that, and endeavoured to show that that profit was not earned out of economies and results of corporation management, not out of anything which had taken place, but at the expense of the gas consumers. If they followed that argument to its logical conclusion, it necessitated that the gas consumers and the ratepayers were different and distinct persons, or else that there was no profit at all. He was quite willing to discuss that point, but he should be quite comfortable with the material guarantee of £30,000 in their pocket. That profit was to a very large extent the legitimate result of the consolidation of services, and other matters in the corporation management of the concern. At the same time it must not be forgotten that there had been a substantial reduction in price.

Alderman COLLINS remarked that, although Mr. Beard might regard himself as the representative of the gas consumers, other members of the council felt that they represented the ratepayers, and they were determined to do for them the best they could. As to the gas consumers being the golden goose, and the people who brought grist to the mill, he should like the council to imagine for a moment that some grave accident took place to their works, that they blew up, or something of that sort, and were of no use whatever, what would the golden goose do then? It would be the ratepayers and not the consumers who would have to pay the piper. The consumers bore no part of any loss, but were simply customers of the concern. He wished to move an amendment to the resolution before the council, though not a hostile one. He was aware that it was an unusual course to adopt, but the circumstances were unusual, and, in his opinion, would fully justify it. His amendment was—“That the report of the Gas Committee be approved, and that, considering the manner in which the business of gas supply has been acquired and conducted, whereby in less than two years afterwards £60,000 has been obtained for the work of the borough and the benefit of the inhabitants, whilst at the same time the price of gas has been reduced, and its quality improved, the council hereby record their thanks to the chairman and members of the Gas Committee for the eminent services which they have rendered to the town.” He thought such a resolution would give in a complete form the best answer to one or two gentlemen, inside and outside the council, who challenged the policy which the council had pursued in respect of the gas. It should be borne in mind that the gas was not like the water, in which profit was obtained in the increased health and comfort of the people; but unless it bore a profit which would aid the rates, it was no use to the corporation at all. Referring to Mr. Beard's letter to the newspapers, he had never seen a more selfish policy advocated in any document he ever read. If such a policy were adopted by the council he should be ashamed of that body. The work of Alderman Chamberlain in promoting the acquisition of the gas undertaking challenged the admiration of all of them, and even though it had been less successful than was expected, he believed the council would still have regarded Alderman Chamberlain's efforts as a noble work. There were some people outside the council who were continually trying to pick holes in the work, and who betrayed a mean and selfish jealousy, which he was sure would never enter into that assembly; but he was glad the great body of the people of Birmingham recognized that and other great works which the council had done.

Mr. MATHEWS seconded the amendment.

After some remarks by Mr. BAKER, Alderman BRINSLEY, and others, Mr. MARRIS briefly replied, and in answer to Alderman Manton he stated that, at the time of the transfer, the Staffordshire Company had nearly completed the erection of a large holder, capable of containing 2 million feet of gas. That had been completed, and was now in use. A similar holder was in course of erection, and a third was contracted for. The committee hoped this would be sufficient for some time to come. With regard to Alderman Brinsley's question as to the present prices of gas and coal, as compared with 1874, he pointed out that the corporation were obtaining a less price for coke than was obtained then, and wages had considerably risen. The only thing the committee had really had in their favour during the past year was the low price of iron. In reply to Mr. Beard, he pointed out that the consumers were in as good a position as they could possibly have anticipated had the old companies continued, and they had no right to expect more than that.

The amendment was then put and carried.

HONLEY GAS COMPANY, LIMITED.—At the annual meeting of shareholders, on the 19th inst., a dividend at the rate of 10 per cent. was declared, and the price of gas was reduced from 6s. 3d. to 6s.

APPROPRIATION OF GAS PROFITS AT BIRMINGHAM.

[From the *Birmingham Daily Gazette*.]

The figures we have quoted show at a glance where the money goes which should be employed for increasing the reserve-fund, if not for other purposes directly connected with the gas supply. Of the net profit in the year of £34,000 and odd, the borough treasurer takes £30,000 for purposes other than those connected with the gas department. In fact, that department is a milch cow to the Town Council, and it is questionable if it is not over-milked to a dangerous extent. This, indeed, was the question which chiefly occupied the time and attention of the council when the gas report was under discussion. Mr. Beard set forth, certain views on the point which were not favoured by the council as a body, but which are, nevertheless, in perfect harmony with all recognized financial rules and economic principles. He contended that there ought to be no such mixing up of accounts as that which at present prevails by favour of the council. Repeating the arguments which he recently advanced in a letter printed in these pages, he urged that it is manifestly unjust for the gas consumers, who are less than half the entire number of ratepayers, to pay general rates twice over—once directly, and once through the profits which they contribute to the gas accounts. A more satisfactory, regular, and equitable way would be to treat the gas as it is proposed to deal with the water—viz., to give every encouragement to householders to consume gas, charging to all classes rates from year to year sufficient only to pay working establishment expenses, interest on capital, and to set aside yearly a sum to be agreed upon to redeem the debt created for the purchase, so as to reduce the price to all consumers to the lowest minimum consistent with proper maintenance of the service. There is really no gainsaying those arguments, and it is surprising that their absolute soundness does not commend them to the approval of the many men of business who form a majority of the Town Council. The gas monopoly which the council claims and enforces should be kept free from the sin of the most objectionable monopolies of former times—excessive profits. The consumers should in justice get the benefit of any surplus profits that are made on the sale of gas, always allowing an ample margin for contingencies; and it is a most vicious financial policy to tax such consumers in order to raise money for general rating purposes. It is unjust to the gas consumers, who are thus made to contribute twice to the rates; it is demoralising to the Town Council, which imposes such a duplicate tax on a special class of its subjects; and it is misleading to the ratepayers at large, who are thus deceived as to the real cost of government. Moreover, there is one class of consumers which has a special right to object to this system of indirect taxation. We refer to those gas consumers who reside beyond the limits of the borough. Whatever may be said in defence of the principle of charging unnecessary high gas rates to residents in the borough—as that they derive some benefit from the profits extracted from them, by other rates not being so high as they otherwise would be—it is obvious that no such defence can be made to the complaints of the outside consumers that they are made to pay Birmingham borough rates through the gas account.

Neither to the borough nor the extra-borough consumers is it any fair answer to say that the price charged for the gas, notwithstanding the excess of profit made, is reasonable and well below the maximum. When a governing body takes into its hands the supply of such essentials to health, comfort, and general well-being as gas, water, and the like, it should not do so for the purpose of securing large gains to be devoted to other purposes, in the manner of an ordinary trading company. The great object and intention of the Legislature in vesting corporations with the power of becoming owners and manufacturers in certain generally required commodities was to secure their cheap, regular, and abundant supply, as essential to the interests of the people at large. It was not contemplated to make that supply a source of profit to be applied to general local purposes. It was designed beyond question to leave the expenditure for such purposes to be met in the ordinary way by the levying of direct rates, and to cheapen the cost and encourage the consumption of such things as gas and water by giving the consumers the full benefit of any profits made by their sale. It is true that the Birmingham Corporation Act, 1875, has a safety-valve clause allowing any stray surplus profits, after the formation of a large reserve-fund and the payment of all direct and incidental expenses, to be absorbed in the borough rates; but this, in the intention of the Legislature, is obviously far removed from any idea that a system should be instituted of making regular excess profits, at the cost of the gas consumers, to be applied to other purposes. Look at the matter as we may, it is evident from every point of view that such a system is economically wrong, grossly unfair to one section of the ratepayers and misleading for the other, and altogether condemnable.

No doubt the town is to be congratulated on the great success of the gas venture, but the twice-taxed consumers will not be favourably impressed with the policy of wringing large surplus profits from them in order that the other ratepayers should benefit thereby.

WEDNESBURY WATER SUPPLY.—At the meeting of the Wednesbury Local Board on the 19th inst.—Mr. Williams in the chair—the Clerk reported that, having considered the various Acts of Parliament of the South Staffordshire Water-Works Company, he was of opinion that the laying down of the new mains along the Walsall Road was in excess of the powers of the company. The company's officials maintained, however—erroneously, as he thought—that the mains were for distributive purposes, and were therefore warranted by the General Water-Works Clauses Act. Mr. Blackmore considered that, even if there were some little irregularity, it would be impolitic on the part of the board to interfere, seeing that the works were for the benefit of the town. Several members urged that the works were not for the benefit of Wednesbury, but for the purpose of ensuring a regular and better supply at Dudley and other places, where the authorities had been engaged in litigation with the company. The Chairman said the pipes the company were laying down were for the benefit of Wednesbury as well as Dudley, seeing that when the works were completed the latter town would be supplied through an independent pipe; and he did not know that the board would be wise in placing obstacles in the way of the company, which for years had been the greatest philanthropist and the best friend Wednesbury had ever had. Before the formation of the company the inhabitants of the town got their supplies of water from foul wells, from the canal, and even from the forges, but the supply which the company had afforded had contributed more than anything else to the preservation of that clean bill of health which Wednesbury presented, as compared with other places; and what was more, the company for many years afforded that supply without a dividend, and then for some years more with only a very small dividend. He was, therefore, disposed to give the company the benefit of any doubt there might be in the matter of their having exceeded their powers; but at the same time he thought the permission of the board for the breaking up of the roads should have been asked, and that the company should be required to do the work as speedily as possible, and to put the roads into complete repair afterwards. A general conversation followed, and eventually the clerk was instructed to write to the company to the effect suggested by the chairman.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Half-Yearly General Meeting of Shareholders was held on Tuesday, the 20th inst.—Mr. J. A. TINNE in the chair.

The SECRETARY (Mr. Garnett) read the directors' report, which was as follows:—

The directors having caused to be prepared and submitted to them an estimate of the profits of the company for the half year ending the 31st of December last, in accordance with the company's Acts of Parliament, and having duly considered the same, recommend the proprietors to declare a dividend for the half year ending as above stated of £3 on every £100 of the ordinary consolidated stock, and at the rate of £3 10s. for every £100 on the consolidated B (7 per cent.) stock, and on the capital paid up in respect of the new £7 10s. shares.

The directors have to deplore the loss which the company have sustained by the recent death of Sir Hardman Earle, Bart., who had been a member of the board ever since the amalgamation of the two companies in 1848, and previously for about 14 years a director of the original Liverpool Gaslight Company, making together a period of above 42 years, during which time his services were always most valuable to the companies.

The question of allowing interest on deposits made as security for payment of gas supplied has engaged the attention of the board, and arrangements have been determined on for making such an allowance in future. This concession will, it is hoped, remove all objection to the system, the maintenance of which is essential for the protection of the interests as well of the general body of gas consumers as of the shareholders of this company.

The CHAIRMAN, in moving the adoption of the report, said this was not the meeting at which the directors published any accounts. He had much satisfaction in saying that, although the accounts were not presented, the affairs of the company were in a very satisfactory state, and they had the pleasure of declaring about the usual dividend, which had been fairly earned.

Mr. D. O. BATESON seconded the resolution, which was passed.

On the motion of the CHAIRMAN, dividends in accordance with the recommendation were formally declared.

Mr. HARMOOD BANNER moved a vote of thanks to the chairman and the directors for the very satisfactory manner in which they had conducted the affairs of the company.

The motion was put and carried unanimously, and the proceedings terminated.

LEOMINSTER GAS AND COKE COMPANY, LIMITED.—The twenty-seventh half-yearly general meeting of shareholders was held on Thursday, Feb. 15, when the following report was submitted:—“The accounts of the company for the year 1876 show a continued increase in the consumption of gas, amounting to 535,400 cubic feet, or about 8 per cent. on that of the previous year. On the 1st of July last a reduction in the price of gas, from 5s. to 4s. 7d. per 1000 cubic feet, was made. The net profit of the year has been £684 2s. 3d., out of which the interest on loans has to be deducted. The directors recommend the payment of the usual maximum dividends, viz., at the rate of 10 per cent. per annum on the original shares, and 7 per cent. per annum on the “B” shares, for the half year ending Dec. 31, 1876, a dividend of the same amount having been paid for the half year ending June 30. The balance to be carried forward will be £29 7s. 2d. The suspense account which arose out of the large amount expended on renewals in 1875, and which stood last year at £300, has been reduced to £150, the balance having been charged in the revenue account to repairs and maintenance of works. The directors believe that this item will have disappeared altogether in the next published statement. In addition to this charge, 13 new retorts have been provided and are now on the ground, and considerable repairs have been done to the station-meter. The cost of these has been wholly charged to revenue. During the present year it will be necessary to provide 10 more retorts, and to reset the whole 23. With this exception, no material outlay for renewals is likely to be required. Out of the charge to capital, about £230 is due to the erection of the new pair of purifiers. Since these were brought into operation the cost of purifying material has been largely reduced. It has now become a subject for consideration whether, having in view the continued increase in the production of gas, it may not be desirable to erect an exhauster and scrubber during the present year.”

SEWER GASES.—At the last meeting of the Royal Society, Professor E. Frankland communicated a paper “On the Transport of Solid and Liquid Particles in Sewer Gases.” He first referred to the large amount of suspended matter in the air, which consists of aqueous and other volatile particles that disappear by a gentle heat. There are other particles that consist partly of organic and partly of mineral matters, and the processes of fermentation, putrefaction, and decay afford abundant evidence that zymotic and other living germs are present among the organic portion. Of the zymotic matters, those which produce disease in man are obviously of the greatest importance, for there are well authenticated cases on record that disease has been communicated by the germs being in suspension in air that has escaped from sewers. Professor Frankland has considered it important to investigate the conditions under which the germs pass from sewage into the air. Does the flow of sewage in a properly constructed sewer produce sufficient agitation to disperse liquid particles through the air space of the sewer? In this and in the other experiments mentioned below a solution of lithic chloride was used, Professor Frankland having previously ascertained by three separate tests that no lithic chloride is carried off at ordinary temperatures by aqueous vapour from a saturated solution of it. Some of the solution being placed in a glass jar, it was agitated, and though this was done with greater violence than would ever happen to fluid in a sewer, it was proved that none of the lithic chloride was disengaged. It is, therefore, extremely improbable that the mere flow of foul liquid through sewers can impregnate the circumambient air with suspended particles. There is, however, another kind of agitation to which sewage is subject that may produce a very different result—viz., the development of gases during the processes of fermentation and putrefaction. When minute bubbles burst at the surface of an effervescing liquid, little particles of it can be seen projected into the air some inches, and then falling again. Professor Frankland experimented to test whether particles too small to be seen might not be also projected, and in consequence of the smallness of their masses in relation to their sectional areas, might continue suspended in the air for a long time. A strong solution of lithic chloride was acidulated by the addition of hydrochloric acid, some fragments of white marble were added, and this produced an effervescing liquid. A tube 3 inches in diameter and 5 feet long, was held over it, and there were distinct traces of lithium found during effervescence at the upper end. A second tube 3 inches in diameter and 12 feet long was then held nearly at right angles at the top of the first, a slight draught through it being caused by external heating. At the further end of this tube, too, lithium was distinctly traced. The particles were also found to pass readily through two inches of charcoal, and they passed even a layer five inches thick, though in greatly diminished numbers. Here, then, in the breaking up of minute gas bubbles, is a cause of the suspension of particles in the air. If, therefore, through the stagnation of sewage or constructive defects which allow of the retention of excrementitious matters for several days in a sewer, putrefaction sets in, then gases are generated, and the dispersion into the air of zymotic matters is very probable. It is of the greatest importance that foul liquids should pass rapidly and freely through drain-pipes and sewers, so as to secure their discharge from the system before putrefaction sets in.

IPSWICH GASLIGHT COMPANY.

The Annual Meeting of Shareholders was held on Monday, the 19th inst.—Mr. W. BUNN, Chairman of the Board of Directors, presiding.

The SECRETARY (Mr. E. Goddard) read the notice convening the meeting, and the minutes of the last general meeting.

The following report and statements of account were submitted:—

The directors have pleasure in presenting to the shareholders a statement of the accounts for the year ending Dec. 31, 1876.

The profit and loss account shows a balance available for the payment of dividend amounting to £6511 16s. The directors, therefore, recommend that a dividend of 10 per cent. per annum be paid upon the original shares, and 7½ per cent. upon the new shares, and that the balance be carried forward to the next account.

The directors report that the extensions to the working plant referred to in their last report are, to a large extent, completed. The new retort-house has been fitted up with two stacks of retorts, each stack containing 35 retorts 20 feet long, being equal to 140 retorts of the ordinary size. One-half of these have been in full operation during the present season; also the new condensing apparatus, Mann and Walker's patent scrubber, and one of Korting Brothers patent steam-jet exhausters.

The works now in progress are two additional purifiers, 20 feet square, with machinery for hoisting the purifying material, by which a considerable saving in manual labour will be effected, and also two of West's patent mechanical stokers, for drawing and charging retorts. The directors purpose laying down a siding from the tramway on the

quay to the company's premises, for giving increased facility for the despatch of coke by rail.

A larger main has been substituted for the main from the Crown Corner, St. Peter's, to the Wherstead Road, with the view of improving the supply of gas to the manufacturing on the Stoke side of the town. Extensions and enlargements of mains have been carried out in other districts of the borough.

In consequence of these extensions it will be necessary to raise additional capital. The directors recommend that the sum of £3000 be raised by the creation of 300 new shares of £10 each, and also to raise as much by loan on mortgage as the Act of Parliament will sanction, which will not exceed the sum of £1600.

During the past year communications have been received from the corporation in reference to the sale of the company's works, plant, &c., to the sanitary authority of the borough. The terms proposed by the corporation were to pay perpetual annuities equal to 10 per cent. on the original shares and 7½ per cent. upon the new shares, or for annuities of like amount to be redeemed by the corporation at the expiration of 20 years, at 20 years purchase.

The directors, having regard to the interests of the shareholders, made inquiry as to what was the practice in cases where gas-works had been taken over by local authorities, and sanctioned by the Legislature; and finding the terms offered by the corporation to be much below the price given in other towns, respectfully declined the offer.

The directors hoped to have been able to announce at this meeting a further reduction in the price of gas to private consumers; but the very large depreciation in the value of coke renders it impracticable at present to do so.

The following directors go out of office by rotation, but are eligible for re-election—viz., William Alexander, Esq., W. B. Jackaman, Esq., and William Turner, Esq.

Mr. William Bantoff, one of the auditors of the company, retires by rotation, and is eligible for re-election.

CAPITAL ACCOUNT, for the Year ended Dec. 31, 1876.

Dr.				Cr.			
	Expenditure to Dec. 31, 1875.	Expended this Year.	Total to Dec. 31, 1876.		Certified Receipts to Dec. 31, 1875.	Received during Year.	Total Receipts to Dec. 31, 1876.
To Expenditure to Dec. 31, 1875.	£62,074 2 3	..	£62,074 2 3	By Ordinary shares of £10 each	£28,000 0 0	..	£28,000 0 0
Since that date—				Ditto	24,925 0 0	1,075 0 0	26,000 0 0
New buildings, manufacturing plant, machines, storage works, and other structures connected with manufacture	..	£7,805 12 11	..	Mortgages and bonds	15,400 0 0	2,000 0 0	17,400 0 0
New mains and service-pipes (not being in place of old ones), including laying same, paving, and other works connected with distribution	..	117 12 0	..	Premium-fund account	4,571 19 3	..	4,571 19 3
New meters (not in place of old ones), including fixing	..	221 2 9	8,144 7 8				
Total expenditure	..	..	£70,218 9 11				
Balance of capital account	..	..	5,753 9 4				
			£75,971 19 3				£75,971 19 3

REVENUE ACCOUNT.

To Manufacture of gas—				By Sale of gas—			
Coals, including dues, carriage, unloading, and all expenses of depositing same on works	£10,158 11 3½			Private light rental	£15,830 17 8		
Purifying materials, oil, water, and sundries at works	382 15 10			Public lighting and under contracts	1,801 17 3		
Salaries of engineers, including chief engineer, superintendents, and officers at works	826 17 7			Rental of meters	..	500 9 7	£17,632 14 11
Wages and gratuities at works	1,677 15 10			Residual products—			
Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour	896 5 8			Coke, less labour and cartage	£4,255 11 2		
			£13,942 6 2½	Breeze	174 2 8		
Distribution of gas—				Tar	927 9 3		
Salaries of surveyor, chief inspector, inspectors, assistant inspectors, and clerks in light office	135 6 8			Ammoniacal sulphate, ditto	530 12 10		5,887 15 11
Repair, maintenance, and renewal of mains, and of service-pipes, including materials, laying and paving, and labour	295 8 8			Rents	..	108 0 0	
Repairing, renewing, and refixing meters	438 5 7			Fittings	..	146 9 9	
			869 0 11				
Public lamps—							
Lighting and repairing	..		497 14 8				
Rents, rates, and taxes—							
Rates and taxes	..		591 11 5½				
Management—							
Directors allowances	200 0 0						
Salaries of secretary, accountant, and clerks, office keepers and messengers	266 13 4						
Collectors commission or salaries	150 0 0						
Stationery and printing	53 19 0						
General establishment charges and incidentals	88 1 8						
Auditors	21 0 0		779 14 0				
Law and parliamentary charges—							
Law	..		14 19 1				
Bad debts	..		298 1 9				
Suspense account	..		442 13 4				
Total expenditure	..		£17,436 1 5				
Balance carried to profit and loss account	..		6,839 8 9				
			£24,275 10 2				£24,275 10 2

The profit and loss (net revenue) account which was appended showed a balance at credit thereof of £6511 16s., subject to payment of the dividends to the 31st of December last; the reserve-fund showed a balance to credit thereof of £2747 4s. 8d., and the capital account a balance to credit of £5753 9s. 4d.

The CHAIRMAN, in moving the adoption of the report, said it fully set out the progress of the concern during the past year, and he did not know that there was anything which required comment from him.

Mr. HUISE seconded the motion.

Mr. W. B. JEFFRIES said the thanks of the shareholders were due to the board for the manner in which they had managed the affairs of the company; but he thought they had somewhat overstepped their duties when they decided that the shareholders should not sell the gas-works to the corporation. They had an offer from the corporation to take over the concern, and to pay in perpetuity to the shareholders the utmost the law would allow in the way of dividends; and, therefore, it seemed somewhat out of order for the directors to say, "No, you shall not accept that offer, but you shall take what dividends we choose to give you for the present, and run the risk of gas being superseded, and a less dividend being earned in future years." The proper course would have been for the shareholders to be called together and their opinion taken as to the offer. There was 10 per cent. on the old and 7½ per cent. on the new shares offered in perpetuity, and it was perfectly impossible for the shareholders ever to be in a better position than they would be if they had accepted the offer. He had been averse to corporate bodies managing commercial affairs, but if the corporation were in a position to say that they could produce better gas at a cheaper rate than was now charged, and offered the shareholders the maximum dividends, he felt strongly that the shareholders ought to have had a voice in the matter before the offer was refused.

The CHAIRMAN said the directors did not come to this resolution hastily. They made inquiries from other places where similar propositions had been made. It was true the corporation offered annuities equal to the maximum dividends, but still the offer was saddled with a twenty years

purchase clause, and they found in other places that that was not acceded to, but much larger amounts were given.

The SECRETARY: Twenty-five years purchase.

The CHAIRMAN said twenty-five years was the lowest it was proposed to offer in other places. Therefore, the directors came to the conclusion that they would not be right in acceding to such a proposition, and respectfully declined it. He believed where compulsory powers to purchase were taken, a much larger price was given.

The SECRETARY: No, twenty-five years. There is now a Bill in Parliament to enable the Warrington Corporation to acquire the gas-works, and in that Bill twenty-five years purchase of the annuities is proposed.

Mr. W. J. ANDREWS said a great many shareholders would have been much dissatisfied if the directors had accepted the offer. They entrusted the directors at the last meeting to do the best they could for them, so that it was not necessary to call a meeting of shareholders.

Mr. W. ALEXANDER said the board regarded the offer of the corporation as so far below what could be accepted, that they did not think it worth while to submit it to the shareholders.

Mr. S. A. MAW said at the time the offer of the corporation was made, it was, no doubt, to some extent, a good offer, but it was only a partial one. The corporation proposed to take everything the company possessed, with the exception of a small amount of £1600, which they offered to leave in their hands, basing their estimate of the value upon the income to which the company were limited by Act of Parliament. No doubt the dividends were so limited, but to some of them it appeared that in estimating the value of the undertaking it would be right to take its commercial value into consideration, as well as its present limited income. There was one phase of the matter which

he believed struck him more strongly than it did many, and it was that no allusion whatever was made to a large amount of capital used in the concern on which no interest was paid, or, if interest was paid on it, it was by a reduction of the interest on other capital. This capital the corporation proposed to take without giving any compensation whatever. He was speaking of the premiums, amounting to £4571, which the company had received by the sale by public auction of the new shares which had recently been created. This large amount of capital had been furnished on which no interest was paid, and the corporation seemed inclined to think that they had a right to take it without paying any interest on it in future. He did not regard it in that way. Perhaps it might be that the company had no claim for a higher price in consequence of compulsory sale, or in acknowledgment of this large sum, which the corporation seemed to regard as though it belonged to the town. No doubt there was a difference of opinion as to how far this sum which they had received, and had used for the benefit of the town, did really belong to the town or to the gas company, for it seemed to be thought by some that these premiums beyond the nominal value of the shares belonged to the town, and that the shareholders had no interest in them. When he looked back several years to the origin of the fund, he found there had, for some years, been criticisms as to the gas company and its management; it had been said that the company had a nice comfortable business, and obtained a good rate of interest, and that it was a close corporation. The directors and shareholders, however, did not wish to make the company exclusive, and offered the new shares then created to the public in order that those gentlemen—whether they had a little jealousy about the company, or whether they thought they could manage it better than it had been managed—might have an opportunity of joining the company. This plan had answered the purpose, in so far as it had furnished them with a large amount of capital on which no interest was paid, and in that way had, no doubt, added to the value of the shares in general, by ensuring to a considerable extent the maximum dividend; but, he must say, he had felt surprised that those gentlemen, who seemed to think the directors were managing the concern too exclusively, had not taken advantage of the opportunity to come among them and see whether they could not manage it better. Those who criticized had not taken advantage of the opportunity, but capitalists who wished to ensure a good 5 per cent. had. The plan of offering new shares for sale by auction had, therefore, failed in its object. Gas consumers had been publicly told that the company were issuing shares on which 7½ per cent. interest was paid, when the money could be borrowed at a much lower rate, and gas made very much cheaper; but, as a matter of fact, the new shares were not receiving 7½ per cent., but a very little over 5 per cent., on account of the existence of the premium capital. He did not wish to be in antagonism to his brother directors, but he confessed that he looked upon the mode of issuing shares, by selling them by auction, as to some extent a failure, for the reasons he had stated, and now the directors proposed to pursue the same plan again by the proposal of issuing 300 new shares. He had had the opportunity of expressing his opinion on the subject to his brother directors, but he was in a minority at the board. He regretted that it was so, for he thought it a question that it became them seriously to consider, whether they should continue this mode of disposing of the shares, or whether they should not revert to that which was formerly the practice in this company, and was the practice in some companies still—allotting the new shares among the present shareholders. At the directors meeting he proposed that a larger number of shares should be issued, not fully called up, but only such a proportion as would provide the capital absolutely wanted. This was a concern which was largely increasing, and, though during the past year things had been dull, the large agricultural implement manufactories and iron-works not having consumed anything like the amount of gas they did in former years, yet when a brighter period came, and the former activity at these works returned, a further outlay of capital would be necessary for a new gasholder. The probability was that next year or the year after the company would have to issue another 300 shares, and his proposition at the board was that a larger number of shares should be issued on which only so much capital as was required should be called up. There were now 5400 shares, and if 540 more had been issued there would have been one new share for every 10 existing shares, and by proceeding in that way the present shareholders would have had the opportunity of receiving the full benefit of 7½ per cent., if the company earned it. If these 300 shares were sold by auction, probably £4000, at least, would be received for them, whereas if issued among the shareholders at par, £3000 only would be received, and, therefore, the town would have the benefit; and it should be borne in mind that there were those who looked upon the company, not as carrying on a business for themselves, but as if they were, after all, only town servants out of livery. They did not furnish even the directors with a cocked-hat, and were yet inclined to treat them as only town servants. It was rather humiliating to find, after having carried on for half a century a good beneficial business, they were regarded as in this subsidiary position. He knew to a considerable extent they were servants of the public, and that they had not an Act of Parliament merely to give them a good income on their shares, but to confer a benefit on the town. He admitted that it was so to a large extent, but thought the thing had been carried a little too far.

The CHAIRMAN was sorry the directors were not exactly unanimous on the point, but it would be remembered that when the company got their new Act some years ago they first adopted the system of offering the new shares to the public. The directors desired to show that the company were not a close body, and the shareholders cordially sanctioned the view they took. This was an age of progress, and he should not like to go back to the old system again, and he hoped the meeting would take that view of it.

Mr. MAW admitted that he was in a minority at the board. He was somewhat—he would not say annoyed, but he would say he thought the company had not been treated in quite the respectful way in which a body of gentlemen who for years had succeeded in doing a great deal for the benefit of the town, as well as for the benefit of their shareholders, might have been treated. It had been put before the ratepayers that they were charging a higher price than they need, when really the price was as low as, or lower than, almost any gas company in the neighbouring towns.

The CHAIRMAN, in answer to an inquiry, said he had not heard of one of the complaining parties buying shares at the last sale. They were purchased chiefly by outsiders.

After some further conversation, the motion for the adoption of the report was put and carried. The retiring directors and auditor were re-elected, and the remuneration of the directors was increased from £200 to £300 per annum.

The meeting was then made special, to consider the question of raising new capital.

The CHAIRMAN moved that the capital of the company be increased from £54,000 to £57,000, by the creation and issue of 300 shares of the nominal value of £10 each.

Mr. J. C. COBBOLD seconded the motion, which was put and carried.

The CHAIRMAN next moved—"That the said 300 new shares shall be offered to the public by auction, at such times, in such numbers, and on such terms and conditions as the directors may deem expedient."

Mr. COBBOLD seconded the motion. As a shareholder, he said he should

quite agree that the principle of allotting new shares among existing shareholders was one that would recommend itself to him, but they had deliberately adopted a different principle on a former occasion, and one which had been acted upon by many public companies, and confirmed by several Acts of Parliament of joint-stock companies, and on that ground he concurred with the majority of his brother directors.

The SECRETARY thought a little explanation might be desirable from him. When the Ipswich Gas Company adopted the plan of offering the shares of new capital, to the public, it was with the view of removing the impression that the company was a monopoly, as every one then had an opportunity of becoming a shareholder. At that time the plan of offering new shares by auction was adopted by but very few companies in the country, but since then the clause for the sale by auction of new shares had been adopted in almost all the Gas Acts that had been through Parliament, and it was now one of the standard clauses in all new Bills that came before the Legislature.

Mr. JEFFRIES moved, as an amendment, that the new shares should be offered to the present shareholders. He was always ready and willing to do everything he could for the good of his fellow-creatures and neighbours. This company had done pretty well in the past, but if any failure took place in the future the shareholders would have to suffer. Gas consumers, if they did not have a supply, would not have to pay for it, and if the undertaking was now a success the shareholders had had to run the risk of its not being so. Those who in the past had stood to lose their capital should be those to reap the profit in these times of success. After what had been done they could not be said to be a close corporation, and, though he did not like to take a job out of the hands of their friend, Mr. William Turner, he must propose the amendment.

Mr. G. S. CLARKE seconded the amendment.

Mr. COBBOLD said the difficulty which would attend the distribution of so small a proportion of shares would be great.

Mr. JEFFRIES said the mode of distribution could be left to the directors.

Mr. W. ALEXANDER said he was one of the minority of the directors on this question, but he admitted the difficulty arising from the small number of shares to be allotted compared with the total number of existing shares. He suggested that it might be understood that in future the shares should be allotted among existing shareholders.

Mr. G. S. CLARKE observed that the difficulty had been got over in former issues of new shares.

The SECRETARY said the capital originally raised was £14,000, and when it was increased to £28,000, one new share was allotted for each old one. When by the second Act £14,000 more was raised, one new share was allotted for each two old shares. Since that time the whole of the new shares had been sold by auction.

The SECRETARY stated, in answer to Mr. JEFFRIES, that there were about 300 shareholders.

Mr. JEFFRIES suggested that one new share should be offered to each proprietor, but it was argued that this would be unfair, and that the allotment should be *pro rata*.

The amendment was carried by 18 to 7.

The CHAIRMAN said he should be glad of the instructions of the meeting how the shares were to be allotted. There were 278 shareholders.

Mr. ANDREWS moved that the new shares should be distributed *pro rata* by the directors among the existing shareholders.

Mr. HUISE seconded the motion, which was carried.

On the motion of the CHAIRMAN, it was resolved to raise £16,000 on mortgage, the chairman explaining that this was the limit they had power to borrow.

On the motion of Mr. JEFFRIES, a vote of thanks was passed to the chairman; and on the motion of Mr. ACFIELD the thanks of the shareholders were conveyed to the secretary for the able manner in which he has conducted the business of the company for so many years.

CORK GAS CONSUMERS COMPANY.

The Ordinary General Meeting of Shareholders was held on Tuesday, the 20th inst.—Mr. T. MAHONEY in the chair.

The SECRETARY (Mr. Denny Lane) read the report of the directors and statements of account as follows:—

Annexed hereto you will find the accounts of the company for the half year ending Dec. 31, 1876. The gas-rental is about £1000 less than in the corresponding period of 1875, but this is accounted for by the reduction made on the 1st of January last year of 6d. per 1000 cubic feet in the price.

We have just arranged with the corporation for a renewed contract for the public lamps, for a term of three years.

The reconstruction of the first retort-benches, erected by you in 1857, will be immediately proceeded with. This will involve a large outlay, but when the work is completed we trust that our wear and tear account will be considerably reduced.

We have written off £500 for depreciation in moveable stock, and added £150 to depreciation-fund; also £200 to insurance-fund. After these deductions the balance of the profit and loss account is £6275 12s. 3d., out of which we propose to pay a dividend at the rate of 8 per cent. per annum; this will amount to £5194, and leave £1081 to be added to reserve-fund, which will then stand at £6999 16s. 6d.

Resident Engineer's Report to the Directors.

Gentlemen,—In consequence of the good condition of your works, and the increased capacity of mains, I am glad to report that the supply of gas during the past winter has been abundant and satisfactory. On reference to your books, I think you will find that in no year since the establishment of the company have there been so few complaints of any deficiency, and that the few which were made arose altogether from purely local causes.

In the course of next month I will be prepared to commence the reconstruction of the first bench of retorts, erected by this company in 1857. When this work is completed all our settings will be in excellent condition, with the exception of some arches which have been working since 1860, and which will, probably within a year or two, require extensive repairs.—I remain, gentlemen, your obedient servant,

(Signed)

THOMAS TRAVERS.

Dr.	Capital Account, Dec. 31, 1876.	Cr.
Share capital of the company	£150,000 0 0	Amount paid on shares . . . £129,872 0 0
Debiture capital of the company	22,000 0 0	Ditto debentures 22,000 0 0
		Uncalled capital and shares not registered 19,698 0 0
		Due by shareholders on registered shares 430 0 0
	£172,000 0 0	£172,000 0 0

Revenue Account.

		Rental—
Coals	£9,406 15 7	September quarter . . . £4,650 0 6
Labour	2,728 8 8	December ditto 11,838 11 4
Wear and tear	1,600 14 7	Public lighting—
Oxide of iron, lime, &c.	276 3 0	September quarter 770 18 6
Water and gas at works	121 12 1	December ditto 1,383 9 0
Public lighting	237 6 10	Residuals 5,952 11 4
Salaries	847 10 0	Transfer fees 5 13 0
Rents	119 6 8	
Rates	783 13 2	
Advertising and stationery	79 2 8	
Office expenses	128 2 1	
House repairs	5 6 0	
Auditors	20 0 0	
Directors	175 0 0	
Profit and loss	8,072 2 4	
	£24,601 3 8	£24,601 3 8

Profit and Loss.					
Thirty-seventh dividend	£5,193	0 10	Balance	£6,070	12 8
Reserve-fund	877	11 10	Revenue	8,072	2 4
Interest—Debentures	512	15 0			
„ Bank, &c.	43	12 4			
Charges	150	14 7			
Insurance	36	9 9			
Law expenses	2	18 5			
Depreciation of stk. materials	500	0 0			
Insurance-fund	200	0 0			
Depreciation-fund	150	0 0			
Bad debts and allowances	200	0 0			
Balance	6,275	12 3			
	£14,142	15 0		£14,142	15 0
Balance-Sheet.					
Capital account—			Permanent investment to		
Shares	£120,372	0 0	June 30, 1876	£144,099	17 8
Debentures	22,000	0 0	Extensions from above date to		
Due to sundry persons	6,611	7 2	Dec. 31, 1876—viz.:		
Dividends unclaimed	265	7 7	Works	£252	16 6
Insurance-fund	1,293	10 2	Mains	33	9 10
Reserve-fund	£5,815	3 1	Services	52	14 9
Interest on above	103	5 7	Meters	324	11 2
			Ammonia	6	1 3
Depreciation-fund	1,000	0 0	Publiclighting	6	7 9
Bank current account	2,952	14 7	Engineering	37	10 0
Profit and loss	6,275	12 3		£713	11 3
			Less work—		
			machinery re-		
			turned to stock	450	0 0
			Accts., meters,		
			and services	39	12 8
				489	12 8
				223	18 7
				921	7 7
			Due by sundry persons		
			Suspense account, re former		
			accountant, to June 30,		
			1876	£1,533	13 8
			Less dividend		
			received from		
			Court of Bank-		
			ruptcy	19	4 7
				£1,514	9 1
			Viz.:		
			Joint National		
			Agency bills on		
			hand	245	0 0
			Bowles Brs. bills	193	4 0
			Balance	1,076	5 1
				1,514	9 1
			Rental account	12,296	4 8
			Public lamps	2,348	6 6
			Stock, coals, meters, mains,		
			oxide of iron, &c.	9,159	16 4
			Cork and Macroom Railway		
			Company—invested in their		
			debentures	1,825	0 0
			Cork, Blackrock, and Passage		
			Railway Company for same	2,800	0 0
			Cork Harbour Commissioners		
			for same	1,000	0 0
				£176,189	0 5
				£176,189	0 5

The CHAIRMAN, in moving the adoption of the report and accounts, said: Gentlemen, I have very few observations to make to you. I have great pleasure in being able to bring before you so favourable a report of your affairs. Our reserve is now £7000. During last half year the increased consumption has only been to a very moderate extent. The quality of the gas has been remarkably good, and we never had so few complaints from our consumers. Mr. Anderson has been in the South of Europe for the whole of the winter and has only just returned. We have, therefore, no report from him, as he was not able to come over to inspect our works, being detained in London on parliamentary business. Although our meeting is held somewhat earlier than usual, we intend to send out our dividend this evening, so that you may have it to-morrow. I am sure you will have no objection to that.

Mr. M'OSTRICH seconded the motion, which was put and carried unanimously.

Mr. ALCOCK moved the declaration of a dividend at the rate of 8 per cent. per annum, free of income-tax. In doing so, he said there was a strong feeling outside that as, during the time the company were under the Board of Trade Provisional Order, the shareholders received only 5 per cent. for the capital they invested, and as they were now, comparatively speaking, sailing in smooth water, a contract having been made with the corporation, and no heavy works to undertake, and as they had a very large sum carried to the reserve-fund, the directors ought to consider the propriety of recouping the shareholders for the 5 per cent. which they got under the Board of Trade Order.

The CHAIRMAN: It was six we received previously.

Mr. ALCOCK said the directors had a precedent for pursuing such a course, because it had been done on a former occasion, and he thought those who had invested their money in the speculation were very well entitled to it. It would be desirable that the directors should consider the subject. It might be done in the shape of a bonus of 1 or 2 per cent. They were making no use of the reserve at present, and he threw this out as a suggestion to the board.

Mr. LAMERTE seconded the motion, and said that although in a great measure he was prepared to endorse what Mr. Alcock had stated, yet he thought that the directors could not now pay the shareholders the difference between the 8 per cent., and the 5 per cent. which they paid while under the Board of Trade Order. Previous to that time, however, there were one or two years when they paid a less dividend than 8 per cent.

The SECRETARY: One year.

Mr. LAMERTE said that, considering the large sum of money the board had as a reserve-fund, the shareholders, if the directors thought fit to give it, were entitled to a portion of the amount as a bonus, or in the shape of dividend.

The CHAIRMAN thought that some of the shareholders were under a misapprehension as to the arrears of dividend due to them. The directors dared not touch the reserve to recoup the shareholders for the decreased dividend paid while the company were under the Board of Trade. It was a matter they could not consider. They obtained permission from the Board of Trade to increase the price of gas beyond what they were authorized to charge by their parliamentary powers, but the Provisional Order enacted that during that time they should not divide more than 5 per cent. It was a very unjust arrangement, because it was not an arrangement applicable to the London companies, although they worked under the Board of Trade in the same way, and while they increased the price to the consumers they were allowed to divide 10 per cent. Unfortunately, this company could not go back on that now. But previous to

that time they only received 6 per cent. for one year, and it had been a matter of anxious consideration to the directors whether they would at present make up any portion of that deficiency. They considered it more conducive to the interest of the shareholders to postpone such a course for the present. It would be a matter of greater interest to the directors themselves, for the board represented £30,000 of the capital, and they would be glad to get their 2 per cent. on that. They thought it better, however, to postpone the payment of the money for some time longer, and he hoped the shareholders would have confidence in their judgment. The board possessed one-fourth of the whole capital, and consequently they would act for the benefit of the shareholders. The money was due to the shareholders, and he hoped it would be paid to them, during his time at all events.

The motion was put and carried.

On the motion of Mr. LAMERTE, seconded by Mr. HARRINGTON, a vote of thanks was passed to the chairman for the interest which he takes in the success of the company, and the proceedings then terminated.

GAS AFFAIRS IN AMERICA.

REPORT OF THE GAS COMMISSIONERS IN RELATION TO THE SUPPLY OF GAS TO THE CITY OF BOSTON.

(Continued from page 238.)

Different Processes for the Manufacture of Illuminating Gas.

These may be divided into three classes—viz., processes for the manufacture of—

1. Coal gas.
2. Petroleum or naphtha gas.
3. Water gas.

Petroleum or naphtha gas may be used in combination with coal gas or with water gas. In fact, the latter is rarely made for illuminating purposes without being enriched with petroleum or naphtha gas.

The general principles of these three processes will be first briefly stated, and then their relative merits, so far as it has been possible to ascertain them, in regard to the quality of the gas, the cost of manufacture, and any peculiarities which may be characteristic of either kind of gas.

1. *Coal Gas.*—The manufacture of coal gas depends upon the principle that, when coal gas is subjected to high heat in a closed vessel, certain gases and vapours are evolved, some of which are combustible, and some, like the steam, are condensable, a residue of charcoal or coke being left behind. This process is essentially destructive distillation, and this property of coal is shared by all vegetable and animal substances; but coal and petroleum are the only substances which have been used economically in the manufacture of illuminating gas in extensive works. The distillation of the coal is the most important of the operations in making coal gas, but it is necessary, before the gas is burned, to remove from it those vapours which can be condensed, such as the tar, water, &c., and also those non-condensable gases which either diminish largely the illuminating power, if left in the gas, such as carbonic anhydride (commonly called carbonic acid), or which, when the gas is burned, give rise to products of combustion which are injurious, such as sulphuretted hydrogen and ammonia. The removal of these substances necessitates two other operations—viz., condensation and purification, which, although they do not affect the theory, do affect very materially the cost of the manufacture.

The distillation of the coal is effected in an iron or a clay retort, three, five, six, or seven of which, according to circumstances, are heated with one fire of coke to a cherry-red heat (1478° to 1830° Fahr.) for iron retorts, or to an orange or white heat (2000° to 2300° Fahr.) for clay retorts; 160 to 200 lbs. of coal are usually introduced into the retort at a time, the lids closed, and the operation allowed to continue uninterruptedly for four or four and a half hours. At first the outer layers of the coal only, which are raised suddenly to a high temperature, undergo distillation, evolving vapours which contain a large amount of carbon. These, in passing through the retort, are converted into fixed gases of a high illuminating power. These outer portions of the charge are thus converted into coke, and the inner portions of the charge undergo distillation in the same way, the vapours being, however, more completely decomposed than those first evolved, on account of being brought in contact with the highly heated coke upon the outside of the charge. They are, therefore, of a lower illuminating power. This is well illustrated by the following experiment, performed with the experimental apparatus of the Boston Gas-Works, by Mr. C. D. Lamson, the engineer.*

Test, 2400 lbs. of Penn. coal; 12 clay retorts; charge, 200 lbs. each; duration, four hours; retort-valves open; one-quarter inch pressure on retorts.

Feb. 18.	Gas Made	Test of each Half Hour's
Time.	each Half Hour.	Candle Power.
3.00	.....	.....
3.30	1930	19.60
4.00	2470	17.07
4.30	2140	15.73
5.00	1880	12.26
5.30	1580	10.79
6.00	1340	6.88
6.30	760	2.91
7.00	240	1.50

It will thus be seen that not only the largest amount of gas, but also the richest, is made during the first part of the distillation.

The gas thus formed passes at once from the retort through a pipe to a large horizontal pipe called the hydraulic main, which is partially filled with water, the gas usually being made to bubble up through half an inch to an inch of the water. Here some of the vapours are condensed. From the hydraulic main the gas passes to the condenser, which usually consists of a series of iron tubes surrounded with water, so as to cool it, and more completely condense the tar and other vapours, which are conducted away.

The gas is next conducted into the washers or scrubber, in order to remove the rest of the tar, and also the ammonia. These washers consist of chambers, in which the gas is brought into contact with jets of water. A scrubber is a chamber filled with brush, coke, fire-brick, or some similar material, which is kept constantly moistened with water.

The next step in the manufacture of coal gas is the purification, which serves to remove those noxious substances not taken away by condensing and washing. These substances are chiefly carbonic anhydride, and sulphuretted hydrogen. The objection to the carbonic anhydride in gas is, that it lowers the illuminating power very greatly, 1 per cent. being said to diminish the illuminating power 5 per cent. The sulphuretted hydrogen and other gaseous sulphur compounds are injurious by giving rise in burning to sulphurous and sulphuric acids, which may injure, by its corrosive action, delicate structures, such as books, gilding, silks, &c., which may be exposed to the air of a room in which the gas is burned. When coal gas was first used in England without purification, many books in the British Museum library were ruined. The ammonia is injurious in that

it destroys the diaphragms of the meters, injures the fixtures, and, in contact with burning gas, it is partly converted into nitric acid, which may also attack some delicate substances. The same is true of cyanogen, which is sometimes present as an impurity.

To remove these substances several methods are in use, the material employed being lime and oxide of iron. Lime is used both in the wet and dry way. The wet-lime process consists in passing the gas through milk of lime. This effectually removes the carbonic anhydride, uniting with it to form chalk, and takes away most of the sulphur compounds by uniting with the sulphur to form calcic sulphide or calcic sulphocarbonate. The wet lime is objectionable, however, on account of the very foul odour evolved from it when removed from the purifier, so that exclusive purification by the wet-lime process has been generally abandoned. The dry-lime process consists of passing the gas through moistened slaked lime placed upon trays. This is about as effective as the wet-lime process, and has generally superseded it. The Boston Gaslight Company employ both of these processes, disposing of their wet lime in such a manner that it is not a nuisance.

The iron process consists of passing the gas through some form of the hydrated sesquioxide of iron mixed with other substances. The great advantage of these mixtures is that they may be used over and over again, the sulphuretted hydrogen reducing the sesquioxide of iron to form water, free sulphur, and hydrated sulphide of iron, which last, on exposure to the air, is changed again to the hydrated sesquioxide of iron, and more sulphur is set free. We have seen a mixture of this kind which has been used very effectively for three years in the New York Mutual Company's works. This process is adopted very extensively in the European gas-works, on account of its economy, the oxide of iron used being either the native iron ores, as the "bog iron ore," or some of the artificial preparations, which are usually made by mixing copperas with lime and sawdust, and exposing the mixture to the air for a while. These iron preparations, however, do not remove the carbonic anhydride from the gas so effectually as the lime.

From the purifiers the gas passes through the station-meter, where it is measured, to the gasholder, and is ready for distribution, through the mains, to the burners of the consumer. Gas thus prepared has about the following composition :—

Name.	Heidel- burg.	Bonn.	Chem- nitz.	London Common.	London Cannel.
Hydrogen	44.00	39.80	51.29	46.00	27.70
Marsh gas.	38.40	43.12	36.45	39.50	50.00
Carbonic oxide	5.73	4.66	4.45	7.50	6.80
Olefiant gas and other hydrocarbons	7.27	4.75	4.91	3.80	13.00
Nitrogen	4.23	4.65	1.41	0.50	0.40
Oxygen.			0.41		
Carbonic anhydride	0.37	3.02	1.08	0.70	0.10
Steam			1.00	2.00	2.00

Of these gases the hydrogen and carbonic oxide burn with a non-luminous flame, and marsh gas burns with only a slightly luminous one, the illuminating quality coming almost entirely from the "olefiant gas and other hydrocarbons." The oxygen, carbonic anhydride, and nitrogen, being incombustible gases, injure the illuminating power very greatly. The oxygen and nitrogen get in accidentally from the admission of a little air in charging the retorts, &c. Hence, other things being equal, the larger the proportion of olefiant gas and other rich hydrocarbons present, the higher is the illuminating power, and the richer is the gas. This proportion depends chiefly upon the kind of coal used, and the temperature at which it is carbonized.

In regard to coals, we need in this report only mention that the gas coals are bituminous caking coals and cannel, and for enriching the gas there is frequently used a certain per centage of bituminous shales, such as the Boghead mineral of Scotland, and asphaltic minerals, such as the Albertite of Nova Scotia, and the Grahamite of West Virginia. These enrichers are not used alone, but are mixed with the ordinary gas coal, and produce an exceedingly large amount of the luminant hydrocarbons.

The amount of gas obtained from a ton (2,240 lbs.) of good gas coal, like the Penn coal, when properly managed, is about 10,000 cubic feet of 15 or 16 candle power. The enriching coals produce a larger amount of gas of a higher candle power, and the asphaltic minerals from 13,000 to 15,000 cubic feet of from 30 to 50 candle power. The value of these as enrichers is a very important question, on account of its bearing on the relative cost of enriching with coal or with naphtha.

A number of experiments have been made at the works of the Boston Gaslight Company for the purpose of testing the value of the Albertite as an enricher. At some of these, one of the members of the commission was present, and the following are the results, taken partly from the record book of the company, and partly from notes made at the time :—

Date.	Amount of Coal Carbonized.	Yield.	Yield per lb.	Yield per Ton.	Candle Power.	Sp. Gr.	Remarks.
May 22 1876.	100 lbs.	600 ft.	6.00	13,440.0	..	..	Mixed with coke.
July 5 100	"	630 "	6.30	14,112.0	..	..	Ditto.
" 6 100	"	700 "	7.00	15,680.0	..	..
" 7 100	"	670 "	6.70	15,008.0	..	..
" 7 100	"	690 "	6.90	15,456.0	..	..
" 8 150	"	930 "	6.20	13,888.0	..	..	Mixed with coke.
" 10 100	"	715 "	7.15	16,016.0	37.91	0.624	Without coke. Argand burner.
" 13 150	"	940 "	6.26	14,022.4	54.45	0.624	Without coke. Scotch fishtail, 45°.
" 17	{ Same as July 13, left standing in holder.	{	{	{ 38.59 36.08	{	{	{ With fishtail burner, 45°. With Argand burner.
	Average . .	6.56	14,694.4	..	..	..

In addition to these, which will be alluded to later, some experiments have been tried with cannel coal. Red Bank cannel gave an average yield of 3.8 feet per lb. of 20.52 candle gas. (Sp. gr. = 0.475 to 0.500.) Mill Creek cannel yielded, in one test, 4.5 feet per lb. of 24.49 candle gas. Cannelton cannel yielded 4.74 feet per lb. of 30.40 candle power as tested with a bat's-wing burner, or 22.65 candle power as tested with a "London" Argand burner.† The specific gravity of the gas was 0.556.

The principal impurities in coal gas are, as has been mentioned above, sulphuretted hydrogen, and other gases containing sulphur and ammonia. The presence of a small amount of these cannot be avoided, and is not

injurious, since the amount of the products of combustion of these substances which can be formed by the burning of gas from a single burner during an entire evening is very small. In fact, the presence of a slight amount of ammonia is beneficial, tending to neutralize the sulphurous and sulphuric acids formed by that portion of the sulphur which cannot be removed. The limit prescribed by law for the London companies is 20 grains of sulphur and 2½ grains of ammonia per 100 cubic feet.

There is quite a difference of opinion among scientific men as to the injurious effect of sulphur in illuminating gas. Thus Dr. William Odling, an eminent chemist, says in a lecture to the British Association of Gas Managers :

But, on the other hand, I am altogether at issue with the public, when they maintain that the sulphur of the gas produces, by its combustion, oil of vitriol (sulphuric acid), or that the amount of sulphur ordinarily contained in gas is of any consequence whatever; and a little consideration will, I think, satisfy you of the soundness of this opinion. We will assume that coal gas contains, not 20, but 40 grains of sulphur in 100 feet—a quantity, at any rate, greatly exceeding the reality. Now, making the extravagant assumption that the whole of these 40 grains of sulphur would be completely burned—and in reality they would be burned but very incompletely—they would furnish by this combustion 80 grains of sulphurous acid gas. This quantity of the produced sulphurous acid would occupy, at ordinary temperature, about 1-15th part of a cubic foot, and since 100 cubic feet of our coal gas gives 1-15th of a cubic foot of sulphurous acid, 1500 cubic feet of our coal gas would be required to furnish one cubic foot of the acid, even upon the extravagant assumption we have purposely made. But the combustion of 1500 cubic feet of coal gas would produce something besides sulphurous acid. It would produce, at least, 1000 cubic feet of carbonic acid, and, in addition to its dilution by other gases and vapours, we should have our sulphurous acid diluted by 1000 times its volume of carbonic acid. Now, if we can get at the proportion of carbonic acid in the atmosphere of a room highly illuminated with gas, and take the 1-1000th part of that proportion, we shall be able to form some notion of the amount of sulphurous acid present. You will remember, that the amount of carbonic acid furnished by the breath of one individual is equal to that furnished by two 3-feet gas-burners, and that the maximum amount of carbonic acid found in the atmosphere of a crowded theatre was 0.32 per cent. Now, if, in addition to our previous unreasonable suppositions, we further suppose that an atmosphere contains 0.2 per cent. of carbonic acid furnished by gas combustion, you will see that the whole matter becomes a *reductio ad absurdum*—that we might actually have one half-millionth part of sulphurous acid present in the air of a gas-lighted room. But this sulphurous acid is not sulphuric acid, and can only be converted into sulphuric acid with very much pains and difficulty. When gas is burned in special apparatus, indeed, its constituent sulphur can be converted into sulphuric acid; but it is very difficult to do this. The probability is that, of the sulphurous acid produced in ordinary combustion, scarcely a particle gets converted into sulphuric acid—certainly not more than the ammonia ordinarily existing in the atmosphere can neutralize, so as to form sulphate of ammonia instead of sulphuric acid.

Dr. Letheby, a still more eminent gas chemist, takes exception to the above statements. In the London JOURNAL OF GAS LIGHTING, Feb. 2, 1869, he says :—

And now I am desirous of making a few remarks on the effects of sulphur in coal gas. Dr. Odling has directed your attention to this matter from a statistical point of view, and has shown you how, by a mathematical process, the amount of sulphur acids in the products of burning gas may be reduced to a vanishing point, and that, therefore, they must be insignificant and wholly harmless; but I will ask you to look at the subject from another point of view, and to examine it in the light of facts as well as of figures. About 15 or 20 years ago, when I began to inquire into this matter, I was struck with a circumstance which is now, as it was then, very remarkable—namely, that wherever gas is burned continuously, and in large quantity, it causes a rapid destruction of textile fabrics, with a very acid condition of them. This is notably so in our public libraries, and in warehouses and shops. I obtained so many striking proofs of this, especially from the libraries of the Athenæum Club House, the London Institution, the College of Surgeons, and elsewhere, that I made them the subject of a special report to the City authorities in 1854, and here you will see the specimens of covers of books which were furnished to me at that time. If you apply a piece of the leather to your tongue, you will taste its acidity, and if it be treated with water or spirit of wine, and tested with a solution of baryta, it will be found that the acid is sulphuric acid. These effects were observed many years ago in the library of the Athenæum Club House, and they were growing to be so serious, that the managers requested a commission of chemists, including Dr. Prout, Mr. Aiken, and others, to inquire into it, and I have before me a copy of their report upon the subject. It is to the effect that the mischief is clearly due to the presence of sulphuric acid, which had come from the burning gas; and they state that the mischief will continue as long as gas is used in the library without proper ventilation. Mr. Faraday, thereupon, designed the system of ventilation which is still used in the library. As to the effects of the products of burning gas on shop goods, they are notorious, for such goods are regularly disposed of as damaged or gassy things. It has been remarked, too, that plants are quickly killed by the products of burning gas, for they are peculiarly susceptible of injury from the presence of sulphurous acid in the air; according to Drs. Christison and Farmer, as little as one part in 10,000 of air will kill plants in less than 24 hours. And you cannot use gas in a conservatory, either for heating or for illuminating purposes, unless the products of combustion are entirely removed. Advancing a step further in my inquiries, I ascertained that the water produced by burning gas, collect it how you will, is always acid, and will rot leather, paper, cotton, and linen. Here are specimens of such tissues, which have been dipped in the condensed liquid products of gas combustion, and you will observe that they are as rotten as tinder.

Mr. C. Heisch, F.C.S., Superintending Gas Examiner to the Corporation of the City of London, says :*

When sulphur is burned in dry air or dry oxygen, this gas (sulphurous acid) is produced; but when burned even in a slightly moist atmosphere, part is converted into sulphuric acid, and, when burned in a large quantity of hydrogen (as in coal gas), the oxidation of which produces water in large quantity, the amount of sulphurous acid gas formed is quite insignificant, nearly all the sulphur being converted into sulphuric acid—not a gas, but a vapour readily condensed on all the walls of, and articles contained in, a room, and most difficult to remove, even by a draught through the room—much less by the ordinary means of ventilation. That such is the fact, the experience of every one who notices the effect of burning gas on metallic articles, plants, &c., abundantly proves. Each grain of sulphur, in burning as it does in gas, gives rise to the production of just over 3 grains of sulphuric acid; 100 cubic feet of gas, if they contain 30 grains of sulphur (a very common amount), would in burning produce 90 grains of sulphuric acid, and three burners, each burning 4 cubic feet per hour, would produce between 3 and 4 grains of sulphuric acid per hour, or about 20 grains in six hours, which would in great part be condensed on the contents of the room in which the gas is burned. All tradesmen are only too well acquainted with the rotting effects produced by gas on their goods. One most instructive instance, in proof of the above, I may mention. Some years since gas was introduced at the Royal Observatory, in place of camphine lamps, for the photographic registration of magnetic variations, &c. In a very short time the surface of every reflector was destroyed, and the draw-tubes of the telescopes quite corroded. It was found necessary to place a tube over each burner, and to connect all these with a central chimney, in which a strong draught was maintained, to carry off the products of combustion. These tubes were, for cheapness, made of zinc. In a few days all the lamps were found extinguished by a crystalline substance, which dropped on the burners from the tubes. This proved to be sulphate of zinc. I recommended the substitution of tinned copper tubes, but the price was objected to; and a contrivance was resorted to by which the condensed matter was run into a vessel at the side of the chimney. In one of these vessels I collected in six weeks, from a burner consuming about one-half foot per hour, three-fourths of a pound of sulphate of zinc.

The weight of testimony appears to us to be in favour of the injurious effects of sulphur in illuminating gas, and hence the necessity of removing all which is possible by purification.

The specific gravity of illuminating gas varies usually from about 0.400 to 0.500; that is, it is a little less than one-half as heavy as air, the specific gravity of which is taken as the unit, or 1.000. As a rule, the specific gravity of coal gas increases in nearly a constant ratio with the illuminating power; so that by knowing the specific gravity, we can tell pretty nearly what the candle power is, and *vice versa*. Tables have been constructed for estimating approximately the candle power, from the specific gravity; but these cannot be used for any other than pure coal gas. The specific gravity of illuminating gas is a very important property, since, as has been already mentioned in describing the apparatus for determining the specific

* American Gaslight Journal of Dec. 16, 1875, from Professor C. F. Chandler's Address to the American Gaslight Association.

† Burners giving a flat flame yield a better result with rich gases than those giving a round flame.

* London JOURNAL OF GAS LIGHTING, Dec. 29, 1874, p. 856.

gravity, the denser the gas the more slowly will it pass through a given orifice, the pressure being the same. It has, therefore, a great influence upon the amount which passes through the consumer's meter and burner.

II. *Petroleum Gas*.—In the manufacture of this gas either crude petroleum may be used, or some of the products of the distillation of petroleum, such as naphtha, &c. In distilling petroleum various vapour are evolved, differing according to the temperature employed. Those which are volatilized at a low temperature, as rhigolene, gasolene, naphtha, &c., are of little value commercially, as compared with those which require a higher temperature, such as kerosene. They are, however, even more valuable for the manufacture of gas, and can be used more economically on account of their cheaper price.

The principles upon which the manufacture of petroleum gas depends do not differ from those of coal gas. In both cases the material is subjected to destructive distillation in the retort; but in the case of petroleum the material may either be introduced directly into the retort, or, in the case of naphtha, may first be converted into vapour, and the vapour conducted into the retort. In either case the liquid is first vaporized—in the one case in the retort, and in the other before it reaches there; and, secondly, this vapour is decomposed, and made into a fixed gas, which is conducted into a hydraulic main and condenser, in the same way as coal gas. One very great advantage in naphtha gas is, that it does not require purification, since it contains no sulphur compounds and no ammonia; hence one item in the expense of the manufacture is dispensed with. Moreover, a loss of some of the luminiferous hydrocarbons is avoided, a certain amount of these being necessarily condensed in passing through the washers, scrubbers, and purifiers.

Experiments which have been made by Professor A. Wagner* show that naphtha is a better and more economical material for the manufacture of gas than petroleum or the heavy oils. Fifty kilogrammes of petroleum produced 1547 cubic feet of gas, while the same amount of naphtha produced 1619 cubic feet. Both petroleum and naphtha produce a large amount of acetylene, a gas which contains a large proportion of carbon. In the above experiments with petroleum, the proportion of acetylene evolved was 5 per cent., of other heavy (rich) hydrocarbons 35·96 per cent., and of light (poor) hydrocarbon gas 59 per cent., the petroleum being split up with deposition of carbon into a mixture of acetylene, heavy and light hydrocarbon gas, and hydrogen.

On a large scale in gas-works in this country, where petroleum and its products are much cheaper than in Europe, it has been found that 60 to 80 cubic feet of gas can be obtained from a gallon of petroleum or naphtha, this gas having an illuminating power of from 50 to 70 candles.

The following experiments were undertaken by Mr. C. D. Lamson, at the Boston Gas-Works, one of the members of the commission being present during the performance of many of the tests, for the purpose of determining the value of petroleum as an enricher for coal gas. One of the retorts connected with the experimental apparatus was fitted with the necessary pipes for conducting petroleum or naphtha into it. The gas was conducted to one of the gasholders belonging to the company, and tested by the photometer described above, with the following results:—

Crude Petroleum.

Date.	Amount Car-bonized.	Yield.	Yield per Gallon.	Candle Power.	Name.	Sp. Gr.
April 5	48 galls.	4000 ft.	83·5 ft.	..	..	..
" 6	33 "	2500 "	75·75 "	..	..	..
" 8	50 "	2700 "	50·4 "	..	..	..
" 10	44 "	3300 "	75·0 "	..	..	..
" 11	43 "	3300 "	76·74 "	..	..	..
" 12	42 "	3400 "	80·95 "	..	..	..
" 17	40 "	3000 "	75·0 "	..	..	..
" 21	30 "	2000 "	66·6 "	..	..	..
May 4	15 "	1200 "	80·0 "	{ 37·11 Argand	..	..
" 6	40 "	2800 "	70·0 "	{ 49·30 Scotch fishtail, flat of flame.	..	..
" 8	37 "	2700 "	72·9 "	{ 40·88 " edge "	..	..
" 11	80 "	5200 "	65·0 "	{ 51·88 Scotch fishtail, flat	..	..
" 20	34 "	2500 "	73·4 "	{ 49·78 " 45°	..	0·600
"	"	"	"	{ 45·44 " edge	..	..
Average		72·71 cubic feet to one gallon.				

Naphtha.

Date.	Amount Car-bonized.	Yield.	Yield per Gallon.	Candle Power.	Burner.	Sp. Gr.
May 9	..	..	..	{ 60·64 Fishtail, flat of flame	..	..
" 10	18 galls.	1200 ft.	66·6 ft.	{ 57·66 Scotch fishtail, flat of flame.	..	..
" 12	Same gas after standing	..	..	{ 58·60 " edge "	..	0·900
" 13	8 galls.	700 ft.	87·5 ft.	{ 65·76 " 35°	..	..
" 17	10 "	800 "	80·0 "	{ 57·10 " edge "	..	..
" 18	10 "	800 "	80·0 "	{ 63·60 " flat "	..	..
" 19	18 "	1500 "	83·3 "	{ 64·80 " 45°	..	..
"	"	"	"	{ 57·69 " flat "	..	..
"	"	"	"	{ 54·11 " 45°	..	..
"	"	"	"	{ 42·81 " edge "	..	..
"	"	"	"	{ 35·73 " flat "	..	..
"	"	"	"	{ 33·41 " 45°	..	0·644
"	"	"	"	{ 31·33 " edge "	..	0·647
"	"	"	"	{ 66·00 " 45°	..	..
"	"	"	"	{ 43·08 " flat "	..	..
"	"	"	"	{ 64·18 " 45°	..	..
"	"	"	"	{ 62·70 " 45°	..	..
"	"	"	"	{ 51·51 " edge "	..	0·850
Average		79·49 cubic feet to one gallon.				

* During the performance of this experiment, the first test was made while the stream of naphtha flowing into the retort was very small, so that the rich hydrocarbons formed were probably still further decomposed with deposition of carbon and the formation of lighter hydrocarbons, thus diminishing the candle power. Upon turning in a larger stream, the candle power at once increased. This is also the probable explanation of the low illuminating power of the gas made on May 13, the amount of gas made being increased at the expense of the light.

There was not a sufficient number of experiments made with crude petroleum to enable us to draw definite conclusions in regard to anything

but the yield. It will be seen, however, that it is somewhat inferior in this respect to naphtha, a gallon of crude petroleum yielding 72·71 cubic feet of gas = 3053·82 cubic feet to the bbl., while a gallon of naphtha yielded 79·49 cubic feet = 3338·58 cubic feet per bbl.*

According to Mr. J. D. Patton,† about 70 feet of 80-candle gas, or 80 cubic feet of 70-candle gas to the gallon is the maximum yield from petroleum or naphtha. When such gas as that obtained from pure Albertite, petroleum, or naphtha is burned, a much smaller burner than that in ordinary use must be employed; otherwise the flame will smoke and much light be lost, although less of any of these gases than of ordinary coal gas would pass through the same burner in a given time, on account of their greater specific gravity.

(To be continued.)

GLASGOW CORPORATION GAS-WORKS.

ANNUAL SOIRÉE OF THE EMPLOYÉS.

This Annual Festival was held in the City Hall, on Tuesday evening, the 19th inst., and was well attended. Councillor MILLER presided, and there were present on the platform Bailies Ure and Thomson; Councillors Moir, Waddell, Clark, Burt, Martin, Garvie, Farquhar, Selkirk, Mathieson, and Dron; Messrs. Foulis, Ross, Bowers, Granger, Manuel, Davidson, Key, Scott, Lyon, &c. After tea,

The CHAIRMAN addressed the meeting. He remarked that all present were connected with one large concern, and he had to congratulate the whole of them that the past had been a very prosperous year. Everything, so far as he had heard, had gone on exceedingly well. They had had very few complaints indeed from the public, either as to bad gas or anything else. The fact was, he supposed, the public had got rather tired of complaining—possibly they found it was not of much use, for they were all doing the best they could. There could be no doubt they had all done remarkably well. He knew that the stokers had done their duty. They had performed a very large amount of work, which, from personal experience, he knew was hard work. He had himself been a stoker for ten years, and knew how to charge and draw retorts; he had done so more than a hundred times. There was another department of which he would like to say a word, and that was the department which sent out the accounts and brought the money in. The money had come well in last year, even although trade was dull. He believed there had not been more than one complaint in connexion with the ingathering of the cash. He could assure the public that whilst they were always anxious to get in the money like other people, yet they treated their customers as leniently as possible; but there was one complaint recently made as to incivility. He thought that in matters of that kind there were faults on both sides. He was quite sure every member of the Corporation and the Gas Committee wished that perfect civility should be shown by all their servants to the public outside, no matter whether the account was one shilling or for ten pounds. He was glad to announce that there had been no serious accident during the year just closed, and that was something for which they should all be thankful. He thought it might be interesting to them to know that last year there were 178,359 tons of coal carbonized in the works of the corporation; the men employed in the works numbered upwards of 1000, and in the other departments 400. The greatest quantity of gas which had been manufactured in one day last year was 9,660,000 cubic feet, while for the year preceding the greatest quantity was 8,898,000 cubic feet, so that there was a considerable increase in the past twelve months. During the seven years that the corporation had carried on the works, the quantity of gas manufactured had increased by no less than 44 per cent. He afterwards referred to the question of Sunday labour, and said that since last annual gathering the committee had arranged that all the men should get twelve clear hours off on Sunday. That had not been done without great disadvantage and at very considerable loss to the public. He rejoiced to hear that the men in general were pleased with the change, though he regretted to understand that some of them did not avail themselves of the benefit which had been conferred. The committee desired that these twelve hours should be to the men a time of rest both to their bodies and to their spirits, and he hoped they would see it to be their interest to take full advantage of the arrangement which had been made.

Messrs. MOIR and WADDELL subsequently addressed the meeting, and musical performances enlivened the proceedings of the evening.

RIVER SUPPLY WATER-WORKS FOR GLASGOW.

The Water Commissioners of Glasgow are at present engaged in the construction of important water-works on the lands of Westhorn, about three-quarters of a mile above Dalmarnock Bridge, the object being to give a supply of water from the upper reaches of the Clyde to those manufacturers who now draw from the river lower down. The subject of a water supply from the Clyde has for more than half a century been a bone of contention between the Clyde Trustees, the Water Commissioners, and some sixteen manufacturers who claim a right to draw their water from a certain part of the river. When the removal of the weir above Hutchesontown Bridge was first mooted, the manufacturers were up in arms, and objected to such a step, on the ground that it would allow the foul water from the city sewers to be carried by the tide up the river, to the injury of their respective industries. This question formed the subject of a protracted litigation. The Clyde Trustees and the Water Commissioners contended that the manufacturers had no legal standing, while the manufacturers, on the other hand, maintained that the weir could not be removed without their consent, or at all events, unless due provision were made for giving them an equivalent supply of water from some other source. In the Court of Session a decision was ultimately given against the manufacturers; but, on appeal to the House of Lords, this judgment was reversed, and the legal claim of the manufacturers established. In view of this decision, there was no alternative but either to abandon the idea of removing the weir, or else to make arrangements for another supply of water. The former course was not to be thought of in face of the advice of every engineer consulted during 50 years; and although the proposed improvement met from time to time with strong opposition, both in the Town Council and elsewhere, (urgent representations being made on behalf of the amenity of the Green, and in the interest of East-enders fond of boating and bathing) other considerations ultimately prevailed, and it was finally resolved that the scheme should be proceeded with as speedily as possible. Hence the necessity for constructing the works now in question.

The operations, which are under the superintendence of Mr. Gall, engineer to the Water Commissioners, were commenced several months ago, and they are now so far advanced that the new supply is expected to be available towards the end of June or the beginning of July ensuing. The engine-house, which forms an important feature of the undertaking, is situated close to the banks of the river, in the immediate vicinity of what is known as Harvie's dyke, while on the high ground, a little beyond, the finishing touches are being given to a couple of reservoirs, each capable of

* A petroleum bbl. contains 42 U.S. gallons. A barrel of naphtha usually contains from 45 to 47 gallons; but the calculations here made are for 42 gallons per bbl., the same as in the case of petroleum.

† *American Gaslight Journal*, Nov. 16, 1875.

* *American Gaslight Journal*, Dec. 16, 1875, from Dingler's "Polytechnic Journal," vol. ccxvii. p. 64.

holding $7\frac{1}{2}$ million gallons of water. The pumping apparatus consists of two large condensing, horizontal, direct-acting engines, made by Messrs. Rait and Lindsay, Glasgow. These machines are furnished with all the latest improvements, and are calculated to be capable of raising $7\frac{1}{2}$ million gallons in 20 hours to the height of about 65 feet. The object of providing reservoirs is to ensure that the supply shall be continuous, and to admit of any necessary repairs being made on the engines without in any way interfering with the mills dependent on these works. The water will be carried from the reservoirs in a 42-inch main, to be laid along the edge of the river, to Springfield Road, passing by Adelphi Street, through the Green, under the river opposite Little Govan Street, and on to the Commercial Road. The main will be carried past all the large public works interested in the supply. The price of the water to the sixteen manufacturers immediately concerned has been fixed at 6s. 6d. per 100,000 gallons; but the commissioners have been left free to sell any extra quantity they may raise to other manufacturers, at a more remunerative price. It is provided by statute that the weir shall be removed within three months after the completion of these works, so that by the end of August or beginning of September this structure, about which there have been so many disputes, will have become a matter of history.

As to the effect of the removal of the weir on the navigation of the river, those best able to judge anticipate that the increased scour thus obtained will tend to deepen the bed of the river, and so facilitate navigation to Rutherglen, if not to Carmyle. To get the full benefit of this water-way, however, the Clyde Trustees would require to commence dredging operations. At present the trustees exercise no jurisdiction above Hutchesontown Bridge, and the question suggests itself whether it would pay to push their system of improvement into the higher reaches. If, however, there seems to be a reasonable prospect of floating vessels of 5 or 6 feet draught as far up as Carmyle, the spirit of progress which has already done so much for the Clyde will probably not be found wanting, and ere long we may see five or six miles added to the navigable channel of this important river.

The cost of the River Supply Works, including the ground occupied, is estimated at between £80,000 and £90,000.—*Scotsman*.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

During the week some descriptions of local and other pig iron have hardly been so firmly held—a fact which may, to a certain extent, be attributed to the weak state of the Scotch market, and the very heavy stocks held at Glasgow and elsewhere in Scotland. Foundry brands are, perhaps, better maintained in price than the forge numbers.

In the manufactured iron trade there is little or no change to be noted, nor is any great variation in prices to be noted either in respect of ordinary merchant irons or of pipe work and other castings. Pipes can be had at about £5 to £5 10s. per ton, and ordinary casting at from £6 10s. to £8.

All classes of fuel remain very plentiful and cheap—good gas coal being obtainable at 6s. to 8s. per ton, steam coal 9s. to 10s. 6d., ordinary engine coal 3s. to 5s., and house coal 10s. to 25s. per ton.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

For all classes of round coal there is still only a very poor demand, and both for house fire and gas-making purposes supplies are abundant in the market, and both house coal and gas coal collieries have been put on short time, many of them not running more than seven and eight days to the fortnight. Prices generally are weak, and there is a great deal of underselling in the market. For good Arley coal it is difficult to obtain more than 10s. to 10s. 6d. per ton at the pit. Pemberton four-feet is quoted at 8s. 6d. to 9s., and the common Wigan seams are offering at prices ranging from 6s. 6d. to 7s. 6d. per ton, according to quality.

The iron trade continues in a very depressed condition, and Lancashire smelters, in the face of the extraordinarily low prices at which north country brands are offered in this district, are completely shut out from any chance of securing orders, except at prices which would be considerably short of covering the actual cost of production. For Lancashire pig iron delivered into the Manchester district, makers are still quoting 56s. 6d. to 57s. 6d. per ton for No. 3 foundry, and 54s. 6d. to 55s. 6d. per ton for No. 4 forge; but at these figures little or no business can be done. Finished iron is also very flat, and for delivery into the Manchester district, quotations range about £6 15s. to £6 17s. 6d. per ton for Lancashire bars, £7 17s. 6d. for hoops, £8 15s. for ordinary plates, £9 5s. for best boiler-plates, and £9 5s. per ton for sheets.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England continues in a very unsatisfactory condition from week to week. The near approach of spring brings no improvement in business; neither has the sudden appearance of cold weather had much effect upon the value of house coals. The best gas collieries are very well engaged—it may be said are fully employed. The difference between best and second gas coals being little more than 1s. or 1s. 6d. per ton, however, and freight being the same, foreign gas companies prefer best to second sorts. Second-class gas coals, therefore, occupy a very middling position in the market. There is an abundance of steam tonnage to carry on all the gas coal trade to coasting ports which have depth of water enough for steamers. Under these circumstances small sailing ships are in limited request in the gas coal trade, and freights are poor. Steamers are paid little more than 4s. per ton to carry coals to London, and other ports are pretty much in the same proportion.

March, like February, threatens to be a very anxious month for all persons connected with shipping business, exports, and continental trade. The travellers for large houses are returning from the Continent, and are giving a most disheartening account of the state of business there. If peace were assured, no doubt a very lively business would soon arise; but the military idea is so dominant on the Continent, that all sort of persons connected with trade are in anxiety lest hostilities should occur in March or April, and throw everything into confusion. The same reports come

from Vienna, Berlin, St. Petersburg, and all the great cities which transact business with this part of Great Britain. The orders come to hand are intended to meet immediate wants, and no more. The trading steamers from the Tyne to the Continent are about one-half the usual number, and load up very poorly.

The iron trade of the North of England is extremely quiet. Iron ship-building is probably the best employed, but much of that is of a speculative character. There is no actual demand for iron shipping anywhere, and shipowners are at their wits end to know where to place them to make a reasonable freight.

A large number of seamen and stokers generally employed aboard steam vessels are ashore out of employment. House building is falling off, and, generally speaking, there is a large number of unskilled labourers out of work in the North of England.

The chemical trade of the Tyne is in a very moderate state. There are considerable sales, but at very low prices, of bleaching powder, which is sent to the paper-makers in Switzerland, France, Sweden, and Germany; but other sorts are not inquired after.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Dr. Wallace's report upon the Glasgow gas for the week ending the 17th of February shows pretty fair results. Over the four testing-stations the average ranged from 25.85 candles to 27.82 candles, the highest maximum being 28.60 candles, and the highest minimum 27.31 candles.

Perth gas during the same week showed, in three experiments, an illuminating power of—maximum, 28.63 candles; minimum, 28.35 candles; and average, 28.49 candles.

At the usual monthly meeting of the Forfar Corporation Gas Commission, held last Monday evening, it was recommended by the Gas Committee that, in respect that from information received it appeared likely that first-class canal would rise in price before April, when the corporation take their annual contracts for coals, 700 tons of gas coal be contracted for. The meeting instructed that the matter be delayed for a month till estimates had been received. It was stated that the illuminating power of gas in Forfar was 26 candles; and it was further stated, with reference to some complaints about the gas, that these were in a great measure caused by defective fittings and old burners, and also from the mains being too small to supply the large factories. Probably next month a proposal would be made to supply the factories of Messrs. Laird (Canmore) and of Messrs. John Lowson, Jun., and Co. from independent mains, which would considerably relieve the pressure.

At this stage I may mention that the somewhat notorious slander case, Rutherford against Lowson, which had been in the Court of Session for a number of months, has been compromised and taken out of Court. It arose out of strong statements that were made in the month of May, 1876, at a meeting of the Forfar Gas Commissioners, and the pursuer, Mr. Rutherford, asked for damages of £1000. On the understanding that the case should be taken out of Court, the defender, Baillie Lowson, agreed to pay to the pursuer the sum of ten guineas in name of damages, as also the expenses incurred in bringing the action.

At a special meeting of the Hamilton Town Council, held last Tuesday, a rather unpleasant scene took place on the question of the Corporation gas accounts for the year ending March, 1876. Members of the Gas Committee stated in the public meeting of the council that they were not able to understand the accounts, and then they proceeded to fight out their misunderstandings. Eventually, it was resolved, on the motion of Baillie Cassels, that an accountant should be employed to draw up a correct balance. In taking such action, the mover did not wish it to be understood that he threw any reflection on Mr. Dunlop, the manager, who, if he attended to the work outside, could not be expected to attend to the books also. Consideration of several recommendations by the committee, including one to increase the capital account by £17,000, and another to reduce the price of gas by 5d. per 1000 cubic feet, was adjourned.

There is a marked tendency just now to invest capital in gas and water stocks, and the consequence is that the prices of the same are advancing. Aberdeen gas shares changed hands on Friday at 6½, which represents an advance of 5s., and on Tuesday last Glasgow Corporation £4 Water Annuities were taken at a rise of 7s. 6d., at 102½.

The Greenock Water Trustees held their usual monthly meeting last Monday, when it was reported that on the 27th ultimo the quantity of water in the reservoirs was 514,863,630 cubic feet, or 147 days supply for all purposes.

On the suggestion of the Water Committee of the Cupar Police Commission, it has just been resolved to borrow a further sum of £3000, on terms of the Local Water Act.

There is now some prospect that the promoters of the Perth Water Bill, now before Parliament, may arrive at a compromise with the opponents of that measure. It is difficult to see how it could pass both Houses of Parliament in the face of the opposition raised by the Water Commissioners, the Town Council, the Police Commissioners, and the Guildry Incorporation. If withdrawn, it is probable that a Bill more generally acceptable will be promoted by the city authorities in the session of 1878. At a meeting of the Water Commissioners, held last Tuesday evening, it was reported that a vote of the ratepayers had been taken in regard to the present water supply, and to the Bill now in Parliament, and that by an immense majority satisfaction in favour of the former was expressed, and opposition against the latter approved of. Messrs. Hawksley and Leslie's report upon Mr. Bateman's scheme was discussed at some length.

Since last report there has been an almost daily decline in the price of pig iron in the Glasgow market:—Monday, 56s. 3d. to 56s. 1½d.; Tuesday, 56s. 3d.; Wednesday, 56s. 2d. to 56s. 1½d.; Thursday, 56s. to 55s. 10d.; Friday, closing at 55s. 7d., at which sellers remained. Several brands of shipping iron have been officially reduced in price, and others are expected to follow. Special brands are now within a trifle of what were the standard quotations previous to 1871, when the great rise began. There is a fair demand for manufactured iron, and the mills are generally well employed.

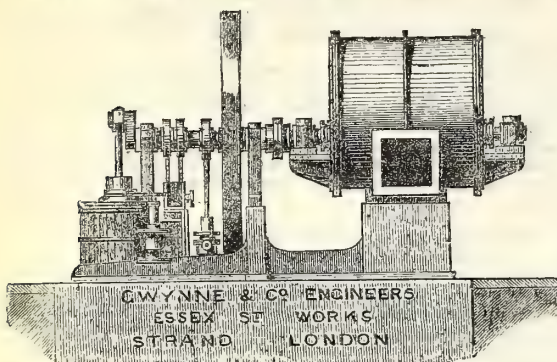
A dull inanimate tone still continues to characterize the coal market, the business passing being very limited. Prices are nominally unaltered, but, where orders are scarce, reductions are made on current rates.

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ENGINEERS,
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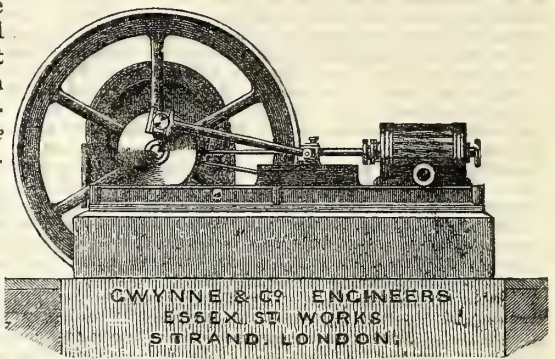
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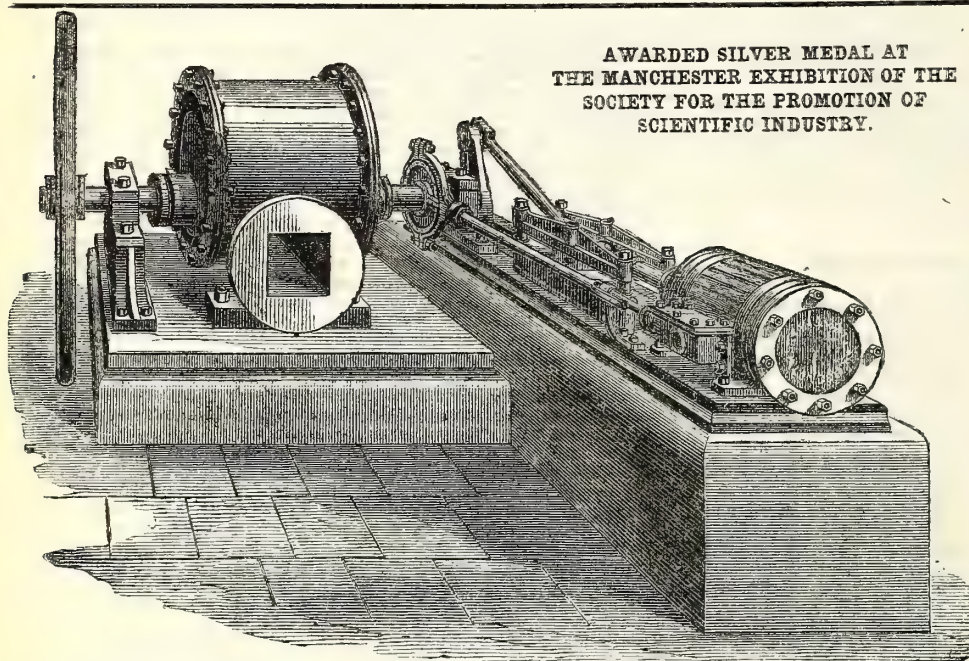
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The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

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BEALE'S Improved Patent GAS-EXHAUSTERS WITH ENGINES COMBINED.

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Makers of **ENGINES, EXHAUSTERS, INDEX and DISC GAS-VALVES, HYDRAULIC MAIN VALVES, BYE-PASS VALVES, TAR, LIQUOR, and other PUMPS, SCRUBBERS and PURIFIERS, CONDENSERS, BOILERS, &c.**

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TO GAS-METER MANUFACTURERS. **WANTED, by a competent and experienced man, a situation as DRY GAS-METER PROVER.** Many years at the business. Address A. B., No. 1, Shrubland Grove, DALSTON, E.

WANTED, a situation as Manager of a Provincial Gas-Works, by a thoroughly practical and competent man. Well up in construction, manufacture, and distribution. Good testimonials and security. Address N. R. G., care of Mr. J. Biffen, Trunk Maker, Davies Street, Oxford Street, LONDON, W.

METER REPAIRER. WANTED, at the Reading Gas-Works, a steady and experienced **METER REPAIRER.** Used to both Wet and Dry Meters. The situation is a permanent one. Apply, stating age, experience, and wages required, to Mr. E. BAKER, Engineer.

FOR SALE, a Set of 6-in. Vertical CONDENSERS, with tar-box and all connexions complete. May be seen, and price obtained, on application to the Southbank and Normanby Gaslight and Coke Company, Limited, Southbank, YORKSHIRE.

TO BE SOLD, Four Cast-Iron Purifiers, 6 ft. square, with hydraulic centre-valve; also 10 in. by 18 in. round, and 62 in. by 15 in. round Retort Mouthpieces, and 47 in. by 6 in. H-Pipes. Apply to W. WINSTANLEY Manager, Gas-Works, NEW-CASTLE-UNDER-LYME.

HAMPTON COURT GAS COMPANY. TO BE SOLD cheap, as they stand, Four Cast-Iron PURIFIERS, 8 feet square, with wrought-iron covers, wood sieves, columns, girders, and lifting apparatus complete; and 8-inch Hydraulic Centre Valve and connexions, all in good condition. Apply to Mr. E. PRICE, Engineer, Gas-Works, HAMPTON WICK.

REQUIRED, as Superintendent or MANAGER, in small Manufacturing Works near London, a gentleman who has held a similar position, and is practised in the control of workmen, and who is a good accountant. Apply, giving particulars of last engagements, to N. J. P., Messrs. Deacon's, 154, LEADENHALL STREET, E.C.

GASHOLDER FOR SALE. THE Directors of the City of Durham Gas Company are prepared to receive TENDERS for the purchase and removal of a 70 ft. by 20 ft. Single-Lift GASHOLDER, with 6 Cast-Iron Tripods. Contractor to bear every expense connected with the transaction. Tenders, sealed and endorsed "Tender for Holder," to be lodged with me on or before Wednesday, the 7th day of March, 1877.

JOHN SUMMERS, Secretary.

CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY.

THE Directors are desirous to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their works for a term of One year, from the 1st of March next. Quantity about 1600 gallons of each. Tenders to be sent in separately for Tar and Water, at per ton of 2240 lbs., before the 8th of March next. By order, Feb. 27, 1877. E. J. HOLWELL, Secretary.

TO CONTRACTORS AND OTHERS. THE Directors of the Watford Gas and Coke Company are prepared to receive TENDERS for telescoping a GASHOLDER, at their Works near the Bushey Station, the drawings and specifications relating to which can be seen on application to the Company's Engineer, H. E. Jones, Esq., 203, Wapping, London. Tenders to be sent to the Company's Office, 5, Derby Road, Watford, on or before the 12th of March, 1877. The Directors do not bind themselves to accept the lowest or any tender. Dated the 22nd day of February, 1877. By order, WILLIAM ROWELL, Secretary.

DRAUGHTSMAN. THE Gas Committee of the Halifax Corporation require the services of an efficient DRAUGHTSMAN. One who has had experience in gas apparatus preferred.

Applications, stating salary expected, and enclosing testimonials and references, to be sent to the Town-Clerk, Town-Hall, Halifax, endorsed "Application for Draughtsman," on or before Thursday, the 1st of March next. Further information may be obtained from the undersigned. W. CARR, Gas Engineer.

HEBDEN BRIDGE GAS COMPANY. THE Directors of the above Company are prepared to receive TENDERS for the construction and erection of Scrubber, Condensers, Engine, Exhauster, &c., and connexions for same. Plans may be seen and all particulars obtained from Mr. Blackburn, Manager, Gas-Works. Sealed tenders, endorsed "Tender for Scrubber, &c.," to be sent in not later than March 7th, and addressed to the Chairman, Gas-Works, Hebdon Bridge. The Directors do not bind themselves to accept the lowest or any tender. By order, THOMAS HORSFALL, Secretary. Gas-Works, Hebdon Bridge, Feb. 16, 1877.

THE Swansea Gaslight Company have for immediate SALE, the following Plant:— A 6-h.p. Patent Trunk Engine. (Beale.) Exhauster to pass 15,000 feet per hour. (Beale.) An 8-h.p. Grasshopper Engine. (Easton and Amos.) Exhauster, 20,000 ft. per hour. (Beale.) Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys. Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons. A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves. May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions. Further particulars may be obtained on application to Mr. THEOBALD ANDREWS, SWANSEA.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

J. J.—We could not publish the results of the competition, it being a trade question, without the assent of the tenderers.

MANCHESTER DISTRICT ASSOCIATION OF GAS ENGINEERS.—Report of proceedings at meeting on the 24th ult. in our next.

A SUBSCRIBER is informed that the treatment of residual products will form a part of the "Treatise on the Manufacture of Gas," as announced in the original prospectus.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 6, 1877.

Circular to Gas Companies.

THE attention of the Board of Trade seems to have been drawn to the difficulties which may arise, when all the manufacturing stations of the Chartered Gas Company are connected by trunk mains, in deciding as to the origin of the gas examined at any particular testing-place. Small as the matter practically is, it deserves some consideration; but, as we have already said, all doubts and difficulties would be removed if the gas were tested in the station at which it is made. It is now perfectly well known that properly condensed gas loses very little illuminating power after travelling for several miles. A belief to the contrary formerly prevailed, but continuous observation has proved the truth of the assertion we make. The "thousand yards" notion is, in fact, exploded, and we know now that it matters very little at what point in the distributory apparatus the gas is tested.

In a communication from the Board of Trade to the Metropolitan Board of Works, which is said to be lengthy, but of which we have at present only a very meagre abstract, the Government Department state that they have advised the parliamentary agent of the Chartered Company to insert in

the Bill now being promoted by the Company, a clause or clauses dispensing with the necessity for specifying the station from which the gas is delivered before the forfeiture to which the Company may have made themselves liable can be recovered. This is a very important matter indeed. The Bill now before Parliament will, if it pass, as we confidently anticipate will be the case, practically abolish all forfeitures for impurities. But the liability to be fined for defective illuminating power will remain; and, when it is remembered that the amount to be forfeited is to be calculated upon the quantity of gas made at the particular manufacturing station alleged to be in default, it seems to us that to specify it is of the utmost importance. Let us suppose, for example, that the common gas tested at Millbank was deficient in illuminating power, on what basis could the amount of forfeiture be computed? Must all the gas made at Beckton, at Fulham, at Kensal Green, and at Camden Town, and the rest, be taken into account, and the Company fined in respect of all the gas made at their seven stations? To such a proposal the Company could never assent. Variations in illuminating power are inevitable; but past experience has shown that the observed power is very rarely below the standard at any station. It is, therefore, very unlikely that, with a mixture of gas from all stations, any defect would ever be discovered. But a fair proportional mixture can never possibly be found at any one testing-place. Beckton gas might, perhaps, be found in the main at Millbank, and so, perhaps, might Kensal Green gas, if they could be identified; but what proportion would they bear to the gas made at Lupus Street? We hold, then, that without some fundamental alteration in the mode of calculating the amount of forfeiture for defect in illuminating power, it is absolutely necessary that the station making default should be specified, and this can only be done when the gas is tested at the works. We are writing without a complete knowledge of the object the Board of Trade had in view when they communicated with the Metropolitan Board. Next week we hope to be more fully informed, but the matter is of too much importance to be passed over without immediate notice.

The Bill of the Chartered Company, which is intended to abolish the power of the Referees to fix a limit on the amount of "sulphur" allowed to be present in their gas, is to be opposed by the Corporation of the City of London and the Metropolitan Board of Works, two authorities who have promoted Gas Bills, but who carefully avoided introducing purity clauses into them. In this fact lies a complete answer to the opposition these bodies are about to raise, and a Parliamentary Committee, we have no doubt, will reject their case with the contempt it will merit. We shall not here quote Lord Thurlow, nor remark on the utter absence of conscience to be observed in much of the conduct of public bodies. In this particular instance the bodies named are about to strive to prevent the Chartered Company from obtaining the immunity they, two years ago, sought for themselves, and for that purpose will incur heavy expenses, which the much-milked cow, the metropolitan ratepayer, will have to furnish. It is not at all creditable to these bodies that they seek to impose on others restrictions from which they themselves claimed exemption; but no consistency is to be expected of them.

There is, however, some amount of consistency to be observed in the conduct of Local Authorities with regard to gas legislation. There are now over ninety authorities who possess gas undertakings, and have special Acts relating to them; and it is, at this moment, of the greatest interest to remark that, of all these Acts, only two contain purity clauses. All the large Corporations in the kingdom, possessing gas undertakings, already enjoy the exemption desired by the Metropolitan Authorities. It is only Gas Companies who have been submitted, and in most cases voluntarily, to restrictions as to the amount of sulphur and ammonia, which were imposed by the Metropolis Gas Act, 1860. But it is well known that the restriction, as far as regards sulphur, is extremely difficult to comply with, and everywhere practically the purity clauses remain in abeyance. Their continuation in Metropolitan Gas Legislation would be an absurdity, for it would be found impossible to obtain a conviction for any casual infringement of the Referees regulations, while, the restrictions being removed, the Companies would continue to purify gas exactly as they do now.

It will be seen, by the Parliamentary papers, the Committee of Selection have arranged the several Gas Bills in groups for the House of Commons, and now it remains for the House to nominate the several Committees whose duty it will be to consider these measures. The fate of many might be safely predicted, when we know the constitution of the Committee who will sit upon them. But all the desire we have to make the acquaintance of the Speaker will not tempt us to vaticinate in any single case.

We do not feel it to be any part of our duty to furnish amusement for our readers, but the following extract from a "City" article, in a London daily, is too rich to be passed over. The "City Editor" is commenting on the fact that £100 worth of share capital in a Metropolitan Gas Company is now quoted at £220. He proceeds as follows:—

It is to be remembered that one element which has tended to raise the market price of these ordinary shares has been the frequent issue of new shares, offered to existing shareholders at prices much below the market value, which shares—such is the elasticity of gas—proved, against ordinary rules, to be the source of wonderful profit to the applicants. Very naturally, these issues have been criticized as a manifest evasion of the law governing gas undertakings, which law fixes, with a quaint and curious involution of legislative absurdity, the dividend to be paid to the shareholders at a maximum of 10 per cent. It was early pointed out by the critics of this wonderful legal enactment that the directors of a gas company, so soon as they reached a 10 per cent. limit, would have no further inducement to benefit the public, and every inducement, on the contrary, to create every possible berth—for sons, sons-in-law, brothers, brothers-in-law, uncles, uncles-in-law, nephews, nephews-in-law, cousins twenty times removed, and so forth—at the expense of the public. It is notorious that all this happened, and yet so gigantic were the profits of the legalized monopoly, that even cousinship failed to absorb them; and the poor directors—was ever so pitiable a case?—at their wit's end, were fain to bleed the apoplectic pockets of the companies, for the benefit of shareholders, in defiance of the law. Truly a mammoth exception to ordinary experience. Usually speaking, the shareholder is robbed, the law notwithstanding. It is reserved for that much maligned thing called Gas to flout the law and bless the shareholder.

It would seem clear that this wonderful "City Editor" has never become aware of the existence of the 58th section of the Companies Clauses Consolidation Act, 1845, which compels the distribution of new shares, when the old are at a premium, among existing shareholders. The broad charge of nepotism brought against the Directors of the Metropolitan Gas Companies, is eminently amusing. Perhaps no class of gentlemen are more free from the charge. What may be called the "prize" appointments in Gas Companies go to men of proved competency, and, for the rest, we believe that the third cousins of most of the Directors would regard with contempt the miserably paid posts their rich relations could offer them in a Gas Company. The concluding part of the above extract is not the least amusing part of it. The "City Editor," doubtless a member of the Stock Exchange, evidently considers it a grievance that the gas shareholder is not robbed, "the law notwithstanding." They manage things better on the Stock Exchange!

We print to-day a report of the half-yearly meeting of the Wakefield Gas Company, which presents for consideration a point of much interest. It has been mentioned before, more than once, in our columns, that the Directors intended to pay back dividends, and, for this purpose, to divide the reserve-fund. This, of course, was a perfectly legitimate transaction. But it would appear from the report we publish, that not only the reserve, but the depreciation and contingent funds also have been applied to the payment of this "backwardation" money. Now, in spite of the opinion of a very eminent member of the Bar, we are strongly disposed to question the legality of such an appropriation of the depreciation-fund. We know that the same thing has been done before, but always, we take it, with a certain consciousness of guilt. In the case of the Wakefield Company, it was manifestly bad policy to leave so small a balance of reserve; and if their Bill be opposed in Committee, we may expect that the recent distribution will provoke strong comments. The mistake, however, is one which the Directors will not have the opportunity of repeating, so it may be passed over.

We were in error last week when we stated that Messrs. Littlewood and Newbigging, of Manchester, had been appointed by the Corporation of Wigan to investigate the complaints of gas consumers. These gentlemen have been selected by a Committee of Consumers; but the selection has been acquiesced in by the Corporation, who have directed their gas manager, Mr. Hawkins, to afford every facility for a thorough investigation. The inquiry possesses considerable importance for our readers, seeing that complaints of the kind now made at Wigan are continually made all over the country. It will be a difficult and intricate business to trace out the causes of complaint, *material*, we may say, and moral; but the inquiry is placed in very competent hands, and we shall not pretend to forestall the results.

As will be seen by a report in another column, Mr. G. W. Stevenson has visited Exeter, on the part of the Corporation of that city, to make an examination of the works of the Gas Company, for which we may say the Company afforded him every facility. He found portions of the works in a state of dilapidation, and other parts excellent in construction and condition. That any parts of the works should have been allowed to fall out of good working condition is a thing greatly to be regretted. The reason is obvious enough. The cost of repairs comes out of revenue, and out of revenue also come dividends. So a starving and a stinting system goes on, with such a result as may, perhaps, follow in this case. Mr. Stevenson recommends that

the Corporation should at once acquire the undertaking, and put the works in perfect order, with money borrowed at four and a half per cent., rather than allow the Company to do so, with money raised at seven per cent. We notice with pleasure that Mr. Stevenson does justice to the present manager of the works, who has had charge of them for only fifteen months, and in this time has made important additions and alterations. That the works have not fallen into their present condition by any remissness on Mr. Stansfield's part we feel certain, but we make the following quotation from Mr. Stevenson's report, because it is a cap which will fit many Directors besides those of the Exeter Company, as well as the Gas Committees of not a few Local Authorities:—"It is not reasonably fair to give a person charge of a gas-work which 'has been starved and stinted in every essential particular, and 'which is totally inadequate for the duty required from it, and 'expect him to conduct it as though everything were of modern 'and approved construction, and of ample capacity.' Cries of 'Hear! hear!' seem to come to us, mostly from towns and cities in the North.

A very instructive discussion took place in the Town Council of Huddersfield at their last meeting, on a proposal of the Gas Committee to reduce the price of gas from 3s. 4d. to 3s. per 1000 feet. The reduction was opposed on the ground that it would lessen the gas profits, which could be applied in aid of the Borough Fund. On the other hand, it was contended that the profits went mainly to the relief of the richer ratepayers, who were not gas consumers, and an Alderman produced a list of fifteen gentlemen, who, he stated, "received, on account of the 'gas profits being added to the Borough Fund, a reduction in 'their rates equal to sevenpence in the pound." Now, the larger number of gas consumers in Huddersfield are cottagers, and the pertinent question was asked, Is it just and equitable to make these people pay rates for their richer neighbours? The advocates of dear gas brought forward other claims on the gas profits. The Corporation have a water undertaking, which is a heavy loss to them. Who so proper to make good the deficiency as the gas consumer? Markets are about to be built, which may be remunerative in a quarter of a century, but, in the meantime, will require constant repairs. Where is the money to come from? "Clearly from the gas profits," some in the council seem to say; "therefore, keep up the price." In the end, however, common sense and justice prevailed, and the reduction was made.

The question of the application of gas profits, and the price of gas, still attracts attention in Birmingham, and we notice a letter in the *Daily Gazette*, written to show that the Corporation are now charging a higher price than the Companies would have charged if they had continued in existence. The price of gas in Birmingham before the coal famine—that is, in the days of the Companies—was (to large consumers) 2s. 5d. per 1000. The price now charged by the Corporation is 2s. 11d.—an increase of sixpence per 1000. In opposition to this, the writer places the reduction made by the Chartered Company, which brings the price of gas threepence per 1000 lower than it was before the coal famine. "The plain truth is," says he, "that the gas consumer is paying much more—very 'much more—to the Corporation for his gas than he would 'have been paying to the Gas Companies if the supply had 'remained in their hands." This is, no doubt, quite true; still it would be incorrect to say that the town might not greatly benefit by the transfer, even when the just rights of gas consumers are fairly considered.

We publish to-day several reports of meetings of Provincial Companies, all illustrating the present prosperous state of the gas industry. Reductions of price are everywhere the order of the day; but, when these are considered, the claims of the reserve, which may, when hard times come again, prevent the necessity of raising the price, ought not to be overlooked. Now is the time to provide for a rainy day, as much in the interest of consumers as shareholders.

Water and Sanitary Notes.

WHEN noticing last week the proposal of the Metropolitan Board of Works to purchase the undertakings of the London Water Companies, we made no allusion to the price the Board would probably have to pay. Nor should we do so now, but that an extraordinary misconception has got abroad. The *Times* report of the meeting makes Mr. Lowman Taylor to say that the undertakings would probably cost £120,000,000 and the mis-statement was adopted in a leading article. The *Pall Mall Gazette* set itself seriously to work to show that the figure stated was highly improbable. We shall be much nearer the truth when we reckon that the value of the Water Companies, if the question of

purchase should be seriously entertained next year, would be found to be about twenty-five millions. It is, however, quite superfluous to go into figures now, for, doubtless, in the course of a short time, the Government will settle the question for some years to come. It is not that the amount of the purchase-money is appalling. That, when added to the present Metropolitan debt, would be insignificant when compared with the resources of the Metropolis. It is the want of an Authority enjoying public confidence, that stands in the way of the purchase of the Water Companies. When, as we said last year, such a body is constituted, the Water and the Gas Companies will probably disappear; at present, both are perfectly safe to retain possession of their property. The London Water Companies are exceedingly strong in parliamentary influence, and nothing but a very decided expression of public opinion will shake their position. At present, however, there is no such expression, and none, we venture to think, will be heard, while vestrydom rules and taxes.

It is with amusement, not unminged with disgust, that we read of such proceedings as the following. The Acton Local Board summoned a poor widow woman to show cause why a well in her occupation should not be closed. The woman said she had lived in the house thirty-seven years, and had brought up a family, and had never had any sickness. A doctor said he had analyzed the water of the well on two occasions, and found sewage in it, and he averred that it was dangerous to health. We are very sorry that it did not fall to our lot to cross-examine that doctor. The magistrate made an order for the well to be closed. This is a sample of the proceedings now being taken all over the country under the Public Health Act, and they are most tyrannical. In the absence of any evidence whatever that a water is harmful—for the speculative opinion of a doctor cannot be regarded as evidence—wells are being closed, and poor people are being put to expense and inconvenience. We know of several small country towns where every well in the place might be closed, if ammonia in the water justified their being shut up; and yet these towns are among the healthiest in the kingdom.

It is reported that the Local Government Board, acting on the report of Colonel Cox, have resolved to make a Provisional Order, constituting the towns and villages around Kingston (Surrey) into a united district, for drainage purposes. We do not yet know what places are to be included; but we have no hesitation in saying, that since the Local Authorities could not agree among themselves, it was time that the Central Authority stepped in with a scheme. It is possible that further complications will now arise; but we shall not refer to them until we have more information.

The Norwich Town Council have been indulging in the luxury of sewage farming, but have not found it pay, so they are now about to let their two farms, nearly 1000 acres in extent. The Council are reticent as to the loss incurred, but we may suppose it is something very considerable. At all events, their resolution to let the farms is to be commended. They are offered, however, on very short leases—one for eight, the other for five years, which will scarcely induce capitalists to make a venture.

The Improvement Commissioners of Tunbridge Wells have been beaten at a town's meeting called to sanction the promotion of the Water Bill we recently noticed, and no poll was demanded. The idea of the majority appeared to be that, at present, there was plenty of reservoir capacity, and plenty of water, and that all would be well if the water were only put into the reservoirs, one of which is empty, while a million gallons of water per day are running to waste. A resolution was, in the end, carried, to adjourn the meeting for a month, and, in the meantime, take the advice of an eminent engineer, with a view to save, if possible, the expenditure of £20,000, which the Bill proposes. This delay, we may take it, will be fatal to the progress of the Bill in this session.

HEYWOOD WATER-WORKS COMPANY.—At a special meeting of the Heywood Local Board, on the 22nd ult., a resolution was adopted to purchase the undertaking of the water-works company on the terms offered by the directors, viz.—To pay to the shareholders on their investments on Nos. 1, 4, and 5 shares $8\frac{1}{2}$ per cent., which will yearly increase until 1883, when the board will have to pay the shareholders in perpetuity 10 per cent.; on Nos. 2 and 3 shares $7\frac{1}{2}$ per cent. in perpetuity; and on No. 6 shares $\frac{1}{2}$ per cent., to rise to 10 per cent. in 1893, and for ever afterwards. Also to allow the directors to call up an additional £2 per share on No. 6 shares, which will make the shares £8 paid.

KING'S LYNN GAS COMPANY.—The half-yearly meeting was held on Friday, the 23rd of February—the chairman, Mr. J. D. Thew, presiding. It appeared from the statement of accounts that the profits for the past half year were £1398 3s. 11d. Of this sum the directors proposed to appropriate £880 for the payment of a dividend at the rate of $5\frac{1}{2}$ per cent. per annum, and carry forward £518. The chairman moved that the dividend be declared. The motion was seconded by Mr. Bagge, and passed. The retiring directors, Messrs. Thorley and Thew, were re-elected, and Mr. Cruso was re-elected auditor. The usual vote of thanks to the chairman and the directors closed the proceedings.

PROVISIONAL ORDERS FOR 1877.

THE following are the applications to the Local Government Board for Provisional Orders, under the Public Health Act, 1875. They all, of course, proceed from Local Authorities.

The *Atherton District Board Order* is to authorize the Board to acquire land, and to erect additional gas-works, and for that purpose to expend money they are already entitled to borrow.

The *District of Bishop Auckland Order* is applied for by the Bishop Auckland Local Board, to enable them to start a gas undertaking for the supply of their district. No borrowing power is asked for. The Board propose to supply gas of twelve-candle power, tested by Sugg's "London" Argand, No. 1, at a price not to exceed 6s. A testing-place, in accordance with the provisions of the Act of 1871, is to be erected before any gas is supplied. The Board will have power to apply to public purposes any surplus revenue, when the price of gas does not exceed 4s.

The *Silsden Gas Order* is to enable the Local Board to purchase gas in bulk, and to construct and maintain storage and distributing works for the supply of their district. Twelve-candle gas is proposed, with a maximum price of 6s.

The *Ynyscynhaiarn Local Board Order* is to confirm an agreement made between the Local Board of a district bearing that name, and the Directors of the Portmadoc Gas Company for the purchase of the undertaking of the latter, and to confer the usual statutory powers. The Order does not disclose the consideration. Gas of fourteen-candle power is proposed, and the price is not to exceed 7s. 6d. per 1000 feet. The Board seek power to raise £5000, either by borrowing a gross sum or issuing debenture stock. In either case the money is to be paid off by means of a sinking-fund within sixty years.

We have in the following group the applications for Provisional Orders made by Gas Companies to the Board of Trade, under the Gas and Water Works Facilities Act, 1870.

The *Abingdon Gas Order* is to confer statutory powers on the Abingdon Gaslight and Coke Company, Limited. The original capital of the Company is £10,000, and this Order will give power to raise a further £10,000, the dividend on which is limited as usual. Fourteen-candle gas is to be supplied, and the price is not to exceed 6s. 8d. per 1000. The Order provides that, if at any time required by the Urban Sanitary Authority of the borough of Abingdon, the Company shall sell their undertaking to the authority.

The *Brotton and Lofthouse Gaslight and Coke Company, Limited*, at present apparently without works, apply for an Order to empower them to construct such for the supply of the township of Brotton. The capital of the Company is not to exceed £15,000, without further authorization. Gas of fourteen-candle power is proposed, with the maximum price of seven shillings per 1000 feet.

The *Cranleigh Gas Order* will, when confirmed, confer statutory power on the Cranleigh (Surrey) Gas Company. The present capital is £4000, and this Order will give power to raise an additional sum to the same amount. The supply of twelve-candle gas is proposed, and the price is not to exceed 9s. per 1000 feet.

The *Guisborough Gas Order* is to confer powers on the Guisborough Gas Company. The share capital is not to exceed £15,000, without further authorization. Gas of fourteen-candle power is proposed, and the price is not to exceed 6s. Guisborough is in the North Riding of Yorkshire.

The *Horsham Gas Order* will, when confirmed, give statutory powers to the Horsham Gas Company for the supply of the parish of Horsham. The present capital of the Company is £15,000, and this Order will give power to raise additional to the like amount. Gas of fourteen-candle power is to be supplied, and the price is not to exceed 7s. 6d. per 1000 feet.

The *Ilkeston Gas Order* is to confer the usual power on the Ilkeston Gaslight and Coke Company. The present capital is £15,530, and the Order will authorize the raising of a like amount. Gas of fourteen-candle power is proposed, and the price is not to exceed 5s. per 1000 feet.

The *Mansfield Gas Order* is to authorize the Mansfield Gaslight Company to raise additional capital to the amount of £12,000, the dividend on which is limited as usual. Borrowing powers to the ordinary extent will be conferred.

The *Newcastle-under-Lyme Gas Order* is to enable the Newcastle-under-Lyme Gaslight Company to raise £6000 additional capital, and to borrow to the usual extent.

The *North Camp and District (Aldershot) Gas Order* is to confer powers on a Limited Company of that name. The original capital is £20,000, and power is granted to raise £10,000 additional. Gas of fifteen-candle power is proposed, and the price is not to exceed 7s. per 1000 feet.

The *Southbank and Normanby Gaslight and Coke Company* apply for an Order which will empower them to raise £40,000 additional capital, the dividend on which is limited to 6 or 7 per cent., according as it is issued in preference or ordinary shares. But a sliding scale is provided. The standard price of gas is to be 5s. 5d. per 1000 feet; and "for every penny, or part of a penny, charged in excess or in diminution of such standard price, in any year, the standard rates of dividend shall, for such year, be reduced or increased by one-quarter per cent. per annum."

The *Stafford Gas Order* is to authorize the Stafford Gas Company to raise additional capital to the amount of £15,000, and to borrow to the usual extent. The Order will make the supply of fourteen-candle gas compulsory in the future.

The *Wimborne Minster (Dorset) Gas and Coal Company*, with a capital of £5000, apply for an Order empowering them to raise additional capital to the like amount. Gas of fourteen-candle power is proposed, and the price is not to exceed 6s. 6d. per 1000 feet.

In order not to weary our readers, we have disposed of these Orders in the briefest possible way. It will be understood that in all cases the dividends on new capital will be limited as usual. Further, that the Gas-Works Clauses Act, 1871, is in every case necessarily incorporated, with all its consequences. A testing-place is everywhere to be established, certain pressures are to be maintained (if they can) by day and by night, and in all cases Companies and Local Authorities will have to pay interest on money received by way of deposit.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXXI.

MAIN-LAYING (*continued*).

The main-cutter made by Messrs. Lambert Brothers, of Walsail, is a useful tool, and answers the purpose of saving a pipe often when its destruction would be objectionable. By its use a cast-iron pipe can be cut clean through without risk of irregular fracture. The fig. 57 of this instrument is sufficiently intelligible without further description.

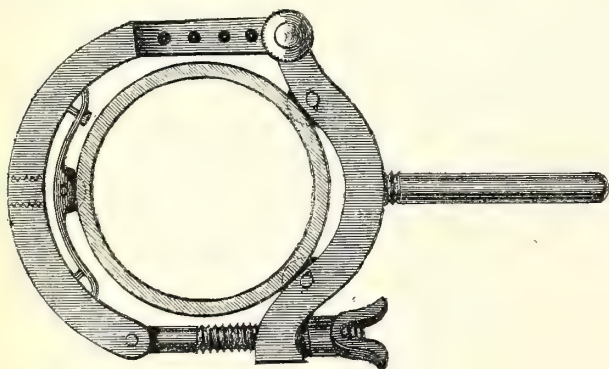


FIG. 57.

Obstructions in mains arise from a variety of causes—1. From defects in the laying. The proper fall may not have been maintained, and, in consequence, an accumulation of water, which should have drained into the syphon-wells, takes place in the slack portion of the line of mains. This is most likely to occur with small pipes laid in level ground. The inspection of each pipe when being jointed may have been neglected, and soil or stones may block the passage of the gas. We knew an instance of a stoppage in a main laid through a field, being caused by a rabbit that had entered the unplugged end of the pipe during the interval of the workmen being absent at a meal. 2. From subsidence in the ground causing the main to sag and fill with water. 3. From a deposit of naphthaline crystals.

The means necessary to be adopted for discovering the vicinity of a stoppage or obstruction are exceedingly simple. To an ordinary pressure-gauge is fitted a half-inch socket. In that portion of the main where the suspected obstacle occurs, a number of holes, to receive each a half-inch wrought-iron stand-pipe, are drilled at distances of, say, 100 feet apart. In the evening, when the consumption is at its maximum, the gauge is attached to each of the stand-pipes in succession, beginning with the first in the line of mains, and the pressure carefully noted in each instance. Should a sudden diminution in the indicated pressure appear at any pipe, as compared with the previous one, the obstruction exists between the two points; then, in order further to localize it, one or two more stand-pipes may be fixed at intervals less apart. The gauge is applied a second time, and between the points where the falling off occurs in the pressure the obstruction will be revealed on severing the pipe.

Deposits of naphthaline may be cleared out without severing the main, by adopting the method devised by Mr. George Anderson, and described by him in Vol. x., p. 817, of this JOURNAL. A pipe from a small portable steam-boiler is inserted through a one-inch hole drilled in the main, and the latter is steamed for several hours. The

boiler is then fed with a gallon or two of common naphtha, and the vapour coming in contact with the naphthaline crystals rapidly dissolves them, the liquid flowing to the nearest syphon, from which it is afterwards pumped. By allowing the liquid to settle, the naphtha, which will rise to the surface may be recovered, and used over again. A portable boiler convenient for the purpose is made by Messrs. C. and W. Walker, of Donnington.

The methods of testing mains for the discovery of leakages have been so recently discussed in this JOURNAL that it is unnecessary to rehearse them; we refer the reader to Vol. xxii., pp. 836 and 875; Vol. xxiii., pp. 245, 322, and 396; and Vol. xxiv., p. 229, for information on the subject. In the published "Treatise," the question will occupy our attention at length, and the best methods and appliances used for the purpose will be illustrated and explained.

In all well-regulated gas-works, a plan of the mains, drawn to a convenient scale, is kept. This should show the situation of all syphons, valves, and district governors. The sizes of the mains should be distinctly marked upon it, the points where a change in the size occurs, and all the places of intersection where branch connexions exist. The depth of the mains should be given, and their distance from the line of adjacent buildings, or other fixed datum.

A carefully-posted register of the above particulars should also be kept for reference, and in this the dates when the several mains were laid should be noted, the lengths of the various sizes, the class of joint, the cost of laying, and other memoranda. On this subject, a suggestive and useful paper was read by Mr. Warner, at the meeting of the British Association of Gas Managers in 1873, which may be perused with advantage.

In the course of our articles on main-pipes, one or two matters have been inadvertently omitted, on which a word is necessary and to these we will now take the opportunity of briefly referring.

In the turning and boring of pipe-joints, the use of gauges for ensuring accuracy in the workmanship is highly desirable. A useful form of gauge is represented in the figs. 58 and 59 for the spigot and

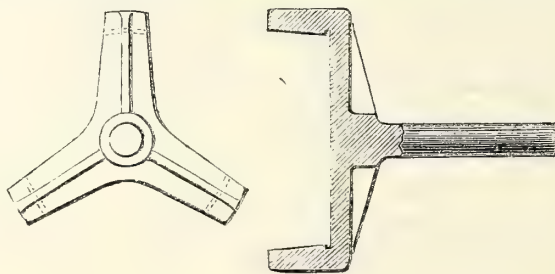


FIG. 58.

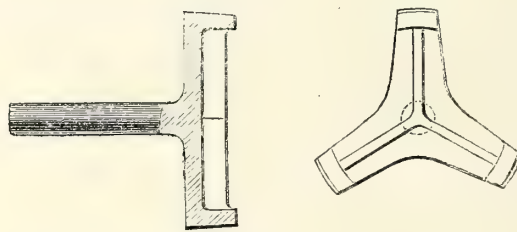


FIG. 59.

socket ends respectively. These should be supplied to the pipe-founder by the engineer, a duplicate set being retained, and every pipe should be rigidly gauged at the foundry before delivery.

In testing the soundness of pipes by hydrostatic pressure during warm weather, the water employed should be equal in temperature to that of the atmosphere. If cold water be used for the purpose, the vapour present in the atmosphere will be condensed on the surface of the metal, and pipes perfectly sound may appear faulty, and be rejected in consequence.

The ordinary length of cast-iron pipes is 9 feet. It is not unusual, however, to have them made 12 feet long. There is a manifest advantage in this, and we do not know of any sufficient reason why, for most sizes, the longer length should not be more generally adopted. The number of joints, and the expense of jointing, would thus be reduced about one-fourth. The difficulty of casting them would probably be slightly increased, and this may add to the cost; on the other hand, a proportionate saving would be effected in the extra thickness of metal required for the socket; but any slight difference in their cost would be counterbalanced by the advantages named.

(To be continued.)

DISCOVERY OF COAL NEAR DARLINGTON.—After sinking for upwards of three years at their new winning at Windlestone, about three-and-half miles from Ferryhill, the Messrs. Pease, of Darlington, have just succeeded in winning the Harvey seam under circumstances that are considered very encouraging. The seam has been found at a depth of 126 fathoms from the surface, and it presents some peculiarities that are not met with, so far as is yet known, in any other part of the county of Durham. The following is a section of the strata just passed through at Windlestone:—Coal, 1 foot 1 inch; metal band, 4 inches; coal, 2 feet 2 inches; seggar clay, 5 inches; coal, 6 inches; clay band, 6 inches; coal, 1 foot 4 inches. The total thickness of the seam is thus 6 feet 4 inches, but it is intermixed or interstratified with clay, seggar, and metal band to the extent of 15 inches, thus deteriorating its value very considerably.—*Newcastle Chronicle*.

Correspondence.

THE EVILS OF COMPETITION IN GAS SUPPLY.

SIR,—If you consider that the following letter, which I have written to a gas company to whom I am consulting engineer, would be of interest to the younger branches of the profession, who may not have had to struggle through the adversities to which it refers, but which some of us older ones have, it is at your service.

GEORGE ANDERSON.

35A, Great George Street, Westminster, S.W., Feb. 20, 1877.

Dear General,—Your inquiry of the 13th ultimo arriving while I was wintering in Italy, my assistant forwarded it to the Editor of the JOURNAL OF GAS LIGHTING, whose answer I herewith enclose. I confirm what he states, and add that the evil of competing gas companies supplying the same town with gas has happily been abandoned in England for something like 20 years. I have had some experience of competition in gas supply, and can state that it was the most erroneous in principle of any custom ever adopted by a community. It is a curious psychological fact that you clear-headed and Protectionist Americans should be floundering in the only Free Trade absurdity that we, a Free Trade nation, have long abandoned, as erroneous in principle and expensive and wasteful in practice.

When I commenced my career, this Metropolis, then of about three millions of people, was supplied with gas by about eight gas companies. They were far asunder, and at first each supplied the district near it, but gradually they ran their pipes into each other's districts, until, in the end, there was no important point of consumption where there were not the pipes of at least two companies.

During the time that this state of things existed, and although the price of gas was double what it is now, the average dividends of the companies were only about 6 per cent., while some of them who extended the principle in a more reckless manner than others were without any dividend, not only on their original capital, but also upon more than one class of preference stock.

For years the £100 original shares of one of the largest of our metropolitan companies could be had in any quantity at £2 to £3 each, and no buyers. When any of them were left as a legacy, it was considered next to a joke. About the year 1852 a crisis in their affairs arose, leading to an investigation, which proved that not 50 per cent. of the gas made was paid for. This was a more than usually bad state of things, but 25 per cent. leakage account was quite common; and when, in 1850, the Great Central Gas Company of London was before Parliament, opposed by two gas companies, one of the objections against it was that it only reckoned on 16 per cent. of its gas to be lost, whereas so small a leakage did not exist with any of the London companies.

The causes of this enormous loss were various. The companies officers had discretionary power to do a great many things which the directors were not supposed to know anything about; each inspector vied with another who would show the largest list of new consumers added for next board day. The efficiency of an inspector was measured by the number of consumers he could take from a neighbouring company. The more drunken, and what would now be considered worthless, an inspector was, the more successful he was in attacking the consumers of a neighbouring company. A sort of "secret service money" was allowed inspectors to accomplish their ends, so that they might "stand treat," and sums varying according to the stated number of lights were allowed, and no questions asked. Besides bribes, as thus stated, inspectors had a discretionary power, in the exercise of which they would give festivities external illuminations free, and these were often given to obtain or retain a customer. Inspectors would even disconnect the meter, and pass the gas without registration, so that the consumers account should be kept below what it had been from a former company, and thus prevent complaints in his district "coming before the board." In fact, the more cunning an inspector was in studying his own interests, while entirely ignoring the interests of the company, the higher he stood in the estimation of the directors, who were ignorant of, or winked at, what they only knew privately.

An inspector at that time was valued in proportion to the magnitude of his scoundrelism. Directors were afraid to part with such a man; if they cashiered him, he would "cheek them;" if they threatened, he would resign; if they accepted his resignation, they found him next day in the same district, but operating for the rival company. Of course, "what was sauce for the goose was also sauce for the gander." The companies reciprocally acted on the same lines; all were demoralized, from the directorate down to the meanest officer. Instead of their intellects being employed in discovering means of cheapening or improving the processes of their manufacture, they were wearied by their efforts at mutual destruction, in which they were entirely successful.

Besides these causes, others operated to increase the loss of gas.

When an escape of gas was known to exist, each company was adverse to opening the streets, as the cost of doing so would fall upon them, and the escape might be found not in their pipes; and it has happened in such a case that the ground has been filled in, and the escape left to continue. Of course, the public inconvenience was increased from the duplicate sets of main-pipes, and so was the expenditure of the gas companies in having to employ two capitals where one would have sufficed, and so was the leakage and condensation more than doubled by the duplicate pipes, and by the nefarious practices which the system led to.

After many years the companies came to see their mutual follies, and private arrangements began to arise, so that they would not canvass each others customers, nor take on a consumer unless he could show his receipt for payment of the last term; but the companies found that they could not depend on the honesty of each other, and frequent bickerings arose.

By-and-bye, in 1852-3, the company on which I was employed proposed to two companies, with whom it competed, that a line should be drawn on the map by which each would supply the district nearest to it, and buy up the pipes of the other lying within it. This was accomplished. The principle extended, other companies did the same, and now, for some fifteen years, competition in the sale of gas has become extinct in this Metropolis. The effect on the companies has been that within a few years the leakage was reduced from 25 to 10 per cent., and the dividends gradually reached 10 per cent., at which they remain, being the maximum allowed in this country.

The price of gas, too, has been reduced several times, until now it is 50 per cent. less in price than it was when dividends were from nothing up to 6 per cent., although, in the meantime, wages and the price of materials have risen 20 to 40 per cent.

While competition existed, the shares of several companies were at a discount, and very few much above par.

Since competition has been abolished, the value of the shares has rapidly risen, until now all are at double their nominal value. The company, whose £100 shares could not be sold at £3, have now for years sold at £200, and the last quotation I find to be £215 to £218.

Such is the history of competition in the sale of gas in London; its history in the provincial towns has been similar, and in almost every case it has gone through these phases:—

1. Loss to both companies, by which the gas consumers benefited for a short time in cheap gas, sometimes sold below its actual cost, exclusive of any interest on capital.

2. Amalgamation of the two companies into one, and price of gas again raised, even in districts where the new company has revelled in the popular cognomen of "Gas Consumers Company," for in all the instances which I have known, and in several of which I have been personally engaged, while many consumers have taken shares, they have never done so in anything like an adequate quantity to float the concern; and therefore, in every instance, recourse has been had to capitalists, and often to payment of contractors in shares of the company instead of cash, with the knowledge that the work was being paid for at 30 to 40 per cent. more than it could have been had for if the company could have paid by a cheque on its bankers.

In the early stage, too, of such companies, very little dividend is earned. The consumers begin to think—"Now I have got cheap gas I will sell my shares; I could make more by the money in my own business." Hence the shares pass into other hands, and it is a "Gas Consumers Company" only in name.

The capitalists naturally want a better return on their investment. The directors are of that class; they are tired of competition—they find it does not pay; they find that there was "more cry than wool" in the agitation that called them into office; they feel that they have been left without that support which they were promised and expected. They meet their rival directors on some common platform, wise notions are exchanged, amalgamation is first whispered, to be scouted by the hot-headed; but as time moves on it gets to speak louder; as the ardour of the hot-headed cools, it begins to speak in an official form. The boards meet, and the gas consumers awaken to the fact that they are again in the hands of one company, who, from its increased capital, finds it necessary to raise the price of gas.

Parliament now, after much experience, understands the course competition in gas must run, and for several years past has discouraged it; but the amalgamation of gas companies, even where there has been no competition, it has encouraged, and encourages more every year.

I may also state that I have never known a gas agitation succeed in forming competing works where the existing company has acted in anything like a fair manner to its consumers, and I have also found that bad gas or insufficient supply tends quite as much to foster agitation as high price does.

Moreover, I have never known an agitation result in the formation of a new company where there was not sufficient cause for it.

Agitations will sometimes arise without any just cause; local politics sometimes divide people, and needy and unprincipled adventurers sometimes have sufficient power to throw the apple of discord into a community by fallacious and unprovable assertions; but if a company that is in error mend its ways, such agitations invariably fail, and the gas companies as invariably profit by them. If the gas has been bad, or of insufficient quantity, or too high in price, the employment of efficient apparatus cures the first evil, and reduction in the price always increases the consumption, and (without any exception, in my experience), increases the profits even upon the larger capital required, and if such increased capital can be obtained from gas consumers, it produces a healthy effect. It has frequently occurred in this country, and I fancy it may occur oftener with you, that the very success of a company keeps it in difficulties, the business increasing faster than it can be met, for it is only in the summer months that enlargements of a gas-work can take place.

In such cases unusual vigour in a broad-minded sense is necessary, and even now works on another site, if possible, well removed from the existing ones, should be undertaken, and if the public see that a gas company is making exertions to meet its wants, it seldom goes out of its usual paths to foster novelties out of its line, and about which there is always a very considerable amount of risk. My experience is that man never does things in a new way until the old one has become more or less intolerable, and gas companies have only to look ahead to be tolerably comfortable. In my career I have had several agitations, but I have always crushed them by merely doing my duty, and the doing so has put money in my pocket.

Trusting you will manage to soon see sunshine through the present threatening cloud, and that you and your citizens will avoid the blunders of us Old World people.—I am, dear General, yours, &c.,

GEORGE ANDERSON.

QUANTITY OF BRICKWORK IN RETORT-SETTINGS.

SIR,—Mr. Cathels is not competent to discuss the practice of continental engineers in respect to retort-settings, for, by his own admission, he has never been on the Continent, and, as he says "the proof of the pudding is in the eating of it," he cannot know anything at all about it. He is, besides, so imbued with last century ideas as, in this year of grace 1877, and in this age of international exhibitions, to term our continental neighbours "frog-eating moosoes and dirthy furriners!" As a means of dispelling both the ignorance and prejudice from the mind of Mr. Cathels, I would refer him to your number of the 30th of January for a good illustration of the right principle of retort-setting, by Herr Oechelhäuser, and to the results given by Mr. Conrad Voss; and I would also refer him to the "Traité d'Eclairage par le Gaz," by Dr. Schilling, for further illustrations of this system of retort-setting. His last communication to your Journal is hardly creditable to the Scottish origin of which Mr. Cathels delights to boast.

G. E. S.

INTERNAL GAS-FITTINGS.

SIR,—In your "Circular" of the 20th ult., reference is made to the above subject, and you pointed out how important it is to companies supplying gas to have the control of the pipes up to the point of consumption. Some two or three years ago, I induced my committee to pass the regulations, a copy of which I enclose by this post, and which, if you think worth while, you can print along with this letter. I have to thank your JOURNAL and Mr. Newbigging for the figures contained in the table, which I have adopted, and carried out satisfactorily. At the commencement, and even yet, I find difficulty in getting the plumbers to give us the necessary notice to inspect the pipes before covering up; but my meter inspector, to whom I give instructions to examine every new house, or any alterations that may be seen going on, immediately reports any breach of the regulations. I then at once write to both the plumber and the owner, and I generally find them willing to comply with our requirements, when dealt with courteously (for we have no power by Act to compel them). I am only sorry that I did not put these regulations into operation many years ago; it was the fear of extra trouble

and the opposition of the plumbers that deterred me from doing so earlier. You will notice that no $\frac{1}{4}$ -inch pipe is allowed to be used. Since putting the rules in force we have had from 200 to 300 houses fitted, and in no case have I had a complaint from a consumer, of bad gas. I have, this week, had to examine houses side by side, and found that in one case, where the new pipes are in use, a good supply of gas could be obtained all over the house with one-inch pressure, and in the other, with old fitted pipes (only less, and some $\frac{1}{4}$ -inch), they could not get sufficient gas at the back of the house with $\frac{1}{2}$ -inch pressure.

If these remarks contribute anything worth notice, my object in writing will be attained.

Gas-Works, Blackpool, Feb. 24, 1877.

JOHN CHEW.

[ENCLOSURE.]
BLACKPOOL CORPORATION GAS-WORKS.
General Instructions to Authorized Gas-Fitters.

The Gas Committee will in all cases lay on the service-pipe, conveying the same through the outer wall of the premises to be supplied with gas, and will attach the service cock and meter to same, for which a reasonable charge will be made, according to the distance of the property from the main.

The following are the sizes of meters, and the maximum number of ordinary lights to be supplied through each:—

Size of Meter.	Greatest No. of Burners.	Size of Meter.	Greatest No. of Burners.
2	4	50	80
3	8	80	130
5	12	100	180
10	20	150	250
20	40	200	350
30	50		

The following are the sizes and lengths of iron, lead, or composition tubes to be used in the premises, according to the number of burners:—

Internal Diameter of Tube. Inch.	Greatest Length Allowed. Feet.	Greatest No. of Burners.
2	20	3
3	30	6
4	40	12
5	50	20
1	70	35
1½	100	60
1½	150	100
2	200	200

On the completion of the work of fitting, and before the piping is covered up, notice thereof must be given in writing to the gas manager, who will cause an inspection to be made of the work, and if found in accordance with the regulations herein contained, it will be passed by the committee, and gas laid on. After fixing, the meter is not allowed to be moved or disconnected, without notice being previously given in writing at the gas office.

If the regulations are not conformed to in every respect, the committee reserve the right to refuse a supply of gas until the necessary alterations are made.

Gas-fitters complying with these regulations will have their names registered on the committee's list of approved fitters, and they are at liberty to designate themselves "Authorized Gas-Fitters."

By order,
Gas Office, June, 1874. JOHN CHEW, Manager.

Parliamentary Intelligence.

HOUSE OF LORDS.
MONDAY, FEB. 26, 1877.

The Lowestoft Water, Gas, and Market, and the North-East Worcestershire Water Bills were read a second time.

Petitions in favour of dispensing with the Standing Orders in the case of the Bromsgrove, Droitwich, and Redditch Water Bill were presented from (1) Local Board of Bromsgrove, (2) Corporation of Droitwich, (3) Local Board of Health of Redditch, (4) John Corbett, M.P., (5) Owners, &c., of land in the line of the works and within proposed limits of supply, (6) Inhabitants of Redditch; and against dispensing with the Standing Orders from (1) The Earl of Shrewsbury and Talbot, (2) R. Paul Amphlett and others, (3) Richard Hemming and others.

Petitions were presented against the Blackburn Borough Gas, Water, and Extension Bill from (1) Owners, &c., of property in Livesey, (2) Sir William Henry Fielden, Bart, (3) John Towneley; and against the North-East Worcestershire Water Bill from the Earl of Shrewsbury and Talbot.

TUESDAY, FEB. 27.

The Londonderry Gas Bill was read a second time.

The following report from the Standing Orders Committee was agreed to:—"That the Standing Orders not complied with in respect of the Bromsgrove, Droitwich, and Redditch Water Bill ought not to be dispensed with."

A petition in favour of dispensing with the Standing Orders in the case of the North-East Worcestershire Water Bill was presented from the Local Board and Town Commissioners of Bromsgrove.

THURSDAY, MARCH 1.

The Blackburn Borough Gas, Water, and Extension Bill was committed.

HOUSE OF COMMONS.
MONDAY, FEB. 26, 1877.

The following Bills were read a second time, and committed:—Alliance and Dublin Consumers Gas (Bray Supply); Ashton-under-Lyne Gas; Bishop Auckland District Gas; Carshalton Gas; Christchurch Gas; Coatbridge Gas; Croydon Commercial Gas; Falmouth Water; Leicester Gas; Louth Gas; Ramsgate Water; Stretford Gas; Thanet Gas; West Surrey Water.

Examiners report presented:—"That the further Standing Orders applicable to the Newcastle and Gateshead Water, and the United General Gas Company (Limerick) Bills have been complied with."

TUESDAY, FEB. 27.

The Kent Water, the Wakefield Gas, and the Warrington Corporation Gas Bills were read a second time, and committed.

Mr. Cawley's motion in reference to Private Bill Legislation was deferred to Tuesday, the 27th inst.

THURSDAY, MARCH 1.

Examiners report presented:—"That the further Standing Order has been complied with in the case of the Southend Gas Bill."

FRIDAY, MARCH 2.

The following resolution reported from the Standing Orders Committee was agreed to:—"That in the case of the Bolton Improvement Bill, petition for additional provision, the Standing Orders ought to be dispensed with; that the parties be permitted to introduce their additional provision accordingly, if the committee on the Bill shall think fit."

A requisition to withdraw their petition against the West Surrey Water Bill was presented from Staines Local Board.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.
SATURDAY, MARCH 3.
(Before Vice-Chancellor BACON.)
In re THE NEW GAS COMPANY, LIMITED.

This was a petition to wind up the company, and it raised the question whether a company formed for the purpose of working patents for the manufacture of gas could not be wound up on shareholders petition when the patents it was formed to work had (as was stated in the petition) turned out failures, and been, in fact, disused. Two patents, the inventions of Mr. Ruck—one for obtaining illuminating gas by driving atmospheric air through petroleum, the other for the manufacture of pure hydrogen by the decomposition of water, and then giving light to the flame by passing the gas through petroleum spirit—had been purchased by a Mr. Eekersley for £12,000, and in 1873 the company was formed, of which that person, Mr. Albert Grant, and others, were promoters, for taking over the patents from Mr. Eekersley, at the price of £125,000, the difference between the two prices having, as was alleged, been divided among the promoters.

MR. KAY, Q.C., SIR H. M. JACKSON, Q.C., MR. SWANSTON, Q.C., MR. HEMMING, Q.C., MR. DICKINSON, MR. MACNAGHTEN, and MR. GROSVENOR WOODS appeared for the different parties.

The opening speech of counsel for the petitioner was only just concluded when the Court rose, and the matter stood adjourned to Saturday next.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

Major Bolton reports that the state of the water in the Thames and Lea was very bad during the month of January, the water taken in being very muddy and turbid, consequent upon the heavy rains and floods. From an examination of the river books kept at the intakes from the Thames, it appears that this is the worst flood on record, being (at its worst, on the 11th of Jan.) 14 inches higher than that of November 18th, 1875, which was then the highest since the establishment of water-works at Hampton. The water in the river Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was very turbid and coloured during the whole of the month of January. The highest flood state of the river was 8 feet 2 inches above the (6 feet) summer level, and the lowest was 2 feet 5 inches above summer level. The highest temperature of the water taken at Seething Wells was 48°, and the lowest 39°, while the highest temperature of the air at the same place was 54°, and the lowest 31°. The condition of the water in this part of the river was also very bad throughout the month. The highest flood state was 10 feet 2 inches above, and the lowest 3 feet 8 inches above summer level. These observations were made daily at 9 a.m. The rainfall for the month was 4.72 inches.

RICHMOND (SURREY) WATER SUPPLY.—At the meeting of the Richmond Select Vestry, on Tuesday, the 20th ult., the Water Committee presented a report, in which, after reciting at length the steps which had been taken for the supply of the town, they stated that all the vestry's mains comprised in the contract, besides mains in other streets formed since the works were designed in 1873 (which mains extend over a distance of more than 14 miles), have been successfully laid; that the whole of 2200 connexions applied for by the parishioners to be made to their houses have been completed; and that the now average daily supply, owing to the partial removal a few days since of the obstruction in the bore of the artesian well in the Lower Road, exceeds 20 gallons per day per head of the population, and the committee are assured by the engineers that the expectations originally held out as to the yield of water from this source will shortly be fully realized. The committee concluded their report by expressing their deep regret at having to call the most serious attention of the vestry to the excessive waste of water which is constantly taking place, owing to the very faulty state of the fittings in the cisterns of many of the inhabitants. As an instance they mention that by the report made by the inspector on the previous Friday, it appeared that out of 90 houses inspected by him in two days, there were 26 instances of water running to waste to so great an extent, that the water wasted would have been more than sufficient to supply 90 additional houses; and by his report presented on the 19th ult., a still greater waste was shown to exist. To this cause the committee attribute any complaints of want of water supply.

FLOODS IN THE THAMES.—In return to an order of the House of Commons, the Conservators of the River Thames have made a report on the works in the upper district of the river, and on the floods in the Thames Valley. The question, they say, arises, Are these unusual floods sufficiently frequent, and is the damage caused by them so great as to make it advisable for the riparian landowners and occupiers, on whom the charge must necessarily fall, to incur a very large outlay with a view to prevent the extension or to mitigate the effect of such floods? "It is to be hoped," they say, "that no amount of temporary inconvenience or damage will induce the Legislature hastily to authorize the construction of impounding reservoirs, or carrying out other schemes on a large scale, which are certain to be extremely costly, and may not prove effectual remedies. The riparian landowners and occupiers should carefully consider whether the execution of the extensive works suggested by various persons may not entail a far heavier burden than any damage caused by these temporary and rarely recurring floods. If excessive floods are to be dealt with, a searching preliminary inquiry should be instituted, for it is manifest that large powers and ample funds, only to be obtained by an Act of Parliament, must be provided, if all the low-lying lands in the Thames Valley are to be secured against every possible inundation. . . . It may be desirable to add a few remarks with respect to the tidal portion of the Thames. Careful observations are being made with reference to the level of the water. Until the land waters have run off, and until the river has returned to its normal condition, no very accurate or trustworthy comparison can be made with former surveys. So far as the recent observations go, they prove that the flooding of the low-lying districts of the Metropolis is chiefly due to the very high tides common to the Thames and to other ports and harbours on the coast, and not to the embankments or other local causes to which this flooding has been attributed."

BARNET DISTRICT GAS AND WATER COMPANY.

The Ordinary General Half-Yearly Meeting was held at the Guildhall Tavern, Gresham Street, London, on Tuesday, the 27th inst.—J. F. BONTOMS, Esq., in the chair.

The SECRETARY (Mr. Alfred Lass) read the notice convening the meeting, and the following report, with the statements of accounts, was presented:—

The directors beg to submit to the proprietors the accounts of the company for the half year ending the 31st day of December last.

The annexed accounts show the financial position of the company. The balance of the profit and loss account amounts to £1963 19s. 2d., out of which the directors recommend the declaration of a dividend for the half year at the rate of 4½ per cent. per annum on the A stock and share, and 3½ per cent. per annum on the B stock.

The gas-rental during the half year has amounted to £3828 12s. 8d., showing an increase on the corresponding period of 1875 of £329 15s. 1d. The water-rental for the half year has amounted to £1826 9s. 9d., showing an increase on the corresponding period of 1875 of £225 19s. 3d.

The sinking of the new well and the erection of the duplicate machinery will, it is hoped, be completed early in the summer of the present year.

The gas and water mains are still being considerably enlarged. A new gasholder will, it is contemplated, be erected in the course of the ensuing year, and other improvements effected.

The retiring directors are James Glaisher, Esq., F.R.S., and William Joslin, Esq., who, being eligible, offer themselves for re-election.

The retiring auditor is J. J. H. Gibbins, Esq., who, being eligible, offers himself for re-election.

The dividend, if sanctioned, will be payable on the 15th day of March next.

Dr. Gas—Revenue Account, for the Half Year ending Dec. 31, 1876. Cr.

Manufacture of gas—		Sale of gas—	
Coals	£1,583 18 8	Private rental	£3,542 1 5
Purifying	40 7 0	Public lighting	286 11 3
Wages	247 13 6	Rental of meters	93 5 3
Repair and maintenance, works and plant	70 19 1	Residual products—	
Salaries of engineer, &c.	83 6 8	Coke	626 15 10
Distribution of gas—		Breeze	28 3 0
Salaries, inspector and clerks	104 9 7	Tar	176 19 2
Repair and maintenance, mains and services	40 11 3	Liquor	4 19 10
Repairing and renewing meters	55 3 3	Rent account	27 9 6
Public lamps—		Miscellaneous receipts	2 6 9
Lighting and repairing	77 9 10		
Rent, rates, and taxes—			
Rent	2 12 4		
Rates and taxes	65 15 1		
Management—			
Directors allowances	100 0 0		
Salaries, secretary and accountant	66 13 4		
Collectors commission	55 7 7		
Stationery and printing	53 6 5		
General establishment charges	84 0 11		
Auditors fees	2 12 6		
Law charges	25 11 0		
Bad debts	33 12 2		
	£2,797 10 2		
Balance to profit and loss account, net revenue	1,991 1 10		
	£4,788 12 0		£4,788 12 0

Water—Revenue Account.

Coals	£431 2 11	Sale of water	£1,826 9 9
Wages	172 18 11	Rents	18 7 6
Repair and maintenance, works and plant	150 10 5		
Salaries, inspector and clerks	20 8 4		
Repair and maintenance, mains and services	41 3 10		
Salaries of engineers, &c.	41 13 4		
Rent	20 16 8		
Rates and taxes	32 17 6		
Directors allowances	50 0 0		
Salaries, secretary, accountant, &c.	33 6 8		
Collector's commission	27 13 9		
Stationery and printing	26 13 2		
General establishment charges	42 0 0		
Auditors fees	1 6 3		
Law charges	17 0 0		
Bad debts	26 15 3		
	£1,136 7 0		
Balance to profit and loss account, net revenue	708 10 3		
	£1,844 17 3		£1,844 17 3

Profit and Loss Account, Net Revenue.

Dividend paid to shareholders for the half year ending June 30, 1876	£1,606 19 7	Balance brought from last account	£1,650 19 10
Interest on loans and mortgage bonds to Dec. 31, 1876	825 5 2	Revenue account, gas	1,991 1 10
Balance available for dividend for the half year ending Dec. 31, 1876	1,963 19 2	Revenue account, water	708 10 3
	£4,396 3 11	Fitting account	45 12 0
			£4,396 3 11

The CHAIRMAN said it now devolved upon him to move the adoption of the report, and he would do so in a very few words. The report itself explained so fully the present position of the company, that he would be only repeating what the shareholders present already knew, if he were to occupy their time by making a speech on the subject. There was just one thing he might mention, as it was not mentioned in the report, because it rather affected the current year than the past—viz., that the directors had been able to place £9700 of bonds at 5 per cent. instead of 6 per cent., which, of course, would be a saving of £97 per annum to the company. He might also state generally that they were now getting into smoother waters. He did not mean to assert that they were entirely clear of rocks, but he thought the difficulties they might yet have to encounter were not of so dangerous a character as some they had had to encounter, and from which they had happily escaped. Here and there they met with difficulties, but they were difficulties more easily overcome than some through which they had passed in bygone years. The dividend recommended by the board indicated that the company were progressing in the right direction, and he could only express a hope that they would continue to do so—perhaps not very rapidly, but sufficiently fast to satisfy the shareholders, looking to the nature of their district, and the drawbacks always associated with the supply of such a sparse population. Having made these few remarks, he thought it would be better to leave any further information to be elicited by questions, rather than to say over again what the meeting already knew.

Mr. J. GLAISHER, F.R.S. (deputy-chairman), seconded the motion with great pleasure, because the report, when compared with that presented at the corresponding period of last year, and more strongly still if compared with that of the year preceding, proved that the company were progressing in a satisfactory, though it might be, as the chairman observed, in a slow (perhaps, therefore, more certain) manner. He could assure the meeting that, in the past, every effort had been made to ensure the happy results exhibited in the report now submitted.

Mr. SPORNE remarked that although the business done by the company in the way of gas-making, during the last half year, had increased, the returns for residuals exhibited a falling off to the amount of £143. No doubt this could be easily explained, and it might be as well for the chairman to let the shareholders know the reason. With regard to the item of "general establishment charges," he repeated the remark he made last year, that the amount seemed very high, and he suggested that it would be well in future accounts to give more details respecting it. Looking at the balance-sheet, he thought the shareholders might congratulate themselves that the company were getting into a very much better position. He rejoiced that they were now sailing in smooth waters, and waters clear from rocks. The increase in the gas-rental for the half year was £273 over that of the corresponding period of 1875, but he found there had been rather more than half that amount absorbed in extra expenses. With the exception just named, he thought the report was most assuring and comforting, and gave promise of a future that was most encouraging.

Mr. GLAISHER, in reply to the first inquiry, said the explanation respecting the residuals was the continuance of mild weather during the winter. He had watched the growth of the coke stock in the company's yard with great fear, there being comparatively no demand for it of late. He was connected with other companies, and knew that this had been a matter of anxiety to them all. The circumstance was altogether beyond the control of the directors, but he was glad to say the Barnet Company were better off in this respect than some others. The mildness of the season had not only affected the sale of coke, but also the consumption of gas, except for lighting purposes.

The CHAIRMAN agreed with Mr. Sporne that it was highly desirable to keep down the general establishment expenses as close as possible; but there would always be such charges in connexion with a company like this. The items which went to make up the sum could not be introduced into the statement of accounts; but any shareholder could satisfy himself respecting them by calling at the office. In answer to a question from another shareholder, the chairman observed that about 1100 new shares had been taken up in all.

The motion was put and carried unanimously.

The chairman moved, in accordance with the recommendation in the report, that a dividend for the half year ending the 31st of December last be declared, at the rate of 4½ per cent. per annum on the A stock and shares, and at the rate of 3½ per cent. per annum on the B stock, free of income-tax, and that the same be payable on the 15th inst.

Mr. LARKIN seconded the motion, which was put and carried.

The retiring directors, Mr. Glaisher and Mr. Joslin, were re-elected.

Mr. GLAISHER, in returning thanks, said he had set himself the task and duty of realizing for his old shareholders that which he placed before them at the time of the amalgamation—viz., 6 per cent. on the A shares, and 5 per cent. on the B shares. No stone had been left unturned for the accomplishment of this purpose, which he still hoped for. The district was a fine one, but it required development, and this involved time and patience; but all that energy and care could contribute to the success of the undertaking of the company would be cheerfully given. The assurance that his efforts would be continued in their service would, he felt, be the best thanks he could give for the confidence reposed in him.

Mr. JOSLIN also returned thanks.

The retiring auditor, Mr. Gibbins, was re-elected, and on the motion of Mr. SPORNE, the sum of £300 was voted to the directors for their services; and a vote of thanks was also given to the board for their careful management of the company's affairs.

The CHAIRMAN having acknowledged the two votes,

A vote of thanks to the engineer, the secretary, and the other officers of the company, was then proposed and seconded.

Mr. GLAISHER, in supporting the motion, spoke in high terms of satisfaction respecting the services of the engineer.

The CHAIRMAN said the company owed much to the secretary for his great exactness and painstaking in every detail of his department, which made it quite a pleasure to the directors to work with him.

The motion having been cordially received and adopted,

The ENGINEER (Mr. T. H. Martin) said he was extremely obliged for the compliment paid to him, and could only assure the shareholders, in return, that his best services in the future, as in the past, would be cheerfully given to promote the interests of the company.

The SECRETARY (Mr. A. Lass), in returning thanks, took the opportunity of expressing the hope that if any shareholder desired information upon any matter within his department, he would call upon him at the office, with the conviction that every detail and explanation should be freely placed at his command. He would only add that he had striven hard to make the Barnet Company a success; and, although he was gratified to witness the degree of excellence to which they had attained, he felt that some years would yet be required to bring the capital into its right and proper relation with regard to revenue.

The proceedings then terminated.

REDHILL GAS COMPANY.

The Ordinary General Meeting was held at the Works of the Company, on Friday, the 16th inst., when the following report and statements of account were presented:—

Your directors have much pleasure in reporting to the shareholders on the affairs of the company during the past year, and again congratulate them upon the satisfactory state of the company's business and property.

A communication having been received early in the past year from the Corporation of Reigate, requesting this company to extend their mains to South Park, a conference was held between a committee of the council and a committee of your board, when terms were arranged and ultimately agreed on, which, whilst providing for the accommodation required by the public, afford a reasonable return to the company for the expenditure involved in the carrying out of the necessary works. The district was lighted with gas in September, and the result has so far proved satisfactory.

The works and plant of the company are in an efficient state, having been well maintained. Looking to the present extent of the business of the company, and to its rapid development, your directors considered it expedient to provide a duplicate engine and exhaust; these are now fixed, and your directors are satisfied they will prove a most valuable addition to your plant. The remaining retorts, alluded to in the last report, have been renewed, and every effort is being made to economize the manufacture and distribution of the gas, consistent with its purity and illuminating power, which is still maintained beyond the standard fixed by Act of Parliament.

The balance-sheet shows a net profit of £2758 15s. 7d., out of which the directors recommend that a dividend be declared on the paid-up capital of the company of 10 per cent., with a further dividend of 1 per cent. towards making up the deficiency on dividends declared in antecedent years below the statutory rate. An interim dividend of 4 per cent. was paid in September last, leaving 7 per cent. to be paid on the 1st of March next, and a balance of £215 19s. 7d. to be carried forward. The guarantee-fund now amounts to £1825 16s. 2d.

Looking to the present state of the coal market and other circumstances, and acting in accordance with the policy to which they have hitherto adhered—viz., to afford the greatest amount of public accommodation consistent with due regard to the shareholders, your directors now feel justified in reducing the price of gas in the parish of Reigate from 5s. 6d. to 5s. per 1000 cubic feet, such reduction to date from the 1st of January last; and they hope the more extended and general use of gas will justify them in making such reduction.

Your directors desire to call attention to the fact that gas may be advantageously and economically applied to cooking, heating, and many other purposes, and that the atmospheric gas-engine is being very largely used where a ready and expeditious means of obtaining motive power is desired for pumping, driving machinery, or other uses; it

may be started with full power in the course of five minutes, and is clean and economical. Mr. A. J. Waterlow being unable to attend the meeting of the board with regularity, placed his resignation in the hands of your directors, who thereupon appointed Mr. Robert Field to fill the vacancy, and that gentleman is now rendering efficient and valuable assistance to the board.

The directors who retire by rotation are Mr. John Lees, Dr. G. W. Grabham, and Mr. Henry Stenning, who, being eligible, offer themselves for re-election.

Dr.	Revenue Account.	Cr.
Balance from last account.	£1468 18 0	Stock on hand, Dec. 31, 1875. £353 11 2
Less dividends paid.	1386 7 3	Coals 2589 3 7
		Lime 114 4 0
	£82 10 9	Salaries 300 0 0
Gas supplied	5676 9 9	Renewals 268 3 3
Coke, tar, lime, &c.	1240 11 4	Wages and petty expenses 512 6 10
Services	104 3 7	Tubes, fittings, &c. 73 2 10
Transfer fees	1 7 6	Rates and taxes 129 13 3
Interest on deposit	8 4 4	Stationery 32 2 7
Old materials sold	5 4 4	Auditors fees 16 16 0
Stock on hand—		Directors remuneration 150 0 0
Coals	410 1 3	Interest on debentures 61 17 1
Coke	72 0 0	Bad debts 13 7 6
Fittings	33 18 4	Amounts written off—
		Meters, mains, &c. 261 7 6
		Balance 2758 15 7
	£7634 11 2	£7634 11 2
Capital Account.		
4500 shares, £5 each, fully paid up	£22,500 0 0	Freehold land £371 10 0
200 ditto, £3 each, called up	600 0 0	Works and buildings 22,130 18 6
Amount paid in anticipation of calls	36 0 0	Meters and miscellaneous effects 998 7 4
Debtenture capital	1,250 0 0	Office furniture 70 0 0
	£24,386 0 0	Balance unexpended 815 4 2
		£24,386 0 0

READING GAS COMPANY.

The Half-Yearly Meeting of Shareholders was held yesterday, at which the following report of the directors was submitted:—

The directors, in presenting to the shareholders the statement of accounts and balance-sheet for the half year ending Dec. 31, 1876, have the pleasure to recommend that full dividends be paid on the 1st of March next on all the stocks and shares of the company, in accordance with the scheme set out in dividend account, and that the sum of £1000 be invested on account of reserve-fund.

The additions to the works and plant at King's Road Station, which were in progress at the time of the last report, have now been completed in accordance with the able plans, and under the superintendence of Mr. Baker, the company's engineer. The contractors have executed their various works in a satisfactory manner, and the new purifiers and other plant came into use in time for the increased make of gas consequent on the shortened daylight of winter.

Your directors were gratified to find that on offering for sale by auction the 400 shares required to meet the outlay on capital, they were eagerly purchased at prices higher than at any previous sale.

The ordinary business of the company has been conducted to the entire satisfaction of your directors.

The recent floods have proved troublesome in interfering with the reception of coals and the dispatch of tar and ammoniacal liquor, but the floods have now subsided without causing any serious loss or inconvenience to the company.

The directors retiring by rotation are Messrs. Blandy, Eisdell, and Player, and the retiring auditor, Mr. W. B. Williams. These gentlemen are eligible, and offer themselves for re-election.

Dr.	Profit and Loss Account, for the Half Year ending Dec. 31, 1876.	Cr.
Coals consumed	£6,112 17 5	Gas-rental £11,441 10 9
Purifying materials	103 5 7	Coke 1,937 7 1
Meters	221 17 6	Tar and ammoniacal liquor 1,226 19 4
Fittings	162 11 11	Rents of tenements 13 18 3
Materials	209 0 3	
Contingency-fund	371 13 4	
Wages	2,246 10 0	
Salaries, &c.	765 10 9	
Tradesmen's bills	225 1 0	
Rates, taxes, &c.	509 9 9	
Interest	242 13 11	
Bad debts and allowances	52 13 14	
Miscellaneous	156 8 5	
Balance	3,239 12 3	
	£14,619 5 5	£14,619 5 5
Balance-Sheet.		
Share capital paid up	£66,000 0 0	Cost of plant, &c. £82,033 17 9
Mortgage debt	11,000 0 0	Amount due for light 8,175 19 10
Premiums on shares	5,990 5 0	Coke 1,128 0 1
Debts due to sundries, viz.:—		Tar and ammoniacal liquor 312 2 5
Capital account	1,007 16 4	Fittings 72 8 9
Coal	1,968 8 11	Stock on hand—
Coke	15 19 0	Tar and ammoniacal liquor 466 14 11
Purifying materials	22 13 8	Purifying materials 175 0 0
Meters	9 1 0	Coals 2,214 13 10
Fittings	25 15 2	Coke 159 0 0
Wages	3 10 0	Meters 104 14 6
Materials	104 6 7	Fittings 115 0 0
Tradesmen's bills	62 5 3	Materials 780 0 0
Rates, taxes, &c.	519 2 7	Office furniture 40 0 0
Barge account	10 18 0	Petty cash in hand 120 0 0
Salaries, &c.	177 2 6	Balance, contingency-fund 117 16 7
Miscellaneous	63 16 1	Balance in banker's hands 1,791 2 8
Unclaimed dividends	74 14 1	Ditto, dividend account 30 9 1
Reserve-fund, £3500, and dividends accrued thereon, invested in £4331 7s. 5d., New Three per Cent. Stock		
Dividends received to be invested	64 3 2	
Balance brought from last account—dividend account (less carried to reserve-fund, 500)	7,477 10 10	
Profit and loss account	3,239 12 3	
	£97,837 0 5	£97,837 0 5

BRIGHTON GASLIGHT AND COKE COMPANY.

The Ordinary General Meeting of Proprietors was held at the Offices of the Company, St. Swithin's Lane, London, on Thursday, Feb. 22—Mr. JOHN MILES in the chair—when the following report and accounts were presented:—

The weather during a great portion of the past six months has in various ways been unfavourable to the business of the company. Not only have contrary winds delayed the ships ordinarily engaged in the company's service, and rendered extra vessels necessary, but others had to be substituted for several disabled by storms, making it very difficult to maintain that full stock of coal which experience has shown to be desirable. This, however, has been effected, but the coal has, from the excessive wet, often reached its destination in a state very unsuitable for immediate use. Main-laying and other works have also been interfered with by the rain.

There has been a considerable increase in the quantity of gas sold, but no improvement in the prices realized for coke.

The directors recommend the declaration of a dividend on the paid-up capital of the company of 5 per cent. for the half year ending the 25th of December last, less income-tax, the same to be payable on and after the 5th of March next. On the present occasion dividend has to be paid on £7500 additional capital called up since the corresponding period of the previous year.

Two of the directors, Mr. Weiss and Mr. Wilbraham, and one of the auditors, Mr. Forrest, retire by rotation, but all are eligible for immediate re-election.

Dr.	Profit and Loss Account, for the Half Year ending Dec. 25, 1876.	Cr.
Coals	£14,246 2 1	Gas and meter-rental £20,271 17 6
Materials for purification	351 8 0	Coke, &c. 5,167 18 9
Wages	2,325 19 4	Old stores, &c. 58 13 1
Rent, rates, and taxes	241 10 1	
Salaries, collectors commission, directors, & auditors	1,491 5 8	
General charges	140 7 5	
Wear and tear	1,550 8 3	
Bad and doubtful debts and allowances	50 0 0	
Balance	5,101 8 6	
	£25,498 9 4	£25,498 9 4

Balance-Sheet.		
Capital	£101,800 0 0	Expended on works £87,164 10 6
Amount received on account of call due 27th inst.	3,820 0 0	Meters 2,701 10 7
Contingency-fund	5,775 12 6	Works in progress 9,197 2 10
Depreciation account	1,977 3 11	Coal, coke, &c., in stock 7,268 1 6
Coal insurance account	1,725 7 1	Mains, service-pipes, and general stores in stock 4,944 0 9
Dividends unpaid	1,817 4 5	Sundry debtors for gas 14,072 15 8
Tradesmen's accounts, &c., owing	5,033 8 6	" " coke, &c. 2,356 10 1
Loan	5,529 15 6	Cash at bankers and in hand 5,112 7 0
Profit and loss balance—		
From last half year	236 18 6	
This half year, as above	5,101 8 6	
	£132,816 18 11	£132,816 18 11

The report and accounts were approved, and the dividend recommended by the directors declared.

The retiring directors and auditor were re-elected, and thanks voted to the board and to the auditors for their services in the past. It was also resolved that the best thanks of the meeting be given to Mr. Rutter, the manager, Mr. Liddall, the secretary, and the other officers of the company. The proceedings closed with a vote of thanks to the chairman.

SOUTH SHIELDS GAS COMPANY.

The Annual Meeting of Shareholders was held on the 26th ult.—Mr. R. WALLIS in the chair.

The SECRETARY (Mr. J. H. Penney) read the notice convening the meeting, and the following report was submitted:—

Your directors, in presenting the twentieth annual report of the company, with the balance-sheet and accounts, for the half year ending Dec. 31, 1876, have the satisfaction to assure you of the continued prosperity of the company.

A large sum has been expended upon the necessary repairs of the works during the past year, and they are now in a most efficient state of working order. The company have been able to meet an increased consumption of $3\frac{1}{4}$ million cubic feet of gas (as compared with the corresponding half year of 1875) without any difficulty, and the illuminating power has generally been greatly in excess of the requirements of our Act of Parliament.

Your directors recommend the payment of the usual dividends of $4\frac{1}{2}$ per cent. on the old and $3\frac{1}{2}$ per cent. on the new capital of the company, which will leave a balance of about £370 to be carried forward.

Your directors retire from office at this meeting, and all, with the exception of Mr. W. H. Fairbairn, offer themselves for re-election. Mr. Fairbairn having left the town, does not desire to be again placed on the board, but your directors cannot allow the occasion to pass without expressing their regret at the loss of his valuable services. Mr. Chapman is the retiring auditor, and he offers himself for re-election.

Dr.	Profit and Loss Account, for the Half Year ending Dec. 31, 1876.	Cr.
Balance brought from last account	£1,870 7 9	Stock of coals, coke, tar, &c. £1,058 18 9
Half year's gas-rent (net)	11,012 3 2	Coals and cartage 3,999 19 2
Ditto meter-rent (net)	543 3 1	Wages and superintendence 3,719 1 7
Sale of coke	1,283 19 0	Salaries 211 0 0
Ditto tar	531 17 8	Collectors commissions 114 8 9
Ditto ammonia	329 8 9	Rents 45 17 0
Transfer fees	0 17 6	Rates 317 13 10
Corporation, upholding public lamps, half season	206 0 0	Directors and auditors fees 113 8 0
Service charges, fixing meters, &c.	103 5 6	Lime 165 0 9
Stock of coals, coke, tar, iron, and sundries	1,356 8 8	Water 34 7 1
Rents from property at Jarrow	19 0 2	Retorts, bricks, &c. 236 0 8
		Service-pipes, gas-cocks, iron, steel, and tin goods 897 1 4
		Castings 124 9 3
		Cartage 210 13 1
		Paving 39 3 11
		Stationery, printing, and advertising 50 18 3
		Incidentals or miscellaneous 993 4 0
		Paints, oils, &c. 71 10 8
		Wear and tear—maintaining and relaying mains 798 13 0
		Interest on loan capital 393 18 3
		New meters 352 9 9
		Repaired meters 295 4 6
		Discounts 0 0 8
		£14,243 2 3
Balance to profit		3,013 9 0
	£17,256 11 3	£17,256 11 3

Balance-Sheet.		
Proprietors capital—		Plant, works, &c., as per last statement £61,855 18 6
A stock	£40,000 0 0	Extensions and relaying mains during half year 1,864 11 7
B "	20,000 0 0	Walker and Stainton, on account of new scrubbers 171 13 4
New "	3,910 0 0	
Loan capital, mortgages, and bonds	21,000 0 0	Revenue account, balance of profit 3,013 9 0
Sundry accounts owing for coals, lime, iron goods, &c.	2,276 19 8	Less wear and tear—maintaining and relaying mains, &c. 798 13 0
Deposits for gas	906 16 5	
Reserve-fund	6,091 1 3	£63,093 10 5
Dividend on £5811 15s. 3d., invested in 3 per cent. Consols	92 10 2	New works in progress at Jarrow 15,976 3 4
		Horses, carts, &c. £785 9 6
		Less profit 246 2 10
		539 6 8
		Ditto ammonia and acid 9 7 6
		Ditto coals, coke, tar, &c. 1,356 8 8
		Consumers gas accounts, inclusive of quarter due Dec. 31 8,571 16 0
		Sundry accounts owing for coke, tar, &c. 1,476 19 2
		Reserve-fund, invested in 3 per cent. Consols 5,811 15 3
		Balance with bankers 363 17 5
		Cash in hand 23 4 1
	£97,290 16 6	£97,290 16 6

The CHAIRMAN moved the adoption of the report. He thought the directors were right in recommending that the ordinary dividends allowed by their Act of Parliament be granted. The balance in hand was not a large

one; but still he thought they were sufficiently justified in recommending that the ordinary dividends be paid. On looking at the reports and balance-sheets for the past few years, the progress of the company had certainly been very extraordinary. Many gas companies throughout the kingdom had doubled themselves in the period of 10 years; but this company had done even more than that. In the year 1864 their capital was £31,600, and their rental was £6862; in the past year of 1876 their capital was £79,600, and their gas-rental was £22,891. When their works were reconstructed, they were intended to make 500,000 cubic feet of gas per day; but, with very slight alterations and improvements, they had during the last half year, sometimes, and not unfrequently, made one million cubic feet of gas per day. They could not have done this had they not had a new holder at Jarro. This showed the necessity there was for their proceeding with their Jarro works; and it was the more necessary, if they wished to progress in the future as they had done in the past 12 years. The Jarro works were quite late enough in being established. It was true they had not been pushed so vigorously forward during the past half year as they might have been, but this had been done for prudential reasons. Before, however, the shareholders met again, he hoped the Jarro works would be in full working order, and that they would be found to be such works as they might well be proud of. The increase in the consumption of gas of late had been very great, and amounted to 3½ million cubic feet, so that if they progressed in anything like the same ratio, their position would be most satisfactory. The directors that day resigned the trust reposed in them by the shareholders, and he could only say they would be glad to be re-elected. He regretted to state that they had lost from the directorate their valued friend, Mr. Fairbairn, who had retired therefrom, and it was only due he should take that opportunity of bearing testimony to his great value. The shareholders had lost a faithful servant, and the board an able and intelligent colleague. He had, previous to concluding, to announce a bold step which the directors had taken, and in doing so he really believed they had not remembered they were an expiring board, but, on the other hand, it might be that they were desirous of producing a large egg before their decay. They had all seen the immense manufacturing power the company had at their command, and he might inform them they had arranged for an exhibition for showing the appliances to which gas might be directed for other than lighting purposes. The exhibition was to take place in South Shields on the 9th, 10th, and 11th of April, and, in his opinion, it was fraught with great and important results, in which opinion he was borne out by the Editor of the JOURNAL OF GAS LIGHTING, a quotation from whose remarks he read. He considered the exhibition was a move in the right direction, and he had no doubt the directors, in the step they had taken, would be supported by the shareholders. There was no doubt there were many appliances to which gas might be directed besides that of lighting, and it was the desire of the directors to bring these under notice. Previous to resuming his seat, the chairman referred to one item in the balance-sheet under the head of "Incidentals or miscellaneous," amounting to £993 4s., and said that attention having been called to it by one of the auditors, it would in future be altered, so as to show the various items.

Mr. JOHN RIDLEY seconded the motion, which was put and carried unanimously.

Mr. W. ANDERSON moved that a dividend of 4½ per cent. upon the first stock, and a dividend of 3½ per cent. upon the second stock, be paid on the 6th of March next.

Mr. NELSON seconded the motion, which was carried.

Alderman GLOVER had much pleasure in moving a vote of thanks to the directors for their services during the past year. The balance-sheet of the company was highly satisfactory, and great credit was due to the directors for the same.

Mr. DUNCAN seconded the motion, and said he had no doubt that the confidence of the shareholders would be maintained that day by the re-election of the directors.

The proposition was cordially agreed to.

The CHAIRMAN returned thanks for himself and his brother directors, and stated that this was the 20th annual report issued by the company, and he might state that he had been connected with the company long before that period.

Mr. NELSON said that the increased prosperity of the company brought increased responsibility in the work of the secretary, and he had much pleasure in moving that the salary of Mr. Penney, the secretary, be increased from £250 to £300 per annum. Their late secretary received £300 per annum, and he thought Mr. Penney was entitled to an increase.

Mr. RIDLEY seconded the motion, and considered that Mr. Penney was justly entitled to an increase. He had gone over the accounts of the company, and found them all to be kept in an excellent manner. He also suggested that the newly-appointed directors should examine the salaries paid to the other clerks in the employment of the company, as they needed an increase of salary.

Mr. CHAPMAN supported the proposition, and said that as one of the auditors it had given him much pleasure to go over the accounts, as they were kept so well.

Mr. J. L. HALL also bore testimony to the abilities of the secretary.

The proposition was carried unanimously.

Mr. PENNEY said that since he was appointed secretary he had endeavoured to discharge his duties in a manner efficient and satisfactory to the company, and with this object in view he had spared neither time nor trouble. For the kindness shown to him that day he had to return his sincere thanks.

Upon the motion of Mr. J. ROBINSON, seconded by Mr. J. M. MOORE, a vote of thanks was awarded to the chairman for presiding.

The CHAIRMAN acknowledged the compliment, and the meeting concluded.

WOLVERHAMPTON GAS COMPANY.

The Half-Yearly Meeting was held on the 27th ult.—Mr. J. UNDERHILL in the chair.

The SECRETARY (Mr. A. Jones) read the following report of the directors:—

In presenting the fifth half-yearly report, it is the pleasing duty of your directors to lay before you the balance-sheet and general account, duly certified by your auditor, showing the revenue for the half year ending the 31st of December to be £26,285 10s. 11d., and the expenditure £19,259 12s. 5d., leaving a balance of £7025 18s. 6d. From this your directors recommend the payment of the usual 5 per cent. dividend upon the consolidated stock, and 3 per cent. (less income-tax) upon the paid-up capital of the preference shares, payable forthwith, if approved by the meeting. The balance left will enable your directors to replace a part of the sum previously taken from the reserve-fund, and carry forward a small balance to the current half year.

Since the last meeting your directors have to regret the loss, by death, of their esteemed vice-chairman, Mr. George Cox. The vacancy thus created in the directorship has been filled by the appointment of Mr. H. H. Fowler. They also inform you that Mr. R. Warner has been appointed a director in place of Mr. B. Savage, who died a few days before the meeting held in August last.

During the past half year considerable extensions and alterations have been going on at your works, which, when completed, will make them capable of supplying 50 per cent. more gas than has been required during the present season. A large quantity of the smaller mains have been taken up, and much larger ones laid in their places, but during the latter end of December the mains in some of the outer districts were found not to be large enough for the increased demands; these will be enlarged this summer.

At this meeting three of your directors retire by rotation—namely, Mr. Ironmonger,

Mr. Warner, and Mr. Fowler, but offer themselves for re-election. Your auditor, Mr. Benjamin Smith, also retires, but offers himself for re-election.

In conclusion, your directors beg to assure you they will still continue to devote their best attention to the interests you have confided to their care.

The CHAIRMAN congratulated the shareholders on the fact that the balance-sheet placed before them showed a larger profit on the operations of the company during the past half year than they had been able to make since the year 1873, or thereabouts, when they experienced the commencement of that extraordinary rise in the price of coal which tended so much to derange the various operations of the country, and none more so than those of gas companies, and of which he believed they had not yet seen the full results. The rise in the price of coal, of which they were necessarily such large consumers, was of that extraordinary character that it quite deranged all the calculations which the directors were in the habit of making with respect to the production of gas, and also with respect to the rates at which they could afford to supply their gas to the consumers. What they had to do under the peculiar circumstances which then arose, and which the directors hoped would only be temporary, was, in justice to their shareholders, to take care, as far as possible, to make such provision as would secure to the shareholders the amount of dividend to which they were entitled by Act of Parliament; but, at the same time, they also owed a duty to the general public, that the price of gas should be advanced as little as possible, consistent with their duty to the shareholders. The directors, after much consideration, came to the conclusion that the best course would be to trench rather freely upon their reserve-fund, so as to enable them to keep the price of gas as low as possible, and at the same time pay to their shareholders the dividends to which they were entitled. This policy they had consistently followed out during the last three or four years, and though at times the position of affairs looked rather cloudy, the directors had never once flinched from the course they first adopted, and now that matters were beginning to look more favourable, they hoped they would be able in a short time to place back to the reserve-fund the large amount they had been compelled to take from it. In confirmation of this he might state that, in order to keep down the price of gas during the period of the high price of coal, their reserve-fund had been diminished one-half the amount at which it stood before that extraordinary advance in the price of coal commenced. Referring to another subject, it might be in the recollection of the shareholders that some few years ago their mode of conducting the business of the company was not quite in accordance with the feelings of the corporate authorities of the town, and, owing to what he believed to be a misapprehension on the part of the authorities, some legal proceedings were commenced by them against the company. However, that was quite a thing of the past, and a good understanding now existed between the two bodies, and he should not have then referred to the matter except to call attention to an allegation that was made against the directors of the company at the time, to the effect that they were extending their operations considerably in advance of the public requirements of the town, and that by so doing they were acting prejudicially to the interests of the gas consumers. The directors, however, felt assured that they were not making a greater provision than the growing requirements of the town demanded, and the result had, he thought, more than justified the calculations upon which they then acted. Since the time to which he had referred, they had been compelled to increase their capital by £50,000 preference shares, £20,000 of which had been called up, and he did not think a long time would elapse before they would have to call up the remainder; for, although it was announced in the report that, when the arrangements they were now making were complete, they would then be able to supply 50 per cent. more gas to the town than they had done hitherto, yet he must say that, if the present extraordinary increase in the demand went on, only a few years would elapse before the directors would have to come and ask the authority of the shareholders to increase their capital still further, in order to provide for these additional requirements. It had always been the desire of the board, and he had no doubt would be so still, that whilst doing their best to promote the interests of the shareholders of the company, they should also consult the interests of the public at large, and, as far as possible, work harmoniously with the authorities of the town, and in accordance with their wishes. That had always been the view they had held, and hence it was that three of the vacancies that had occurred on the board of directors during the last few years had been filled by gentlemen connected with the corporation. The directors had nothing to conceal, and the position and ability of the gentlemen to whom he referred, and their connexion with the governing authority of the town, were in themselves guarantees to the public that any question that might arise at the board in which the public, as consumers of gas, were interested, would be sure to receive the fullest consideration and investigation. He concluded by moving the adoption of the report and statement of accounts.

Mr. OWEN seconded the motion.

The CHAIRMAN, in reply to Mr. H. LANGMAN, said that there were a number of 6 per cent. preference shares, some of which, for various reasons, were not taken up by the persons to whom they were allotted, and others that could not very well be allotted. The directors had not yet given any instructions as to how these shares should be disposed of; most probably when they did so it would be by public sale at the best possible price.

Mr. LANGMAN said, judging from the price that was given for some gas shares the other night, it would be advisable to have the shares sold at once.

The CHAIRMAN agreed with Mr. Langman that if as good a price could be secured for the shares as was paid for those sold on the occasion he referred to, it would be advisable to sell.

The motion for the adoption of the report was then put and carried.

The dividend recommended by the board was then declared, and the retiring directors and auditor re-elected.

Mr. FOWLER, as the junior director of the three last mentioned, returned thanks. He said he was much obliged to all present for the compliment they had paid him in first electing him—for that practically was his election—as a director of the company. He cordially approved of the remarks of the chairman with reference to the desirableness of the directors of the gas company working harmoniously with the corporation, who were their largest customers, and represented likewise the interests of the public at large, and he had no hesitation in saying that the harmonious feeling which had existed for so many years past between the gas company on the one hand and the corporation on the other was very largely due to the fact that the two senior directors of the company were also the two senior aldermen of the corporation. For his own part, he could only say that it would afford him great pleasure to co-operate with them in the management of their undertaking, and that he would do his best in helping to promote the interests both of the shareholders and of the consumers.

MESSRS. WARNER and IRONMONGER also briefly returned thanks for their election.

A vote of thanks having been cordially voted to the directors,

The CHAIRMAN acknowledged the compliment. In doing so, he said the directors were very largely indebted, in the conduct of the company, to the manager, and other officials connected with it; and he concluded by moving that the best thanks of the directors and shareholders be accorded to them for the energy and attention they gave to the discharge of their duties.

Mr. IRONMONGER, in seconding the motion, remarked that, although he was not so much acquainted with their secretary, Mr. Jones, as he was with Mr. Annan, he could say that Mr. Jones was most assiduous in his attention to his duties, and both for that and the ability and accuracy with which those duties were discharged, the directors very highly appreciated his services. With regard to Mr. Annan, he (Mr. Ironmonger) as a member of the Committee of Inspection, and therefore a good deal about the works, was better informed. Whatever information the directors required about the works, Mr. Annan was always ready to give it them, and to advise them for the best interest of the undertaking; indeed, the assistance he rendered them was invaluable, and the directors considered themselves very fortunate in having a gentleman of so much practical experience as their manager.

The motion having been put and carried, Mr. ANNAN acknowledged the vote on behalf of himself and colleagues, and the proceedings terminated.

WAKEFIELD GAS COMPANY.

The Sixtieth Half-Yearly Ordinary Meeting of Shareholders was held on Monday, the 19th ult.—Mr. W. STATTER in the chair.

The following statement of accounts was presented:—

Dr. Revenue Account, for the Half Year ending Dec. 31, 1876.			Cr.		
Coals and carting	£3,315	16 3	Gas, meter, and fittings rents	£8,404	4 1
Lime	216	1 0	Coke sold	1,076	13 11
Salaries and wages	2,034	11 0	Tar	1,020	18 10
Rates and taxes	122	4 5	Spent lime	61	9 5
Tradesmen's accounts	863	14 3	Ammoniacal liquor	565	10 9
Bankers interest and commis- sion	119	8 0	Rents of real estate	34	19 0
			Sundries, service-pipes, &c.	140	10 10
	£6,671	14 11	Interest on debentures	79	0 0
Balance, half year's profit	4,648	15 4	Registration fees	4	0 0
			Old metal	31	9 9
			Interest on delayed calls	1	13 8
				£11,420	10 3
			Deduct estimated losses	100	0 0
				£11,320	10 3
General Balance—Revenue Account.					
Coals	£967	13 4	Gas, meter, and fittings rents	£9,058	13 0
Lime	70	4 9	Coke accounts	1,222	6 0
Rates and taxes	119	13 0	Tar	449	7 3
Tradesmen's accounts	954	14 6	Ammoniacal liquor	483	9 9
Unpaid dividends	151	15 5	Sundries	72	16 9
Dividend to be declared	3,452	0 0	Rents of real estate	48	7 11
Due to the treasurer	3,139	12 0	Due from capital account	1,927	4 10
Balance	4,406	12 6			
	£13,262	5 6		£13,262	5 6
Capital Account.					
Amount expended to June 30, 1876	£80,919	0 0	1000 £25 shares	£25,000	0 0
Since expended to Dec. 31, 1876	2,213	4 4	3660 £5 shares	18,300	0 0
			7340 £5 shares, B 5ths. (Unpaid calls, £64.)	36,636	0 0
				£79,936	0 0
			Balance (unprovided capital)	3,196	4 4
				£83,132	4 4

The CHAIRMAN, in moving the adoption of the accounts, said the directors thought they had to put before the shareholders a very satisfactory document. He might state generally, as he usually did at their half-yearly meetings, what was the condition of the company's works at the present time. He was glad to be able to report that they were in a very good condition. The new apparatus for purifying the gas, which was erected last year, had been found to answer very well indeed. The gas now supplied by the company was purer than ever, and its illuminating power was also much higher. Since the new apparatus had been in use, the gas had never been less in illuminating power than 14 candles, or two candles more than the statutory limit. The directors had thought it best to keep up the gas to a high standard, and, therefore, as he had just said, they had sometimes exceeded 14 candles, and the purification of the gas had certainly been more perfect than it had been before. The directors believed they furnished gas as cheap and as pure as at many other places, and perhaps the Wakefield gas would be found rather purer than at most places. Referring to the payment of back dividends, he said the directors were in hopes they would have been able to make them up to 10 per cent., but as they had only enough money to pay 9½ per cent., the remaining half per cent. must be left to further consideration. They would have required £1764 more to pay 10 per cent. on account of backwarranty dividends, and therefore they had decided to ask the shareholders to agree to the payment of 9½ per cent., and to leave a surplus of £810 5s. 10d. in hand. If they had decided to pay the other half per cent., they would have had to anticipate their income to the extent of £954. This they did not think it prudent to do, but thought it would be better to rest content with 9½ per cent., and leave the £810 5s. 10d. in hand. He concluded by moving the adoption of the accounts.

Mr. L. A. SHEPHERD seconded the motion.

Mr. R. WHITELEY said the chairman had, in going over the items of accounts, stated that there was a large stock of coke on hand at the close of the half year, and he asked, seeing that there was no account of it in the balance-sheet, what was the value of the stock of coke at the end of December.

The CHAIRMAN said it had not been usual for them to give the value of the stock of coke on hand in the balance-sheet, and he also remarked that they could only guess at its value.

Mr. WHITAKER, jun., the manager, said the value of the stock of coke on hand at Christmas was from £300 to £400.

The CHAIRMAN said coke was now going off very fast; they were selling far more than they were making.

Mr. WHITELEY asked to what years the back dividends applied.

The CHAIRMAN replied from 1848 to 1857, both years inclusive, making ten years.

Mr. WHITELEY asked what dividends were paid in those ten years he had referred to, and

The CHAIRMAN stated that the dividends were as follows:—1848, 6 per cent.; 1849, 6 per cent.; 1850, 6 per cent.; 1851, 7 per cent.; 1852, 7 per cent.; and 1853 to 1857, 8 per cent. per year.

Mr. WHITELEY said that supposing the company prosecuted their

present Bill in Parliament, would there be anything to prevent such a payment?

The CHAIRMAN replied that there would not, but what shape the Bill might eventually take the directors could not tell. Some of the clauses might be much modified.

Mr. H. ROBINSON said he supposed that if the directors had been in a position to pay £1764 more, all the backwarranty dividends would have been completely wiped off, and all the shareholders would then have been on the same footing?

The CHAIRMAN replied that that was so, but as the directors had not quite enough money to pay 10 per cent. for arrears they were obliged to content themselves with paying 9½.

After some further conversation,

Mr. ROBINSON said he very much doubted whether the directors had the power to take all the depreciation-fund, or the reserve-fund, to pay away in backwarranty dividends. If they did so they would have nothing to fall back upon in case of accidents or anything else.

The CHAIRMAN: We anticipated that question being raised, and in order to satisfy the shareholders upon the point we have taken the opinion of one of the most eminent men at the Bar, and he has given us a very strong and decisive opinion that we have the legal right to do as we now propose. Fortified by that opinion, the directors have no hesitation in recommending their proposal to the shareholders.

Mr. ROBINSON: It is for the shareholders to use their own discretion, and to say if, although it may be legal, it is advisable and prudent to sweep up and divide everything.

The CHAIRMAN: We shall not sweep up everything; we shall have £810 5s. 10d. in hand, and the works in a thoroughly efficient state.

The motion was put and carried with one dissentient.

The CHAIRMAN then proposed a formal resolution ordering the payment of the current and the back dividends. The resolution was as follows:—“That a dividend of the profits of the undertaking, at the rate of £10 per cent. per annum, on the respective old shares, and at the rate of £7 10s. per annum, on the B 5th shares, be made for the half year ending 31st of December last, and also that a backwarranty dividend of £5 15s. per share of £25; £1 per share on the £5 shares issued on Aug. 9th, 1847; and of 4s. 4d. per share on the £5 shares issued on Aug. 22nd, 1853, bringing up the arrears of dividend on those respective shares to £9 10s. per cent.; all such dividends to be paid on Thursday, the 1st day of March next, clear of income-tax.”

Mr. W. BRIGGS seconded the motion, which was also put and carried with one dissentient.

A resolution conveying a vote of condolence with the family of the late Mr. Senior, one of the directors, was unanimously adopted.

After some conversation upon the act of the directors in filling up the vacancy at the board caused by Mr. Senior's death,

A vote of thanks was given to the chairman and directors, and the proceedings terminated.

SUTTON-IN-ASHFIELD GAS COMPANY.

The Twenty-fifth Annual Meeting of Shareholders was held on the 19th ult.—Mr. S. LITTLEWOOD in the chair—when the following report of directors was submitted and approved:—

“The directors regret that, owing to the illness of one of their auditors, they are unable to present to the shareholders the usual detailed statement of accounts. These will, however, be forwarded within the course of the next few days. They are glad to state that, notwithstanding the continued depression in the trade of the district, and the reduction in the price of gas which has been made, the result of the year's working has been of a satisfactory nature. The amount available for distribution (subject to completion of audit) is £864 16s. 8d., including £190 17s. brought from last account. They recommend the payment of a dividend of £1 per share, being at the rate of 10 per cent. per annum. Seeing, moreover, that the financial and general position of the company is good, and that its future prospects are promising, they feel that the time is come when they may fairly and reasonably use their powers in making up the deficiencies of dividends of past years. The shares which were first issued are equitably entitled to first participate in back dividends; and the directors therefore recommend that a payment of 5s. per share be made to the holders of all shares from 1 to 250, both inclusive, being the first issue of the share capital of the company. This will bring up the dividend which was paid in May, 1853, to the authorized rate of 10 per cent. The directors are assured that this step is one which they ought to take, and they trust, with the natural growth of the district, and the revival of trade which may be looked for, to be able in future years to continue these payments. The balance to be carried forward will be £152 6s. 8d. The amount of the reserve-fund stands at £400, which the directors consider to be for the present sufficient.

“Formal application has been made by the inhabitants of Kirkby and Kirkby Folly, which are included in the statutory district of the company, for an extension of the mains for the purpose of giving them a supply. Looking at the rapid growth of the latter place, and the very considerable number of consumers who are desirous of being supplied, the directors are of opinion that this application should be entertained, and the details of the matter will have their early attention. The additional share capital, which will be required for this purpose, the directors propose to raise by an issue of new shares, allotted *pro rata* to existing shareholders, to such extent as may be found necessary, at the original price of £10 per share.

“Notice has been given by the Local Board for the District of Sutton-in-Ashfield, of their intention to apply for power to purchase, by compulsion, a considerable portion of the company's land, for the purpose of improving the approach to Tenter Lane. The directors, after careful consideration of the matter, were compelled to the conclusion that the sale of so large a portion of their estate would be most detrimental to the interests of the company, and also of future applicants for gas, by disabling the company from making extensions which are certain to be required, the land proposed to be taken being that which will certainly be needed for the next extension of their producing plant. Seeing this, therefore, and being of opinion that the street improvement might be better and more economically arranged without materially interfering with their land, they have intimated their dissent, and will do what is necessary for the company's interests.

“The directors have been requested by the clerk of the same local authority to state the terms upon which they would be willing to dispose of their undertaking, and invited to meet a committee of the local board for the purpose of making preliminary arrangements. They are, however, unanimously of opinion that such transfer would offer not the slightest advantage to the shareholders, whose position has the security of recent legislation, and would, at the same time, task severely the resources of the ratepayers, who would for many years find the works a drain upon their funds. Learning from the highest authority that no such transfer would be valid without the sanction of a special Act of Parliament, they decided, after careful consideration, to decline to negotiate for the sale of their works. They trust to have the support of the good sense of their shareholders in this matter, which, though no part of the business coming before the general meeting, is one in which every member of the company has a direct interest.”

CANTERBURY GAS AND WATER COMPANY.

The Half-Yearly Meeting was held on Friday, the 23rd ult.—Mr. G. FURLEY in the chair.

The following report was presented:—

Since the last half-yearly meeting a re-valuation of the company's property has been made for rating purposes. The assessment within the area of the city of Canterbury, including the extra-parochial places, has been increased from £1136 to £1825; that within the Bridge Union (which the directors have not finally agreed to) from £330 to £1203. This assessment, together with a small increase to be looked forward to in the Blean Union, will subject the company to an estimated annual charge of £700, being an increase of £330 over former payments. This alteration will take largely from the profits of the undertaking; but the directors feel that, whilst the affairs of the company continue in their present state of prosperity, they not only will be able to pay the shareholders the full dividend authorized by their Act of Parliament, but also to relieve the rates of Canterbury and adjoining unions to the extent above mentioned.

The balance standing to the credit of the profit and loss account is £3870 14s. 11d., and the directors are pleased to recommend that a dividend at the rate of 8 per cent. per annum, free from income-tax, be declared, and paid on and after Monday, the 26th of February.

Messrs. Henry Castle, Robert Young Fill, Edward Rayner, and William Sharp, are the retiring directors for this year. Messrs. Castle, Fill, and Rayner being duly qualified, seek for re-election; Mr. Sharp retires from the direction, and Colonel William Henry Horsley, of St. Stephen's Lodge, Canterbury, late chief engineer at Madras, and secretary to the Government in the Department of Public Works, and who has been very extensively engaged in carrying out large irrigation works in India (being duly qualified), offers himself as a candidate for the vacant seat.

The CHAIRMAN, in moving the adoption of the report, alluded to the re-valuation and rating of the property of the company. The increased assessment, he said, was arrived at with the consent of Mr. Castle, who was called in to act on the part of the company. With regard to the city of Canterbury rating, he could only say that if the guardians had felt confidence in them, the directors would have arrived very closely to the same amount as they had now put it. They knew there must be a large increase in the rating of the property, and they were prepared to meet it; but they were not prepared for such a large increase as had been made in the Bridge Union, and they had not finally agreed to that. If they had separated the gas and water property they could have upset the valuation, but as they were entered together they were bound by the one rating. Altogether the assessment had been increased by £1562, and he was pleased to think that the valuation was not taken earlier when they were in a struggling condition, as it would then have told upon them. Having referred to a long outstanding item in the accounts, a sum due to the contractor for the water-works, which the directors had recently adjusted, he said, since 1866, when the company were re-formed under an Act of Parliament, they had been struggling on in their existence, and he had a comparative statement of what their condition was then and what it was now, and he hoped the shareholders would feel some satisfaction at the work that had been done. In 1866 their capital for gas and water was £22,500, and the reserve-fund consisted of £507 in New South Wales bonds; the yearly rental was £8134, out of which, after defraying all expenses, they hardly paid 6 per cent. in full. In 1867 they had to take £160 from the reserve-fund in order to pay 6 per cent. They had been prospering from that time to the present, and in 1876 the share capital was £66,500; the loan capital £7500, making a total capital of £74,000, and he might state with a great deal of satisfaction that nearly the whole of the capital had been raised in Canterbury and the neighbourhood. The reserve was £5956 instead of £507 as in 1866, and their gross rental £14,374, being an increase of £6340; and they were now able to pay a dividend of 8 per cent. This would show that the company had been carried on in a most prosperous manner, and he trusted the efforts of the directors would meet with their satisfaction. Of the officers who had paid a great deal of attention to their work, he might mention the clerk and manager, to whom the shareholders ought to be thankful for the success of the company as well as to the directors. The chairman then mentioned a number of works the directors intended to carry out under the direction of their consulting engineer, Mr. Jones, and which would put the works in good order for many years to come. He said the directors could not divide more dividend, but in addition to the carrying out of the works he had mentioned, and the increased rating they had to pay, they hoped and intended on the 1st of April to reduce the price of gas to 3s. 9d. per 1000 feet, and therefore having attended to their plant they were enabled to look to outsiders and consumers, and give them the benefit of the prosperity of the works.

Admiral MARTEN seconded the motion, which was put and carried.

The retiring directors and auditor were re-appointed, the dividend declared, the remuneration of the directors (£250) was voted for the past year, and five guineas was given to the Kent and Canterbury Hospital and the Canterbury Dispensary.

The proceedings terminated with a vote of thanks to the directors and officers.

SUNDERLAND AND SOUTH SHIELDS WATER COMPANY.

The Annual General Meeting was held on the 21st ult.—Mr. R. VINT in the chair.

The SECRETARY (Mr. W. Dixon) having read the notice of meeting, the following report was presented:—

Your directors submit their twenty-ninth annual report, together with the financial statement, from which it will be seen that the gross income for the year has reached £27,394 8s. 11d.

With the view of obtaining an early supply of water at Stoney Gate, your directors, under the advice of their engineer, entered into an arrangement with Messrs. Mather and Platt, of Manchester, to put down, by their patent process, a bore-hole of from 2 feet to 2 feet 6 inches diameter; and they have now reached a depth of 168 feet; but the hard nature of the limestone has prevented them getting on so well as was expected.

The large works at Dalton are being pressed forward as quickly as practicable, and your directors trust that if the weather is favourable, the engine-house will be so far advanced as to enable the contractors soon to begin fixing the engines. The pumping-stations of the company are all in good working order.

Your directors recommend that a dividend of 5 per cent. on the ordinary preference stock of the company, for the half year ending Dec. 31, 1876, be declared payable on the 1st of March next, making, with the interim dividend paid on the 1st of September last, 10 per cent. for the year; also that 5 per cent. be paid on the amount called up on those shares allotted on Sept. 3, 1875, in accordance with the 21st section of the company's Act of 1866.

The CHAIRMAN moved the adoption of the report, and made some remarks on various items in the accounts. He said the shareholders were aware the past year was one of extraordinary depression of trade, everything in connexion with the trade of the district being in a very depressed state, and consequently they had not received the amount of increase to which they had been accustomed. They had had an increased demand for domestic supplies, but not for water delivered by meter for trade purposes, which he might account for by saying that the weather, which had stopped them in one direction, also operated rather prejudicially against them in this respect, as many of the manufacturers had a surplus supply of water, and in wet seasons did not require so much as at dry periods. They had no reason to be desponding with respect to the state of trade, for neither this year nor the preceding twelve months could be taken as an average. They must go over a series of years, and if they did so they would find a large increase. In fact, he was rather surprised to find, in looking back over 10 years, the difference between 1866 and 1876 amounted to the large sum

of £20,000. They had no reason to despair, for as soon as trade revived, they would participate in the prosperity, in addition to which, when the Dalton works were finished, they would be in a position to supply any amount of water that could be required for some years to come. The available balance was an important item. After paying the intermediate dividend on the 1st of December, at the rate of 5 per cent., he found that they had for the half year an available balance of £24,980 3s. 4d. The dividend which they would be asked to authorize, and the interest on the money which had been paid on the calls on new shares, amounted to £14,875, which, deducted from the other amount, would leave £10,105 to be carried forward. He thought, under all the circumstances, they had cause to congratulate themselves on their favourable position.

Mr. W. ANDERSON (vice-chairman) seconded the motion, which was put and carried. The dividends recommended in the report were declared, the retiring directors and auditor were re-elected, and a vote of thanks was given to the chairman and directors for their services during the past year.

The CHAIRMAN acknowledged the vote, and called upon Mr. Hawksley, the company's consulting engineer, to state to the meeting the result of his survey of the works.

Mr. HAWKLEY said while he was very glad to give every information in his power, he had on that occasion very much less to say than he had had at previous meetings, for this reason, that everything was going on in their undertaking so exceedingly well, and that their works were in such an improved and improving condition that really there was nothing to relate, in respect to the transactions of the past year, which would be of any interest to them, excepting to repeat what they had themselves said in commending the action of the board of directors. As respecting the new works, he might say that they had been retarded by the weather, and by other causes over which they had no control. The difficulties they had had to contend with in regard to workmen had not been very materially decreased. Nevertheless, the large works at Dalton were in this position, that, in accordance with a new arrangement which had been made with the engine makers, they would be enabled to pump water there for the general use of the district by the 1st of September next with one engine, and the second engine was to be completed for the purpose of pumping in about two months after that period, and he supposed some six months would be occupied, not entirely for the purpose of supplying the town, but in completing the large sinking, which would produce more than 50 per cent. increase of water upon the very large resources at present in use. They had realized a large quantity of water—about one million gallons per day—from a bye-shaft at Dalton, and that water seemed to be quite equal to any water supplied by the company, and water of a quality which was not only satisfactory to the proprietary, but to the public at large. He could tell them a remarkable fact with regard to their financial position as proprietors of a large water-works undertaking. In many of the water-works supplying the large towns of the kingdom, it cost from £150,000 to £160,000 to obtain and distribute a million gallons of water. In their case the cost, when all the works were completed, would not exceed £80,000 per million gallons. That fact explained two things—the good and safe dividends they were receiving, and the cost, which was very much lower than was usual over a large portion of the manufacturing districts of the kingdom in which water was delivered to the public at large.

The proceedings then terminated.

SOUTH STAFFORDSHIRE WATER-WORKS COMPANY.

The Half-Yearly Meeting was held on Thursday, the 22nd ult.—Mr. F. JAMES in the chair.

The following report was submitted:—

During the half year ending Dec. 31, 1876, the company's revenue from water-rates showed a satisfactory increase, notwithstanding the prevailing depression in the trade of the district. As compared with the previous half year's income, the amount of increase was £117 19s. 10d., and at the same time the total of the working expenses is reduced. The number of houses supplied is also considerably augmented.

The result is that, after providing for interest on loans and preference shares, the balance remaining amounts to £12,678 5s. 9d.; and your directors, therefore, recommend the declaration of a dividend for the half year on the ordinary share capital at the rate of £6 per cent. per annum, less income-tax. The amount of this dividend will be £5619 1s., and there will remain £7059 4s. 9d. to be carried forward to the credit of future half years.

The new works are steadily progressing, and although the continuance of wet weather has caused some delay, your directors hope to see them completed within a short time of the limit stated in the contracts.

Your directors announce, with great regret, the death of their late colleague, Mr. Henry Rotton. In his place they have elected Mr. William Henry Holland, C.E., of 102, St. George's Square, London. Your directors have also thought it advisable to fill up the vacancy in the direction caused by the death of the former chairman of the company in 1875, and they have accordingly elected Mr. Henry Wiggins, J.P., of Metchley Grange, Harborne.

The following members of the board will retire from office by rotation, but are eligible for re-election—viz., Mr. Maximilian Lindner and Captain Henry Townshend.

At a special meeting to be held after the ordinary meeting, the shareholders will be asked formally to approve an agreement made in April, 1874, with the Dudley Water-Works Company, as to the sale of Parkes Hall reservoir to the Earl of Dudley's trustees, and to confirm all acts done by the directors in relation to the matter.

Dr. Profit and Loss Account, for the Half Year ending Dec. 31, 1876.				Cr.	
Engine charges	£2,586	11	6	Balance brought forward, June 30, 1876	£10,378 5 9
Maintenance of works	1,083	5	7	Deduct amount of 30th dividend, declared Aug. 24, 1876	5,020 7 3
Wages, turncocks, &c.	615	17	11		
Directors' attendance fees	375	0	0		
Salaries—secretary, engineer, and clerks	950	5	6		
Collectors' commission	658	2	3		
Rents	501	13	4		
Rates	431	6	2	Half year's water-rates	22,066 0 8
Income-tax	176	15	9	Service laying	467 17 7
Incidental expenses	260	2	9		
Current law charges	183	5	3		
Discount to landlords	358	0	0		
Allowances	309	0	1		
Bad debts	10	13	8		
Interest on loans	2,265	13	5		
Interest on permanent debenture stock	158	8	10		
Interest on preference shares	4,289	9	0		
Balance	12,678	5	9		
£27,891 16 9				£27,891 16 9	

The CHAIRMAN, having expressed the regret felt by the board at the loss they had sustained through the death of Mr. Rotton, said that from the accounts just presented it would be seen that the capital of the company had been increased, some £56,000 having been expended on works during the last half year, so that that made something like £101,000 since they went to Parliament in 1875. It was hardly necessary for him to say that the revenue of the company bore the charge of that capital. In all works of that character no benefit could accrue until the works were completed. In the meantime, all the charge upon that expenditure and the new capital that was raised was borne by the revenue of the company. The engine charges were somewhat less than in the previous half year, which arose from the smaller cost of coal, and perhaps from the engines

being in good condition, and requiring a slightly less consumption of fuel. The item for maintenance of works was a trifle less; wages a little more. In the law charges there was a diminution from £959 to £188; the excessive charges last half year arose from certain transactions at Dudley, which he then explained. The interest on loans was necessarily more, because as new capital was called up new sums also were borrowed. With regard to the debentures, at the last half-yearly meeting, the directors took the power of converting all debentures, as they became due, into permanent debenture stock, and he was happy to tell them that that had resulted in an entire success. The amount of debenture stock already issued was something like £20,000, and the company had to pay 4 per cent. on that stock. There were sufficient indications, from the applications which they had for debenture stock, that debentures would gradually cease to exist upon their accounts, and eventually the whole sum would become one debenture stock. The water-rates had increased a little over £1100. Nearly £1000 of the increase arose from their trade supply, but they naturally looked each half year for a considerable increase from the domestic supply. The result of the half year was that the directors were enabled to come before them with a dividend of 6 per cent., upon the ordinary stock of the company, after paying all preferential shares and carrying forward a balance of £7059 to next half year. The new works of the company were satisfactorily progressing. They often saw complaints with reference to the South Staffordshire Water-Works Company in the papers, and they had no opportunity of answering these complaints except at the half-yearly meeting. Some months ago there were complaints about the company in the Lower Gornal district. The company without waiting for an agreement on the part of the authorities of the district, believing the district was in want of water, undertook to lay the pipes and do the necessary work ready for the supply of water. They had received a deputation from the local board of the district, and the deputation appeared entirely satisfied with what the company proposed. They had laid out in pipes and pipe-laying about £1000, and that work had been completed three or four months. From some difficulties with the local board, however—he said most positively that it rested with the local board entirely—not one single house in that district had yet been supplied with water. The local board had hitherto failed to put the powers they possessed into execution and compel the owners of property to lay on the water. It was often said that the company imposed excessive requirements with regard to service. The fact was, a great number of people borrowed their water, and they had to take care that a larger number of people did not do so. The local boards sometimes said that if they would put in a single tap for a block of houses, the landlords would be glad to take their water, whereas they required a service for each house. He pointed out that that difficulty could be removed if the local boards would take the water, for the company would put in taps at different blocks of houses, because they would then know that they would be paid for all the houses, and that some would not borrow from the others. He concluded by moving the adoption of the report.

Mr. BROWN seconded the motion, which was put and carried. On the motion of the CHAIRMAN, a dividend for the half year was declared on the preference shares at the rate of 5 per cent. per annum, and a dividend on the Dudley preference shares at the rate of 4 per cent.; also a dividend of 6 per cent. on the ordinary share capital of the company for the half year. The retiring directors and auditors were re-appointed, and the usual votes of thanks brought the proceedings to a close.

LEICESTER WATER-WORKS COMPANY.

The Half-Yearly Meeting was held on the 19th ult.—Mr. E. S. ELLIS in the chair. The SECRETARY (Mr. J. H. Williams) read the report of the directors as follows:—

Your directors have to report that during the half year the gross receipts amounted to	£11,387 19 5
From which deduct—	
Working expenses	£2194 18 5
Rates	543 12 8
Interest	1156 4 4
Parliamentary expenses	596 5 5
	4,491 0 10
Leaving net profit	£6,896 18 7
Apportioned as required by the company's Acts:	
To the shareholders	£6,133 4 0
To the Local Board of Health	763 14 7
	£6,896 18 7
From the shareholders proportion	£6133 4 0
Deduct income-tax	91 11 9
	6,041 12 3
Add balance from last half year and interest	8 10 11
Will leave at the disposal of the shareholders	£6,050 3 2

From this amount, your directors recommend a dividend at the rate of 5½ per cent. per annum for the half year (free from income-tax), leaving a balance of £55 3s. 2d. to be carried forward to the next account.

Your directors have to report an addition to capital outlay during the half year of £7835, principally on account of the new reservoir at Gilroes, and the new main which is being laid to the south-eastern side of the town, to meet the requirements of the increasing population of that district.

The revenue of the company continues steadily to improve, and notwithstanding the half year's expenses have been increased by £596, the balance of parliamentary costs of last session, your directors are enabled to recommend the usual dividend of 5½ per cent. per annum after paying £763 to the Local Board of Health as their share of profits.

The works of the company are well maintained, and, as may be expected after the unusual rainfall of the last few months, both reservoirs are overflowing.

The retiring directors are Mr. W. H. Ellis, Mr. A. Faget, Mr. J. D. King, and Mr. W. W. Stretton; they are all eligible for re-election. The retiring auditor is Mr. William Billson, who is also eligible for re-election.

The CHAIRMAN, in moving the adoption of the report, said on the capital account they had received, in the whole, on account of shares, £218,000; loans on debentures, £60,174; and on other sundry receipts, £833; making a total received of £279,007. They had expended £279,498, leaving a balance against the capital account of £491. There had been laid out during the half year £7835, of which the new reservoir at Gilroes had absorbed £4600, and the new mains for the south-eastern part of the town, mentioned in the report, about £1700. With regard to the revenue account, the expenses of this half year exceeded those of the former half by about £200, £100 on account of wages, and £100 or thereabouts in repairs of works. They had had to procure additional and for the filter-beds, and there was also some addition to wages in filtering, in consequence of the water having become rather bad through the drought of last summer. In addition to the working expenses they had £596 to pay, being the balance of the parliamentary expenses last year, which he explained on the last occasion was fairly chargeable against revenue. The result was that they had a balance this half year of £6896, as against £6664 last half year, and that would enable them to declare a dividend of 5½ per cent., after paying £763 to the Corporation, as their share of the profits. The revenue of the com-

pany continued to increase, and he had no doubt that a further small addition to the dividend of the company would be shortly paid if they escaped accidents.

Mr. W. H. ELLIS seconded the motion.

Mr. GRAY asked, as the capital account was overdrawn, whether it was probable that a further call would be made upon the shares during the present year.

The CHAIRMAN said the capital account was slightly overdrawn at the end of the last half year, but since that time they had borrowed £1500 on debentures. They had still power to borrow £4000. That amount would be absorbed during the half year, and they would have to make a call upon the shareholders to the extent probably of £5 per share on the last issue of shares during the current half year.

The motion was carried, and the dividend recommended ordered to be paid.

The retiring directors and auditor were unanimously re-elected.

Mr. HOLYLAND moved a vote of thanks to the chairman and directors for their services during the past half year, and asked whether the whole of the parliamentary expenses were paid now?

The CHAIRMAN answered in the affirmative.

Mr. HENTON seconded the motion, and it was carried.

The CHAIRMAN acknowledged the vote and said it was very gratifying to the directors to receive the approval of the shareholders. He wished sometimes that those meetings were a little less formal, and that there was a little opposition. He seemed to have it all his own way. Still he he was much obliged to them for the vote.

The proceedings then terminated.

NEWCASTLE AND GATESHEAD WATER COMPANY.

The Annual Meeting of Shareholders was held on Tuesday, the 20th inst.—Alderman PLUMMER in the chair.

The SECRETARY (Mr. Main) having read the advertisement convening the meeting, the following report was submitted:—

The accounts for the past year which the directors have to present to the proprietors show an increase of revenue amounting to £1651 7s. 4d., which has arisen chiefly from additional consumers for domestic use. The following is the comparison with the previous year:—

	Tenants.	Receipts.
Year ending Feb. 1, 1876	50,896 ..	£30,811 16 7
Year ending Feb. 1, 1877	54,410 ..	52,463 3 11
Increase	3,514 ..	£1,651 7 4

Along with this increase of revenue there has been a reduction in the working expenses of £1544 17s. 7d. After the lamented death of Mr. Burdon Sanderson, the directors unanimously elected Alderman Plummer to be their chairman. The engine and works at Wylam for pumping water from the Tyne for manufacturing purposes are now completed, and a considerable portion of the 30-inch connecting-main has been laid. Progress has also been made in laying new mains on both sides of the river, for the separate supply of Tyne water to the manufactories. The filter-beds at Throckley, for filtering water for domestic use, have made satisfactory progress, and some of them are completed and in operation. The following are the lengths and dimensions of the mains laid during the year:—2 inches, 630 yards; 3 inches, 23,333 yards; 4 and 5 inches, 5883 yards; 6 and 8 inches, 4945 yards; 10 inches, 1023 yards; 12 inches, 924 yards; 35,441 yards, or nearly 203 miles. For the separate supply for trade purposes, the following have been laid:—6 inches, 1733 yards; 8 inches, 1437 yards; 10 inches, 2859 yards; 12 inches, 2388 yards; 18 inches, 1815 yards; 24 inches, 99 yards; 30 inches, 258 yards; 10,529 yards, or 6 miles. The provisions of the Bill now before Parliament will be submitted to the shareholders at the special meeting called for the 20th inst. By agreement with the landowner a larger and in every respect more advantageous site for a reservoir than that for which parliamentary powers were obtained last session can be secured on the Swinbourne. The floods in the district have recently been unprecedentedly large, but the only portion of the works affected was a tunnel near Horsley, where it passes through a bog, and where the accumulated weight of water above forced its way in, carrying with it a quantity of soil, which choked the filters for a time. This will be remedied as soon as the state of the ground will admit. The directors have considered the responsibility and increasingly laborious duties of the secretary, and by a unanimous vote of the board have advanced his salary from £500 to £600, which they feel sure will meet with the confirmation and approval of the shareholders. An interim dividend at the rate of 6 per cent. per annum having been already paid, the directors recommend that a dividend at the same rate for the half year ending the 1st of February be paid on the ordinary stock, free of income-tax, and 5 per cent. on the preference shares, on the 8th of March.

The CHAIRMAN said he hoped the shareholders would all feel gratified with the financial part of the report, which was very satisfactory. The directors could, if they had thought it prudent, have recommended a slightly larger dividend; but they did not think it advisable to do so in consequence of certain difficulties—very small he hoped, and which they would soon be able to surmount—which were hanging over them. He was glad to say that the surplus which the directors had would be transferred to the following year. As the shareholders would see, the engine and works at Wylam were now completed, and progress had been made in laying the new mains on both sides of the river for a separate supply for the manufactories, and these pipes would very soon be completed, and would afford very great relief, not so much in having two strings to their bow, but as it would increase the pressure very much for domestic purposes. Some of the arteries being drained by the manufactories frequently reduced the pressure for domestic service very much, so that there was sometimes considerable difficulty in supplying everybody, and that difficulty would in a considerable degree be done away with by this separate supply. The filter-beds at Throckley had made considerable progress, though the work had been very much interrupted by the bad weather during the winter, but the directors expected these filter-beds would very soon be extended so that, when one filter-bed was being cleaned, the supply could still be kept up from the others. The floods in the district had been unprecedentedly large; and one portion of the works, a tunnel near Horsley, had been injured. It was about a mile and a quarter in length; and about 100 yards of it was upon a bog or quicksand. When it gave way the directors had a trench dug 16 feet or 17 feet deep, for a length of about 80 yards, and they hoped soon to have the tunnel repaired, without damaging the water. It was, unfortunately, about three miles on this side of Whittle Dene. With respect to the proposed increase of Mr. Main's salary from £500 to £600 a year, he would remind the shareholders that Mr. Main had been in the service of the company for the last 35 years; and during a great portion of that time he had been a most industrious and indefatigable secretary. Considering the large amount of the capital which he now had charge of, and the serious responsibility devolving upon him, and also comparing the salaries which other secretaries received from similar companies, the directors considered he was fully entitled to this addition to his salary.

Mr. POTTER seconded the adoption of the report. Ever since they got their Act of last year the directors considered it desirable to act as soon as possible upon that portion of the Act which provided for a separate supply for manufacturing as distinguished from household purposes, in order that the directors might stand well with the consumers and Corporations of Newcastle and Gateshead; and they fully expected that in the month of May they would be able to supply the manufacturing portion of the community with unfiltered water. They had gone to a considerable expense in this matter, and the weather had been very much against them. The pipes through the town would be ready before the pipes from the pumps at Wylam; but, at the same time, they hoped there would be such an abundant supply of water this year—he need not tell them that there was very much more than they could store—that there would be little or no occasion to use the pumps; and before the pumps would be required

the pipes would be completed. The directors thought it would be very much better that they should be a little beforehand in meeting the requirements of the Corporations of Newcastle and Gateshead, rather than they should be urged to do so; and they hoped the promptness with which they proceeded with this portion of the Act, and the promptness with which the work had been carried out, would be satisfactory to the town. They felt, now that they were in this position, that there would be little or no fear of Newcastle and Gateshead being unsupplied with filtered water, unless there should be such an excessively dry season as they had a few years ago.

Mr. BROWN added that owing to the depressed state of the iron trade they had purchased the pipes on very advantageous terms, and had saved about £1000, which would go in reduction of the capital.

The motion was then put, and carried unanimously.

The retiring directors and auditor were re-elected, and the dividends recommended in the report were declared.

The meeting having been made special,

The CHAIRMAN moved that the company's Bill now in Parliament, authorizing them to abandon the construction of the Upper Swinburne reservoir and other works, and the construction of a new reservoir and the works therefor, be approved.

Mr. ARMSTRONG (the company's solicitor) explained the provisions of the Bill, and

Mr. POTTER seconded the motion, approving the same.

The CHAIRMAN, in answer to an inquiry, said the Town Council of Gateshead had petitioned against the Bill, and the Newcastle Corporation were to have a special meeting to consider it. Until the company knew what the corporations required, it was impossible for the directors to say how far they would agree to it. It was really almost impossible to say what the corporations wanted to be at. There had been for a very long time some sort of *animus* against the company, which he could not understand. Last year, when the company brought in their Bill, they gave up some of the clauses, and the corporation gave up others; and on the faith of the contract then entered into with the corporation, the company set to work to carry out their part of the agreement, even sooner than they need; and before the end of the present year they would have spent, in carrying out their part of the bargain, no less than £70,000 of the shareholders' money, and now, when the company were going to Parliament for a little amendment, the corporation threatened to break altogether the contract which they made last year. He was satisfied that Parliament would never consent to any such breach of faith. At the present time the Local Government Board and Parliament were encouraging the whole of the water companies in the kingdom to extend their works; and new companies were commencing in every little market town and village in the country; but if they were to insist upon putting into their Acts such penal clauses as had been suggested for this company, and which were not in any other company's Act, the people would never advance their money to these companies. Though he had no fear that Parliament would sanction these clauses, he was only sorry that one public body should be so unreasonable towards another as the Newcastle Corporation apparently wanted to be towards them. There seemed to be an opposition in the town to the water company, such as no other water company in the kingdom had to contend with. They were attacked in all sorts of ways, and very unreasonably. The company were being so harassed that it had come to this—they would fulfil their contract, but beyond that they did not think it prudent to go.

Mr. DOUGLAS said he was very glad to hear that the directors had resolved on obtaining water from the Swinburne and the Erring. He resided there a good deal in the summer, and had been grieved to see the water running into the Tyne. It abounded with trout, which was a good sign, and a supply of water for Newcastle and Gateshead could be obtained there for many years to come.

The resolution was carried unanimously.

Mr. J. B. ALEXANDER moved—"That inasmuch as the present Bill is entirely with a view to improve the water supply, by giving a very large increase of water storage, if the corporations should continue their opposition, and the committee put the company under penalties which other companies are not liable to, that it be an instruction to the directors to withdraw the Bill." He said when they remembered that the Corporation of Newcastle had the opportunity only last year of purchasing these works on most reasonable terms, and were advised to do so by a very eminent engineer, he thought it was both unreasonable and unjust that they should now be seeking to impose on the company conditions to which, as they had reason to believe, no other water company in the country are subject. It looked very much, he thought, like a dog-in-the-manger trick. The company had a clause in their Bill which bound them to include the Water-Works Clauses Act, and all water companies which went to Parliament must be subject to the conditions of that Act. Now, he did not think it possible to imagine any reason why the water-works of Newcastle should be subject to conditions to which no other water companies are subject; and, therefore, he thought it right that the directors should be empowered, if they should be subjected to any oppressive movements in that way, to withdraw the Bill, and then throw upon the corporation themselves the responsibility of supplying the town with water.

Mr. DODD seconded the motion. He thought it unreasonable to attempt to throw upon the company more responsibility than they were already subject to.

The resolution was carried unanimously.

The CHAIRMAN said the directors were much obliged to the shareholders for carrying a resolution of that sort; but they had already resolved unanimously that on no account would they submit to any such penal clauses, and that, if the committee of the House of Commons should grant them, the directors were agreed to withdraw the Bill before it went to the House of Lords.

A vote of thanks to the chairman concluded the meeting.

ROCHESTER AND CHATHAM WATER-WORKS COMPANY.

The Half-Yearly Meeting was held on the 20th ult.—Mr. J. BAIRD in the chair.

The SECRETARY (Mr. Heckford) read the following half-yearly report:—

In presenting the balance-sheet and accounts for the half year ended the 31st of December, 1876, the directors have again the pleasure to report the continued satisfactory progress of the company. The receipts for the year show an increase of £410 10s. 5d. over those of the year previous, while the reserve-fund now amounts to £5480 8s. 7d. The directors recommend that a dividend at the rate of 47 per cent. per annum (free from income-tax) be declared upon all shares fully paid up, on the calls due in respect of such shares, prior to the 31st of December last, in proportion to the length of time which such shares or calls have been paid respectively, and that such dividend be payable on the 20th day of March next. The directors also recommend that the sum of £200 be added to the reserve-fund for contingencies, and that the balance of the revenue account be carried forward to the next half year's account.

Mr. G. R. Brock, Mr. John Tribe, and Mr. E. Hutchinson, three of the directors, retire from office by rotation, and, being eligible, offer themselves for re-election. Mr. Wm. Syms, one of the auditors, retires from office by rotation, and being eligible the directors recommend him for re-election.

The first section of the new headings referred to in the last half year's report has been so far completed that a junction has been effected with the old headings, under the engine-house, but in consequence of the unusually wet season, and the large quantity of

water flowing into the new wells and headings, it has been found necessary to provide another and larger pump to obtain entire command of the water, before it is possible to attempt to lower the main-pumps to the level of the new headings. This undertaking, which is one of extreme difficulty, is about being proceeded with, and the directors are most anxious to get it completed, as there is every prospect of obtaining an abundant supply of water when this important work has been successfully carried out.

The accounts showed the capital of the company to be £44,000, the whole of which had been expended. The revenue account showed that the sum of £5310 had been received during the past half year, and the expenditure £3892, leaving the sum of £1418 to be divided in the shape of dividend.

The CHAIRMAN, in moving the adoption of the report and balance-sheet, congratulated the proprietors upon the steady progress of the company. There had been many difficulties to overcome, in the shape of additional works, &c., but these the directors trusted would be surmounted. Referring to the reserve-fund, the chairman said it now amounted to between £5000 and £6000, which the directors hoped to increase to £10,000, a point which would be reached in a few years. He should be happy to answer any questions that might be asked.

The motion having been adopted, the retiring directors were re-elected, and the dividend recommended in the report was declared.

Mr. WARNE moved a vote of thanks to the chairman and directors, remarking that the board possessed the entire confidence of the shareholders, and he believed that under their management the affairs of the company would continue to be prosperous.

Mr. PRALL seconded the motion, which was unanimously adopted.

The CHAIRMAN, on behalf of the other members of the board, thanked the shareholders for this renewed mark of their confidence, and assured the proprietors that everything would be done to increase the prosperity of the company.

The retiring auditor, Mr. W. Syms, having been re-elected, a vote of thanks to the secretary and officials of the company—which was acknowledged by the secretary—brought the proceedings to a close.

CHESTERFIELD WATER-WORKS AND GASLIGHT COMPANY.—The ordinary general meeting of shareholders was held on the 28th ult. The balance of net revenue account enabled the directors to recommend the declaration of a dividend on the ordinary stock of 5 per cent. for the past half year, and 10 per cent. in respect of deficiencies of dividends in previous years, as well as the full amount of dividend on the preference shares and guaranteed stock of the company. The board are completing the extension of the water-mains to Grassmoor. Preparations are being made for laying the northern main from Linacre to Drone Bridge, pursuant to the company's Act of last session. Considering the long continuance of wet weather, the contractors for the new retort-house have made satisfactory progress.

PROPOSED PURCHASE OF THE EXETER GAS-WORKS.—At the meeting of the Exeter Town Council on the 28th ult., it was stated that, in accordance with a resolution of the Sanitary Committee, passed in January last, to the effect that a practical gas engineer be employed to thoroughly examine the gas-works, with a view to the discovery of the cause of nuisance, Mr. G. W. Stevenson, C. E., of London, had made a report to the council thereon. Mr. Stevenson stated that he visited the works on the 8th of February, accompanied by the city surveyor and Captain Thompson, and attended by one of the directors of the company, and by Mr. Padfield, the secretary, and Mr. Stansfield, the manager. He considered the works admirably situated, but at present the confusion of buildings and plant was absolutely painful and distracting. The condensing power of the works was less than half of what it ought to be. The scrubbers ought to be four in number. At present there were only two, and of a size which only afforded one-fourth of the required capacity. The nuisance of the 16th of January last and following days was directly attributable to the breakdown of the exhaustor, and to the fact of the bye-pass valve not being self-acting. He did not know of any work of less than half the magnitude that was not provided with those appliances. The four 12-foot square purifiers, and two others 20 feet by 16 feet, were totally inadequate for the proper purification of the gas. Nowhere was it more imperative that there should be a reserve of power than in the purifying department of a gas-works. The gas should be passed first through lime in the 12-foot purifiers for the extraction of carbonic acid, and then through oxide of iron for the extraction of sulphuretted hydrogen. The reverse method was the practice of the company, which was not economical. The four original holders, still employed, were quite worn out and leaky, and ought to have been abandoned years ago, for their united contents would supply the city for only 15 minutes any night in mid-winter. With regard to the allegations of Captain Thompson and others of nuisance from the gas-works, he was bound to say that it would be a matter of surprise if so badly designed and constructed works could be managed without occasional mishaps and consequent nuisance. From the state of the works, it was manifest that no amount of vigilance on the part of the manager could secure him from accident by several causes, any one of which might occasion trouble to himself, loss to the company, and nuisance to all the neighbourhood. It was not reasonably fair to give a person charge of a gas-works that had been starved and stinted in every essential particular, and which were totally inadequate to the duty required from them, and expect him to conduct it as though everything were of modern and approved construction and of ample capacity. The only wonder was that the nuisance complained of was not constant throughout the winter season, instead of occasional. The works required to be remodelled, and a large expenditure of capital to be made on them, before they could be placed in sound condition as respected economical production and comfort to the neighbourhood. It was a question whether the time had not arrived for the council to acquire possession and control of the undertaking, to meet the present and growing demands of the district; and whether it would not be better, in the interests of the consumers of gas and the ratepayers generally, that the capital necessary for the remodelling and future extension of the works and mains should be provided by themselves at, say, 4½ or 5 per cent. interest, rather than by the company at 7 per cent. dividend. It did appear to him that the Council of Exeter might very properly follow the example of other authorities in acquiring the works and business of the gas company. The present was a favourable time for so doing, because the capital powers of the company were nearly exhausted. He strongly advised the council to arrange terms with the company on the basis which he had verbally explained to the town-clerk, and then they could be in Parliament next session with an unopposed Bill. A special meeting of the committee was held on the 26th to consider the report, and it was resolved, after full consideration, that it be recommended to the council to resume negotiations with the gas company, with a view to the purchase of the works. Alderman Lloyd moved that the matter be referred to a committee. Mr. Willey seconded the motion. While not defending the company, he admitted that steps had been taken by them to meet the requirements of the town. At the same time he considered the gas consumers had a right to have gas supplied at a less price than at present, taking into account the reduced price of coals. The resolution was agreed to without further discussion.

GAS AFFAIRS IN AMERICA.

REPORT OF THE GAS COMMISSIONERS
IN RELATION TO THE SUPPLY OF GAS TO THE
CITY OF BOSTON.

(Continued from page 316.)

III. *Water Gas*.—The theory of the manufacture of this gas differs entirely from that of coal or naphtha gas. It depends, first, upon the production of a non-illuminating gas from steam; and secondly, upon the manufacture of petroleum, naphtha, or canal gas for the purpose of furnishing the illuminating power. The great advantage of this process is, that very large volumes of non-luminous combustible gas can be made very cheaply. This is done by passing steam over incandescent carbon, which has a very powerful attraction for oxygen, and abstracts it from the steam (water being a compound of hydrogen and oxygen), uniting with it to form, at first, carbonic anhydride, which is, on passing over another layer of coal, deprived of one-half of its oxygen to form carbonic oxide. Hydrogen, the other constituent of the steam, is set free, and mixes with the carbonic oxide. Thus we have, if the process has been properly conducted, a mixture of hydrogen and carbonic oxide as the result, both of which gases are combustible, but burn with a colourless flame.

In some of the processes for the manufacture of this gas the petroleum or naphtha gas is not mixed with the water gas until the latter has been made and purified. In others the petroleum is added directly to the coal.

In making water gas, anthracite, not bituminous, coal is used, and great care is necessary to keep the temperature up to a white heat; since, if it falls too low, a large proportion of carbonic anhydride will be formed, which diminishes the yield of the finished gas, as it must be removed by purification, or, if it is not removed, it injures the illuminating power very much. Anthracite coal contains sulphur and yields ammonia when distilled, so that purification is as necessary in the case of water gas as of coal gas, and no practical saving is made in this respect.

The great advantage which is claimed for water gas is the very large amount of gas made with one ton of coal, since a large volume of steam can be decomposed by a ton of coal. In one of the processes, to be referred to later, the average result of four months working was 67.71 lbs. coal and 3.22 gallons of crude petroleum to each 1000 cubic feet of gas; or one ton of coal and 106.5 gallons of crude petroleum produced 33,082 cubic feet of about 19-candle gas. Allowing 70 cubic feet for each gallon of petroleum, we have 7335 feet of the yield produced by the petroleum, leaving 25,745 cubic feet made from steam by one ton of coal, or more than double the yield from ordinary gas coal. This result was calculated from an entire make of 13,134,400 cubic feet in four months.

Water gas as thus made contains, as a rule, about 40 to 50 per cent. of hydrogen, 30 to 40 per cent. of carbonic oxide, about 10 per cent. of naphtha or petroleum gas, and a few per cent. of carbonic anhydride. Its specific gravity will be higher than that of coal gas, since so large a proportion of it is composed of the heavy petroleum gas (sp. gr. = from 0.600 to 0.700), and carbonic oxide (sp. gr. = 0.967). The hydrogen, which is the lightest known gas (sp. gr. = 0.067), brings down the specific gravity of the mixture to usually between 0.500 and 0.600.

Comparison of Processes.—Such are the general principles upon which the manufacture of these three kinds of gas depends. As has been already mentioned, the so-called "water gas" is a mixture of the gases made from steam and petroleum. In the same way we may have a mixture of coal and petroleum gas, such as is made by the New York Mutual Company, the Chicago People's Company, and the Detroit Mutual Company. As the illuminating "water gas" is water gas enriched with petroleum gas, so that made by these companies is coal gas enriched with petroleum or naphtha gas.

It now remains to consider the relative value of gas made by these different processes. This will be done here only in a general way, since they can be compared in detail much better when describing the works and companies using the different methods.

In regard to quality, naphtha gas is the purest, since it does not contain any sulphur or ammonia; and, therefore, requires no purification. It is also the richest gas, being from 60 to 70 or 80 candle power, while common coal gas is only from 15 to 20 candle power. Owing also to its higher specific gravity, it burns much more slowly than coal gas, and is, therefore, more economical. In fact, we may say here, once for all, that the higher the specific gravity of a gas, the more economical it is for the consumer, other things being equal. Also the higher the candle power, the less gas has to be consumed to obtain the same amount of light. Thus one cubic foot of pure petroleum gas will give as much light as 4 or 5 feet of ordinary coal gas.

In regard to cost, there is, in the first place, a great saving in the handling of the material. The retorts do not have to be opened every few hours for the reception of the charge in the case of the petroleum, its introduction into the retort being continuous. A much larger amount of gas can be made from petroleum or naphtha in one retort than from coal. Hence a saving in both labour and wear and tear of works. About 10,000 feet of petroleum gas can be made daily with a single retort, while only about 5000 cubic feet of coal gas can be produced; and in regard to the labour, while 25,000 to 30,000 cubic feet of gas per stoker per day is considered a fair amount in a coal gas-works, 60,000 to 70,000 cubic feet per stoker per day is about the average amount in a petroleum gas-works.

Notwithstanding this saving, to which also should be added a great diminution in the cost of works for manufacturing pure petroleum gas, we do not consider it practicable or advisable in a large city like Boston, where coal gas has always been used, to change at once and use pure petroleum or naphtha gas, for several reasons. In the first place, every burner in the city used for consuming gas must be changed, since burners adapted to a 16 or 20 candle gas are totally unfit for burning a 60 to 70 candle gas. Those now in use are graduated to burn 4 or 5 feet per hour of gas which has a specific gravity of about 0.450. If a rich naphtha gas were burned with such burners, although less than the ordinary amount would be consumed per hour, it would give a very smoky flame. In those places where unmixed petroleum gas is used, the works are new and the fixtures contain burners suited to the gas, which permit only one or two cubic feet to pass through them per hour. It would be impossible to convert large works used for the manufacture of coal gas into works suitable for manufacturing pure petroleum gas. Then, too, the flame produced by petroleum gas burning in an appropriate burner is a very small flame, and one which, in our opinion, would not prove satisfactory to consumers who had been accustomed to the larger coal-gas flames, the fact that the smaller flame gives an amount of light equivalent to the larger coal gas flame not being appreciated.

It has been stated as one of the principal objections to the use of petroleum gas in any form, that it injures the meters. This statement we cannot find substantiated, although we have made inquiries of the largest meter manufacturers in this country—viz., the American Meter Company, and W. W. Goodwin and Co., both of which firms have meters both to manufacture and repair for gas companies using naphtha gas.

There can be no doubt whatever that petroleum or naphtha gas can, at

the present price of petroleum, be made cheaper than coal gas of an equivalent illuminating power, on account of the saving in labour, in original cost of works, and in wear and tear of works; nevertheless we feel justified in saying that in the present state of public opinion, satisfaction would not be given by a pure, unmixed petroleum or naphtha gas in Boston.

Pure petroleum or naphtha gas is, however, very different from other gases, which are enriched with it. Practically coal gas, water gas, or air may be enriched with it, and it remains for us to consider its value as an enricher, as compared with coal gas made for that purpose.

In some places, it is customary, in order to avoid the necessity of changing the burners, to add air to the naphtha gas, in order to bring down its illuminating power to 15 or 20 candles. This, however, does not recommend itself to our judgment, since it is poor economy both for the consumer and the company. It is said that 1 per cent. of air will reduce the illuminating power of coal gas 6 per cent., or more than carbonic anhydride, the removal of which is considered necessary by all gas engineers for the sake of economy. Air is much heavier than even naphtha gas, and when the two are mixed, a very heavy gas is produced, which passes but slowly through the pipes and burners, and requires the application of great pressure upon the holders, in order to obtain the requisite pressure at the burner. It is this feature which we have especially to criticize in the manufacture of gas by the Detroit Mutual Company, their gas having a specific gravity of about 0.800, although about one-third of it is made from coal. Another great objection to this mixture is, that it is almost impossible to keep the gas uniform in quality, a slight excess of air creating so rapid a diminution of the illuminating power. The deterioration in quality is so great, that, unless the price of naphtha is very low, such a gas would cost more than a coal gas of equal quality, notwithstanding that air, which costs nothing, is sold at so much per 1000 cubic feet. Hence the failure at Saratoga, where the first attempt was made to manufacture illuminating gas from petroleum by the Gale and Rand process.

If, however, naphtha be used to enrich a combustible gas poor in illuminating power, the question becomes merely one of the value of enrichers. It may be used to impart light-giving properties to an absolutely non-luminous combustible gas, like the mixed hydrogen and carbonic oxide gases, or to enrich a poor quality of coal gas. In the latter case its value can be best ascertained by comparing it with one of the other substances used for enriching gas, and it cannot be compared to any greater disadvantage to itself than with the mineral Albertite. In order to do this, since naphtha is not sold by the ton or pound, it will be necessary to compare amounts which are equal in money value. It will be seen by the experiments reported above (vide pages 14 and 20*), that naphtha is far superior to the Albertite as an enricher. The yield from the Albertite was 14,694.4 cubic feet of about 55-candle gas per ton, which costs, say, 25.00 dols. (It cost the Boston Gaslight Company in 1875 more than that delivered.) Naphtha, at 10 cents per gallon (4.20 dols. per barrel), will yield for 25.00 dols., 19,872.5 cubic feet of 64.5-candle gas, or 5178.1 cubic feet more gas of a richer quality than a ton of Albertite. Moreover, 10 cents per gallon for naphtha has been an extravagant price. It cost, at the time of our visits in New York, 5 cents; in Detroit, 3½ cents; and in Chicago, 4 cents per gallon delivered.

Crude petroleum, at 12½ cents per gallon, would yield 14,542 cubic feet (and of rather a poorer quality of gas, so far as is shown by the few tests of illuminating power made), for 25.00 dols., or about the same amount as was obtained from Albertite. It may be said, in this connexion, however, that the result of the photometric tests with the gas made from crude petroleum does not agree with the results of others, and it is to be regretted that we were unable, owing to circumstances, to make further experiments.

In addition to this increase in the amount of gas made from the enriching material, we must take into account also the increased amount obtained from the ordinary caking coal. In enriching with Albertite, the coal with which it is mixed is distilled in an iron retort, at a comparatively low temperature; while, if naphtha be used, all of the common coal can be carbonized in a clay retort, which is acknowledged by all to be more economical, and all of the gas in the coal can be exhausted, so that nearly, if not quite, 1000 cubic feet more can be obtained per ton of coal than if distilled in the ordinary way. Mr. W. W. Greenough testified, in the hearing before the Board of Aldermen in 1874, that iron retorts were more expensive than clay, both because the first cost of the retort was greater, and because they did not last so long.

Where a large amount of gas is made, as in our large cities, the saving in labour is also very great. In the New York Mutual Works, for example, about 150 million cubic feet of pure naphtha gas are made annually, for the sole purpose of enriching. Now, one retort will make of naphtha gas about 10,000 cubic feet daily, or 3,650,000 cubic feet in a year. Only about 40 retorts, therefore, would be required to supply the total amount of enriching gas made by the New York Mutual Company in a year, while more than 80 retorts would be required to furnish the same amount of coal gas, since each retort will not make more than about 5000 cubic feet per day, or 1,825,000 in a year. (In the Boston Gas-Works, each retort averaged less than 4000 cubic feet per day, during 1875; the amount during three months of 1876 was, however, about 5500 feet.) Here is, therefore, a saving of the labour required to run more than 40 retorts for a year, a larger amount of gas from enriching coal being required, than from naphtha, to bring the finished product up to the same illuminating power, and less labour is required to manage the naphtha retorts. Thus, to make all of the naphtha gas made in the New York Mutual Works requires but one foreman, two gas-makers, two stokers, and two helpers—seven men—per day.

Now, let us compare the total amount of gas made per ton of coal. In the Boston Gas-Works in 1875 there were made 688 million cubic feet of gas from 71,872 tons of coal (including Albertite), or 9572 cubic feet per ton. In 1875 there were sold by the New York Mutual Company, 509,463,700 cubic feet of gas, and 38,000 tons of coal were carbonized. Of this 509 million feet, 141 million were made from about 2,104,500 gallons of naphtha, or 67 cubic feet per gallon. Reckoning naphtha at 10 cents per gallon (it really cost 5 cents in New York in 1875), this 141 million feet of enriching gas cost as much as 8418 tons of Albertite at 25 dols. per ton. Adding this amount to the 38,000 tons of caking coal carbonized, gives us 46,418 tons, producing 10,975 cubic feet per ton of 19 to 20 candle gas, as against 9572 cubic feet of 18 to 19 candle gas produced in Boston. In the case of the naphtha gas the calculation is made on the amount of gas sold. Reckoning the Boston gas with the Albertite enricher on the amount sold would give us 8779 cubic feet per ton—a difference of 2196 cubic feet per ton in favour of the naphtha. This difference is much greater, if we reckon the price of naphtha at what it really costs in New York—viz., 5 cents per gallon. In that case we have 12,070 cubic feet, or a difference of 3291 feet per ton.

In 1874 the New York Mutual Company made 432,477,700 cubic feet of gas from 29,455 tons of coal. Of this production, 118,766,100 feet were made from naphtha alone. The naphtha required to make this amount was equivalent in price, at 10 cents per gallon, to 7090 tons of Albertite at 25 dols. per ton, which, added to the caking coal, makes 36,545 tons, or 11,834 cubic feet to the ton, against 9572 cubic feet made by the Boston

* [These are the tables given in pages 315 and 316 of last week's JOURNAL.—J. G. L.]

Gaslight Company in 1875; a difference of 2262 cubic feet per ton of coal in favour of the naphtha.

To explain this difference we have the fact, which has already been alluded to, that the common caking coal can be exhausted of its gas, so that between 10,500 and 12,000 cubic feet can be obtained per ton. This is easily shown from the above figures of the New York Mutual Company, the accuracy of which we can vouch for. In 1874, 313,711,600 feet of gas were made from the coal alone, 29,455 tons being carbonized, or 10,650 cubic feet per ton. In 1875 about 368 million feet of coal gas were sold, which gives 9684 cubic feet of coal gas sold per ton of coal. During one month the average amount made from coal alone was 11,173 cubic feet. This coal gas without the enricher would not be suitable for burning, since it has an illuminating power of only 9 or 10 candles.

The two great objections usually urged against the use of petroleum or naphtha to any extent in the manufacture of gas are (1) the danger in storing it in large amounts; and (2) the liability to such a diminution in its production as to raise the price so that it could not be used economically.

In regard to danger, we may say that the gas itself which is made from petroleum or naphtha has precisely the same properties as coal gas. It is, if there is any difference, less dangerous, on account of containing a larger proportion of carbon, and, therefore, requiring admixture with more air to render it explosive. The only trouble to be feared is in protecting the raw material from fire. There is no doubt that it is more difficult to extinguish burning naphtha than burning coal; but the statements that naphtha is like gunpowder (explosive), and as dangerous to store, are erroneous. When naphtha is ignited, it burns as other inflammable liquids burn—alcohol, for example; but it does not explode as gun powder does. In fact, it is almost impossible to mix naphtha vapour and air so as to make an explosive mixture, for the reason that when the proper amount of oxygen is present, the mixture is diluted with so large a bulk of inert nitrogen that it cannot be ignited. Were this not the case, there would be numerous reports of explosions and accidents from the use of gasoline gas-machines. In these, air is simply passed through the gasoline, which is one of the lighter products of petroleum, and in its passage takes up and carries with it a certain indefinite proportion of the gasoline vapour. Could an explosive mixture be formed, the use of these machines would have been abandoned long since. An explosive mixture can, however, very easily be formed with pure oxygen and gasoline or naphtha vapour. It is not just, therefore, to compare liquid naphtha with gunpowder, since there is nothing explosive in the nature of the former.

Naphtha can be stored as well as alcohol or any other inflammable fluid, and with perfect safety, if placed in a tank at a little distance from other buildings, as in the New York and Detroit Mutual Works, or in the West Chicago Works. The arrangement of the naphtha tank at the New York Mutual Gas-Works recommends itself to us as being preferable to that in the other works mentioned. There it is situated near the water's edge, and raised several feet above the level of the ground, so that, if a leak occurs, it can be easily got at and remedied. The bottom of the tank contains about six inches of water (naphtha, being lighter than water, floats upon it), and its top is provided with a chamber about six inches deep, which is filled with water. Stored in this manner, it is impossible for any dangerous conflagration to take place, since no large amount of the liquid could escape, unless the tank was completely shattered, as by lightning; and danger from this source can be obviated by surrounding it with a trench capable of containing all the naphtha in it. Should such an accident occur, the result would be no more disastrous than if it had happened to a gasholder. The naphtha would flow out into the trench, and quietly burn away until exhausted. If the tank is situated near deep water, the naphtha can be pumped from the oil-boats into it without any exposure to the air whatever. In Chicago and Lowell the tank is underground, and in Detroit it is situated upon a pier over the water. These methods do not recommend themselves to our judgment, since leaks cannot be as well taken care of in the former case, and in a great fire there would be danger to the wharves and shipping in the latter, if the tank should become broken, as naphtha burns as readily on water as on land.

If we examine the history of the petroleum production, we see no reason for fearing a failure to supply any demand which may exist in the future, and considering the large extent of oil-producing territory, which is at the present time well defined, embracing not only a wide district in Pennsylvania, but also in Eastern Ohio, Western Virginia, Kentucky, Indiana, and Western Canada, there seems to be no more danger of the failure of the supply of petroleum than of that of coal.

The following table* will show the progress of the petroleum business in the Pennsylvania oil regions, from its commencement up to 1875:—

Year.	Production. Bbl.	Average Price per Bbl. Dollars.	Average Price per Gallon. Cents.
1859 ..	3,200	—	31
1860 ..	650,000	—	16
1861 ..	2,113,600	2.73	6½
1862 ..	3,056,606	1.68	4
1863 ..	2,611,359	3.99	9½
1864 ..	2,116,182	9.66	23
1865 ..	3,497,712	6.57	15.7
1866 ..	3,597,527	3.73	9
1867 ..	3,347,306	3.18	7.6
1868 ..	3,715,741	4.15	10
1869 ..	4,215,000	5.85	14
1870 ..	5,659,000	3.80	9
1871 ..	5,795,000	4.35	10
1872 ..	6,539,103	3.75	9
1873 ..	9,879,455	1.84	4
1874 ..	10,910,303	1.17	2.8
Average.		3.48	8.3

From Jan. 1, 1869, to Jan. 1, 1875, about 5000 wells were drilled, producing 42 millions of barrels, at an average price of 2.91 dols. and giving a production to each well of 8400 barrels. The average life of a well appears to be a little more than two and a half years.

The opinion of those familiar with the petroleum trade is, that the depression which has existed, owing to the excessive production and consequent large storage in the oil regions, has ceased, and that the supply will be regulated to suit the demand, so that there will be less fluctuation in the price than heretofore. Also, as most of the territory is now in the hands of large operators, only a sufficient number of wells will be sunk to supply the demand, and the probabilities are that petroleum will remain pretty steady at about 10 cents per gallon at the wells. Undoubtedly the days of cheap oil—that is, 40 or 50 cents a barrel—have ended. Freight from the wells to Boston, including pipeage, is about 3 cents per gallon; so that, since naphtha, although it is subject to considerable fluctuation in price, is cheaper than crude petroleum, our estimates of naphtha at 10 cents per gallon cannot be far from correct, if it is obtained in large quantities.

* Second Geological Survey of Pennsylvania.

The pure water gas, having no luminous qualities, is, of course, unfit for illuminating purposes, but when enriched it gives a gas of good quality and with a varying illuminating power, according to the amount of petroleum used. Of petroleum as an enricher of water gas we need add nothing to what has already been said.

The objections to this gas advanced by its opponents are—(1) its high specific gravity; (2) its large proportion of the extremely poisonous gas, carbonic oxide; and (3) the fact that its manufacture is still in its infancy, and, consequently, that it has not as yet been proved to be a success.

In regard to its high specific gravity, all that need be said is, that it is not necessarily higher than that of rich coal gas, the specific gravity of the gas supplied by the New York Mutual Company reaching as high as 0.725, while that supplied by the Lowe process at Utica, New York, was found by Professor Würtz to be 0.571, and that by the Harkness process at New London was 0.683. If the carbonic anhydride is properly removed, there will be no trouble from this source unless, perhaps, to add a little more enricher to make up for the slightly smaller flame resulting from the passage of a smaller volume through the burners. At all events, the consumer is benefited by burning a smaller amount, and the company are benefited by having a less per centage of leakage. That is, however, true of all rich gases, and it will be seen to be true of the Boston gas, as compared with that of most of the other companies manufacturing from coal alone.

The second objection has much greater weight, and is in our opinion sufficient to entirely prevent the use of the mixed hydrogen and carbonic oxide alone for heating purposes, for the reason that, since it is devoid of odour, its escape from pipes and diffusion through the air of an inhabited room in dangerous amount could not be detected. The addition to it of petroleum gas as an enricher for illuminating purposes at once imparts to it a peculiar odour, as strong as that of coal gas, which would lead to the immediate detection of a leak.

In reference to the poisonous nature of this gas, the constituent carbonic oxide is one of the most active poisons, producing when inhaled speedy death. It does not act like carbonic anhydride, which, when it poisons, does so by merely preventing the entrance of air or oxygen into the lungs, as is the action of water in drowning, and persons can be as readily resuscitated after confinement in an atmosphere of pure carbonic anhydride as after confinement under water. Moreover, accidents from this gas can readily be prevented by a moderate dilution with atmospheric air. Carbonic oxide, on the other hand, is a true physiological poison, producing death almost as readily when diluted as when pure. It forms a compound with the red colouring matter of the blood, which is much more stable than that formed by carbonic anhydride, and cannot be readily decomposed by oxygen. "Carbonic oxide is a gas of so poisonous a character that, according to Leblanc, one volume of it diffused through 100 volumes of air totally unfits it to sustain life; and it appears that the lamentable accidents, which too frequently occur from burning charcoal or coke in braziers and chafing-dishes in close rooms, result from the poisonous effects of the small quantity of carbonic oxide which is produced and escapes combustion; since the amount of carbonic anhydride thus diffused through the air is not sufficient in many cases to account for the fatal result."*

When it was proposed to supply the Hôpital des Invalides in Paris with water gas, a commission was appointed, consisting of Messrs. Dumas, Chevreul, and Regnault, eminent chemists, to investigate it. They found that it contained from 34 to 40 per cent. of carbonic oxide, and reported "that it would be dangerous to the occupants of the institution to introduce, even by way of experiment, gas obtained from the decomposition of water according to the Kirkham process."†

In the report of M. Pelouze‡ to the Municipal Council in June, 1854, there occur the following passages in relation to the gas of the Cormier Company:—

By this mode of manufacture we still obtain hydrogen mixed with carbonic oxide. Consequently all that has been said respecting carbonic oxide applies to the process of M. Cormier; and that being so, the use of this gas should be forbidden. As this gas is not mixed with any volatile oil, and is delivered for consumption without being carburized, it has no smell.

Dr. Letheby§ says:—

Seligue, in 1840, obtained permission to use the gas in the towns of Dijon, Strasburg, Antwerp, and two of the faubourgs of Paris and Lyons. At Strasburg an accident occurred which put a stop to its use. The gas escaped from the pipes into a baker's shop, and was fatal to several persons; and not long after an aeronaut, named Delcourt, incautiously used the gas for inflating his balloon. He was made insensible in the car, and those who approached to render him assistance fainted and fell likewise. The use of the gas has, therefore, been interdicted on the Continent.

In view of these facts, we cannot consider the use of water gas as safe as that of coal or naphtha gas. The addition to it, however, of petroleum gas greatly diminishes the danger by imparting to it a very powerful odour. No accidents have, so far as we are aware, yet occurred in those works in this country where water gas has been manufactured. Prof. Würtz, in his report upon the "Lowe Gas Process," at Utica, N.Y., says:—

I was surprised to find among the men constantly exposed to the inhalation of the pure water gas itself—those employed in feeding and manipulating the generators, whose work was often over the opened generators—I could obtain no support for the universal opinion as to the necessarily baneful action of the water gas. These men had observed a little headache and vertigo, when they had first exposed themselves to the inhalation of the gas in this way; but in a few days it "wore off, and they never observed it now."

I would, however, make the obvious reservation, that this is only negative evidence, and would not justify rash exposure to this gas without care and precaution.

Experimentally carbonic oxide can be removed by heating to a high temperature in contact with an excess of steam; but that this is accomplished in any of the processes used for making water gas on a large scale, we are unable to say. It would be more likely to be thus destroyed in the Lowe process than in any other, since an excess of steam passes with the gas through the superheaters, Prof. Würtz having found 413.95 grains of steam in 100 cubic feet of gas, just after it issued from the superheater. The amount of carbonic oxide, however, was not determined by eudiometric analysis. The carbonic oxide is not destroyed by the Harkness process, more than 40 per cent. having been found by H. H. Edgerton, by eudiometric analysis.

Coal gas has a certain amount of carbonic oxide in its composition, varying from 5 to 10 per cent., but in water gas the amount is usually from one-third to one-half of the entire volume.

In regard to the third objection, that its manufacture is yet in its infancy, and has not yet been proved to be a success, we must say that this is true to a certain extent; that is, water gas has not yet been manufactured on a very large scale. There are several different processes now in use in the United States. The Gwynne-Harris process is in use in Poughkeepsie, N.Y.; the Lowe process was in use in Utica, N.Y., until the works were destroyed by fire; and the Harkness process supplied, until recently, a part of the gas for New London, Conn. The works at Utica are being rebuilt; and we are informed that works are nearly completed for the supply of

* Bloxam's "Chemistry," p. 118.

† Report of the Committee on Public Buildings and Grounds, U.S. Senate, from London JOURNAL OF GAS LIGHTING, June 10, 18 6.

‡ Ibid.

§ London JOURNAL OF GAS LIGHTING, May 20, 1862, p. 335.

water gas by the Lowe process in one of the districts of Philadelphia—Manayunk.*

In these places the amount of gas required is not so large by several hundred times as that manufactured in the larger gas-works in our cities, and none of the processes for the manufacture of water gas have yet been adopted by any of the large gas companies in Europe or America, although the making of water gas has been subjected to investigation, experiment, and trial for more than 20 years. It does, however, appear to have been much more successful in this country than in Europe, probably on account of the introduction of petroleum, which affords a cheap and adequate means of enriching it with luminants, and which may at no distant time make a very great difference in the success of its manufacture. Formerly the illuminating power was obtained by introducing into the non-luminous flame metallic platinum, or by mixing it with rich gas obtained from peat, resin, or some other carboniferous material.

The results which have been obtained in the above-mentioned places will be spoken of later, but we do not think that the experiments have as yet been continued for a sufficiently long time, or on a sufficiently large scale, to warrant our recommending the adoption of any of the water-gas processes in works of a size sufficient to supply the city of Boston.

(To be continued.)

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The previously reported quietude in almost every branch of the iron trade has prevailed during the past week, and, at the time of writing, there does not appear to be any prospect of an early improvement. It is true that many business men are hopeful, now that the Eastern Question appears to have entered upon a more pacific phase, and think that, as soon as Russia's intentions are officially announced, there will be an immediate and considerable alteration for the better. This, however, is as yet wholly problematical, and the bare fact remains that in many departments the iron trade never was worse. Hoping against hope has lasted for a long time, but in practice the time must come for a stoppage, when manufacturers have made it a rule to keep their works going at an ascertained selling loss, rather than set down their machinery at a loss which may be ruinous. Under these circumstances the coming few months are likely to be very trying to the stability of many small houses. At the present time there is a tendency to restrict the production of pig iron, in consequence of the very heavy stocks held in Scotland, and a disposition on the part of the smelters to accept rather less money on current deliveries. Some few of the foundries—both of iron and brass—are well engaged; but houses having nothing but a general trade to depend upon are not in a thriving condition. Pipes, colliery castings, and special articles for various engineering purposes, are in most request.

In the coal trade there is a deep and growing stagnation, except in respect of slack, which is scarce and dearer. Owing to the limited output this state of affairs is likely to become intensified as the year grows older.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The frost has not been of long enough duration to have any material effect upon the coal trade of this district. All classes of round coal continue plentiful and difficult to sell, the inferior sorts being a complete drug, owing to the very limited requirements either for home, manufacturing, or shipping purposes, and there is a good deal of underselling to secure orders. The better classes of burgy move off pretty freely at late rates, but the common sorts are still being pushed in the market. Slack continues to stiffen in price, not so much, as I have pointed out in previous reports, from any really great increase in the demand, although colliery proprietors are now more pressed with orders than they have been of late, but owing more to the present smallness of the production, and better prices are obtained without difficulty, whilst coalowners are altogether averse to quote for forward delivery, as it is anticipated that this class of fuel will be both scarce and dear during the summer. The average pit prices may be given as under:—Good Arley, 9s. 6d. to 10s. 6d.; common ditto, 9s.; Pemberton four-feet, 8s. 6d. to 9s.; common coal, 7s. to 7s. 6d.; burgy, 5s. 6d. to 6s.; and slack 3s. 6d. to 4s. 6d. per ton.

In the iron trade there has been very little doing, and prices, although nominally without change, are weaker. Lancashire makers are unable to secure any new orders consequent upon the low prices at which north country brands are offered here, and in the finished iron trade there is also very keen competition for what few orders are in the market. The quotations for Lancashire pig iron are the same as those last given, and in finished iron Staffordshire bars, delivered into the Manchester district, are quoted at £7, and Lancashire, Sheffield, and Middlesbrough ditto, £6 15s. to £6 17s. 6d. per ton.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England was just a shade more lively last week. The sharp and cold days in the early part of it threatened a spell of cold weather, and house coals became firmer in the market. But there was not a great deal in it. The Sound and lower parts of the Baltic are opening, and a trade in gas coals to some of the larger German ports has sprung up. The shipments of all classes of coals from the Tyne dock would amount to 30,000 chaldrons last week. There is a little better inquiry for manufacturing and small coals, and the shipments are improving with the early prospect of trade with the Baltic this year. Steam coals occupy no better position in the market. There is a prospect that these sorts of coal will fall in price, but the reduction cannot be very much—for without a reduction of wages they could not be produced at a profit. The ordinary production of the Northumberland steam collieries is not one-half the average, and the pitmen continue to feel the pinch of bad times.

The principal portion of the coasting coal trade is carried on with steamers, and freights are extremely low. They never were lower at this time of the year. Notwithstanding the fact that there are not many handy sailing vessels in the coal ports seeking engagements, they are more than enough for the trade. The Mediterranean business is quiet.

There is somewhat more business doing in the manufactured iron trade. The general manufacturing trade is quiet. Very little more than half the ordinary quantity of goods are being shipped on the Tyne for the Continent.

The chemical trade of the Tyne is without change.

Our "Trade Notes from Scotland" have not arrived this week.

NATIVE GUANO COMPANY, LIMITED.—A petition for the winding up of this company has been presented to the Court of Chancery by a contributor, and the parties are to be heard thereupon before Vice-Chancellor Malins, on the 16th inst.

QUALITY OF THE BIRMINGHAM GAS.—The reports of Mr. Thomas Jackson, the gas examiner, show that during the month of February, at the four gas-making stations of the corporation, sixteen examinations were made of the illuminating power of the gas supplied to the borough. The maximum light in sperm candles was 17·91; minimum, 16·80; average, 17·81. The parliamentary standard is fifteen candles, with Sugg's No. 1, "London" burner.

NORMANTON GAS AND WATER COMPANY.—The half-yearly meeting was held on Saturday, the 24th ult.—Mr. J. H. Westerman, of Wakefield, presiding. The report, which was a satisfactory one, was adopted, the dividend declared being at the rate of 6 per cent. It was stated that the profits would have yielded a little more dividend, but the directors thought it safer to add to the reserve-fund. The retiring directors, Messrs. J. H. Westerman and John Connor, were unanimously re-elected, and the proceedings terminated with the usual vote of thanks.

KIRKBY LONSDALE GAS COMPANY.—The ordinary half-yearly meeting was held on Tuesday, the 20th ult.—Mr. W. Dodd in the chair. The accounts showed a balance of £273 8s. 1d., which the directors recommended should be disposed of as follows:—A dividend at the rate of £7 10s. per cent. per annum, which would absorb £210, carry £50 to the reserve-fund, and leave the balance of £13 8s. 1d. to be carried forward to next year's accounts. The directors proposed to reduce the price of gas to 6s. 6d. per 1000 feet after the 31st inst. The report was adopted, the retiring director (Mr. Dodd) was re-elected, and Mr. W. James was appointed in place of Mr. Pearson, who did not seek re-election. Votes of thanks were afterwards given to the chairman and to the manager of the works, Mr. Airth.

REDUCTIONS IN THE PRICE OF GAS.—The shareholders of the Great Grimsby Company, at their meeting on the 22nd ult., resolved, upon a recommendation to the directors, to reduce the price of gas on the 1st prox., from 4s. 2d. to 3s. 9d., this being the second reduction within two years. At Kirkby Lonsdale the price will be reduced to 6s. 6d. at the same time, and at Canterbury to 3s. 9d. The Batley Town Council have approved a resolution of their Gas Committee to allow a discount of 3d. per 1000 cubic feet to large consumers at Soothill. The Local Board of Horncastle have made a reduction of 3d. per 1000. At a meeting of the Stockport Corporation Gas Committee on the 22nd ult., it was resolved that the price of gas inside the borough be reduced from 4s. to 3s. 7d. per 1000 for consumption under 500,000 cubic feet, and 3s. 6d. per 1000 exceeding 500,000; outside the borough, that the price be reduced from 4s. 8d. to 4s. 3d. per 1000 feet over 500,000, 4s. for over 500,000 and under 1,000,000, and 3s. 11d. over 1,000,000. These reductions are to take effect from the 1st of January last. The gas supplied by the corporation is entirely made from cannel, and has an illuminating power of 22·5 candles.

THE GAS QUESTION AT BISHOP AUCKLAND.—For some months the chief topic in Bishop Auckland has been the question as to whether the town should be supplied with gas by the present company, or whether the Board of Health should purchase or erect works of their own. Some time ago overtures were made by the local board, and an application on the subject was made to the Local Government Board. No arrangement could be come to between the gas company and the local board, and the latter applied for a Provisional Order, whilst the gas company are asking Parliament for an Act to empower them to supply the town and district with gas. A fortnight ago a public meeting of the ratepayers was held to consider the question as to whether or not the gas company's Bill should be opposed by the local board. The meeting was almost unanimously in favour of a resolution to oppose the Bill, but at the conclusion a poll was demanded. During the past week voting papers were issued to the ratepayers, and the result showed 1173 votes in favour of the board, against 440 for the gas company. There is now every probability that the gas company will not persevere with their Bill.—*Newcastle Daily Journal*.

A WORKMAN POISONED BY GAS AT LEITH.—On Wednesday last, an accident happened on the premises of the Edinburgh and Leith Gas Company, Canonmills. George Peattie, aged 60 years, and foreman in the smith department of the company's works, was sent with other workmen to repair one of the large pipes which convey the gas from Leith to the gas-holders at Canonmills. To this end a deep opening was made in the ground near one of the gas-holders, and the inflow-pipe laid bare. Air bladders are usually employed in preventing the escape of the gas when the large pipes are opened, and a bladder had been inserted in the pipe exposed during the operations. It would appear, however, that the bladder had not effectually stopped the leak, and the rush of gas outwards was so great that Peattie was speedily overcome. Two labourers who were working in the pit made their escape before the gas had affected them to a dangerous degree. Assistance was procured, and Peattie, who had become insensible, was drawn from the pit. In a short time he recovered consciousness and after drinking some lemonade, was able to walk about the yard unassisted. His fellow-workman in a few minutes missed him again, and on a search being made Peattie was found in a tool-house insensible. He was carried to the New Town Dispensary, and thence by a cab to the Royal Infirmary, but he died shortly after admission.—*Scotsman*.

AUDLEY (STAFFS.) GAS SUPPLY.—It has been considered desirable to erect gas-works in Audley for the purpose of supplying gas to that and adjacent districts. As the Kildgrove Gaslight Company have powers under the Act of 1871 to supply gas to the whole of the parish of Audley, they were communicated with as to whether it was their intention to supply gas to the parish of Audley further than the parish district of Talke. The company expressed their willingness to release the local board their powers to supply gas to the parish of Audley beyond the district of Talke, on a line of boundary decided upon between themselves and the local board. A line having been decided upon, an application was made to the Local Government Board for their approval of the same. A letter has been received in reply, stating that before their sanction could be given to the proposed arrangement it would be necessary to hold a local inquiry by one of their inspectors, notice of which would in due course be given. At the meeting of the local board on the 14th ult., resolutions were passed to the effect that it was desirable that gas-works should be erected, and that application be forthwith made to the Local Government Board to sanction the purchase of the above-named right of the Kildgrove Gaslight Company for a nominal consideration; that the Local Government Board be requested to sanction the leasing of a quantity of land, part of the Wynne Bank Farm, Audley, for a term of not less than 99 years, at an annual rent of £20; and that application be also made to the Local Government Board for permission to borrow a sum of money not exceeding £5000 for the purpose of establishing gas-works, such sum to be redeemable in 30 years; and the clerk of the board was directed to make all necessary arrangements in the matter.

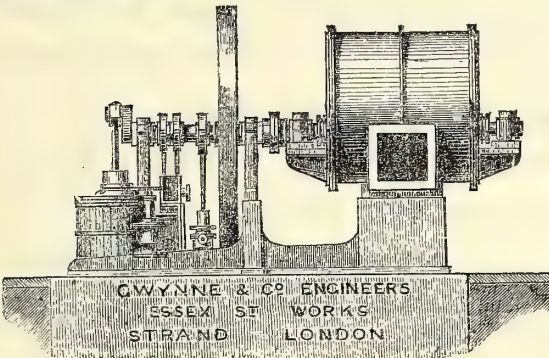
* The manufacture of gas by the Lowe process has been in operation at Manayunk since Aug. 5, 1876.

Share List of Metropolitan Gas and Water Companies.

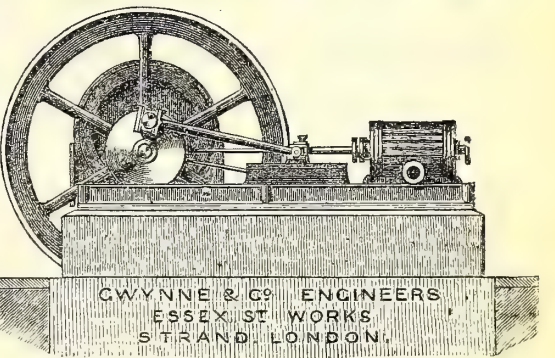
(Corrected by Mr. F. N. GOLDING, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.
10000	20	GAS COMPANIES.	£ s. d.	£ s. d.	£	5000	£	GAS COMPANIES.	£ s. d.	£ s. d.	£	9000	£	GAS COMPANIES.	£ s. d.	£ s. d.	£
5000	20	Anglo-Romano . . .	20 0 0	9 0 0	20-22	5000	10	Hong Kong (Lim.)	10 8 0	10 0 0	163-173	4	10000	United General . . .	4 0 0	2 10 0	3-83
1000	20	Bahia (Limited) . . .	20 0 0	2 0 0	14-16	50000	50	Imprl. Continental	43 15 0	9 10 0	93-95	10	15000	Wandsw. & Putney	10 0 0	10 0 0	19-20
1000	20	Do., do., redeem.	20 0 0	2 0 0	25-27	250000	Sk.	London	100 0 0	10 0 0	210-213	10	1500	Do.,	10 0 0	7 10 0	11-12
1500	20	Do., 2nd pref.	20 0 0	7 10 0	21-22	150000	Sk.	Do., 1st pref.	100 0 0	6 0 0	138-142	2957	10	Do.,	10 0 0	7 0 0	..
40000	5	Bombay (Limited).	5 0 0	7 10 0	71-73	14450	Sk.	Do., 2nd pref.	100 0 0	6 0 0	..	993	10	Do.,	3 0 0	7 0 0	..
10000	5	Do., fourth issue.	4 0 0	7 0 0	51-53	4350	Sk.	Do., 3rd pref.	100 0 0	6 0 0	..	16000	5	West Ham	5 0 0	10 0 0	8-83
10000	20	British (Limited).	20 0 0	10 0 0	41-43	7622	25	Do., A shares.	12 10 0	6 0 0	33-34	10000	5	Do., new shares .	2 10 0	10 0 0	3-4
7500	20	Cagliari (Limited).	20 0 0	5 0 0	16-17	268057	All	Do., Debent. stk.	100 0 0	57. & 61.	..						
550000	Sk.	Commercial	100 0 0	10 0 0	215-220	15090	5	Malta and Mediter-	5 0 0	2 0 0	23-3						
70000	100	Do., 7 per cent.	..	..	150-155			anean (Limited).	5 0 0	7 10 0	5-53						
20000	20	Continental Union.	20 0 0	6 0 0	223-232	6000	5	Do., preference	5 0 0	7 10 0	..						
10000	20	Do., new	12 10 0	6 0 0	13-2pm	20000	5	Mauritius (Limited)	2 0 0	..	1-1						
10000	20	Do., preference	20 0 0	7 0 0	26-28	25000	20	Monte Video (Lim.)	20 0 0	8 0 0	19-193						
75000	Sk.	Crystal Palace Dis-	..	..	..	8000	10	Nietheroy, Brazil	10 0 0	3 10 0	..	12000	100	WATER COMPANIES.			
		trict	100 0 0	10 0 0	215-220			(Limited)	10 0 0	3 10 0	..	1800000	100	Chelsea	100 0 0	6 0 0	155-156
125000	Sk.	Do., 7 per cent.	100 0 0	7 0 0	150-155	300000	5	Oriental (Calcutta).	5 0 0	9 10 0	81-83	100	100	East London . . .	100 0 0	6 0 0	158-161
50000	Sk.	Do., preference	100 0 0	6 0 0	135-140	30000	5	Do., new shares .	3 0 0	9 10 0	21-23	8000	50	Grand Junction . .	50 0 0	5 0 0	77-80
23400	10	European (Limited)	10 0 0	10 0 0	183-191	10000	5	Ottoman (Limited).	5 0 0	3 0 0	23-3	5840	25	Do., 4 shares . . .	25 0 0	5 0 0	362-373
12000	10	Do., new shares .	7 10 0	10 0 0	7-8pm	17500	10	Para (Limited) . .	10 0 0	7 0 0	5-51	2160	25	Do., new ditto;			
35400	10	Do., new shares .	5 0 0	10 0 0	51-53pm	27000	20	Phaniz	20 0 0	10 0 0	44-46			max. div. 7 1/2 p.c.	25 0 0	5 0 0	32-34
37977707	Sk.	Gaslight & Coke A.	100 0 0	10 0 0	217-220	560000	100	Do., new	60 0 0	7 10 0	100-105	547960	100	Kent	100 0 0	8 0 0	177-182
100000	Sk.	Do. B	100 0 0	4 0 0	84-88	144000	Sk.	Do., capitalized.	100 0 0	5 0 0	105-110	970	100	Lambeth	100 0 0	6 5 0	151-157
30000	10	Do. 5 per ct. pref.	..	..	..			Do., new, 1876.	20 0 0	10 0 0	33-35	1161	100	Do., max., 7 1/2 p.c.	100 0 0	6 5 0	152-155
		conv., 3rd issue.	all	5 0 0	203-21	36000	20	Rio de Janeiro (L.)	20 0 0	10 0 0	33-35	442	100	New River	100 0 0	7 0 0	183-195
50000	10	Do. do., 4th do. . .	6 0 0	5 0 0	93-10pm	7359	5	Singapore (Limited)	5 0 0	7 10 0	51-53	4475	100	Do.,	60 0 0	7 0 0	150-155pm
50000	10	Do. do., 5th do. . .	2 0 0	5 0 0	83-91	2000	5	Do., preference	5 0 0	7 10 0	53-63	400000	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	161-163
200000	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	228-233	1500	323	Shanghai	32 10 0	12 0 0	30-32	3036	100	Southwark & Vauxh.	100 0 0	4 0 0	113-118
300000	"	Do. D	100 0 0	10 0 0	228-233	4000	50	South Metropolitan	50 0 0	10 0 0	114-119	1296	100	Do., pref. stock .	100 0 0	5 0 0	113-118
165000	"	Do. E	100 0 0	10 0 0	228-233	4000	123	Do.,	12 10 0	10 0 0	28-29	..	100	Do., 4 shares . . .	100 0 0	4 0 0	112-115
300000	"	Do. F 5 do. do. . .	100 0 0	5 0 0	114-116	20000	123	Do., new shares .	10 10 0	10 0 0	123-133	..	100	Do., 43 preference	100 0 0	4 10 0	156-168
60000	"	Do. G 7 1/2 do. do.	100 0 0	7 10 0	163-170						pm.	..	100	Do., new ordinary	..	..	..
1300000	"	Do. H	100 0 0	7 0 0	153-156	15000	10	Surrey Consumers.	10 0 0	10 0 0	213-223	1600	100	Do., new ord. No.1	40 0 0	4 10 0	106-108
6200	5	Georgetown, Guiana	5 0 0	5 0 0	..	10000	10	Do., new	8 0 0	10 0 0	92-103 p.	12172	61	West Middlesex . .	61 0 0	6 1/2 p.sh.	139-142

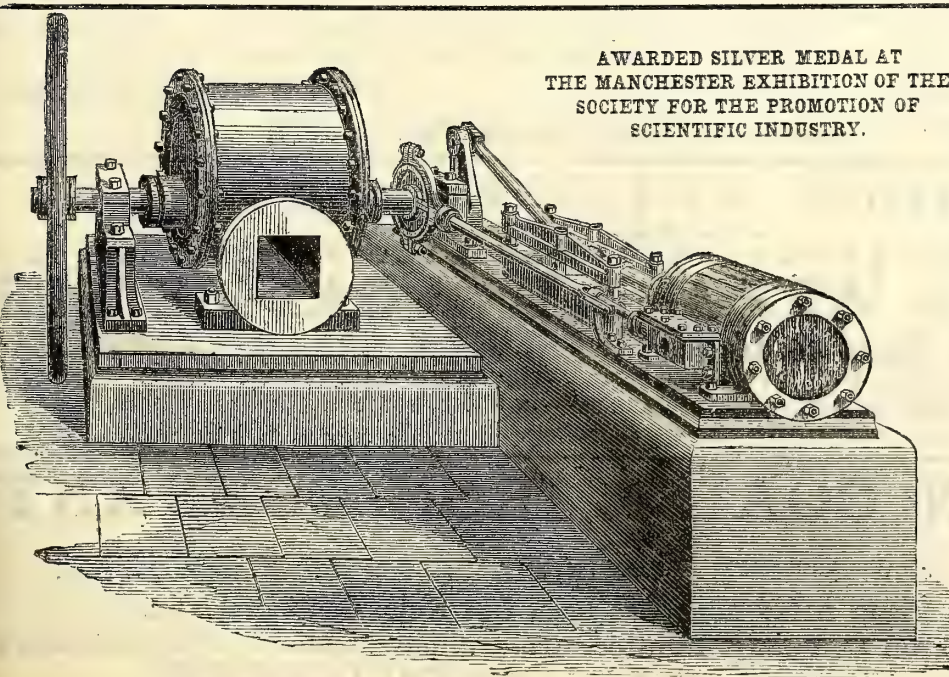
The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS. GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship." GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour. 52,500 EXHAUSTER, with Horizontal Engine combined. GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past. Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes. PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND. G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines, with many others of all Sizes.



BEALE'S Improved Patent GAS-EXHAUSTERS WITH ENGINES COMBINED. Sole Makers, GEORGE WALLER & CO. Makers of ENGINES, EXHAUSTERS, INDEX and DISC GAS-VALVES, HYDRAULIC MAIN VALVES, BYE-PASS VALVES. TAR, LIQUOR, and other PUMPS, SCRUBBERS and PURIFIERS, CONDENSERS, BOILERS, &c. PHOENIX ENGINEERING WORKS, HOLLAND STREET, S.E., AND STROUD, GLOUCESTERSHIRE.

WANTED, a situation as Working MANAGER in a small Gas-Work. Well up in main and service laying, and all fittings, indoor or out. Apply to E. Rook, Gas-Works, PETERSFIELD.

SKIPTON GAS COMPANY.
WANTED, Tenders for fifteen Clay RETORTS, "D" shape, say 16 in. by 14 in. and 7 ft. 6 in. long, delivered free at Skipton Station.

WANTED, by the Advertiser, a situation as RETORT SETTER. Can do general repairs in Gas-Works. Will take piece-work if required. A good reference can be had. Address W. G., Post Office, Weston, Bath.

TO GAS STOKERS.
WANTED immediately, a good Gas STOKER; one accustomed to brick ovens preferred. Apply, stating wages required, to T. LAYTON, Manager, Gas-Works, REDDITCH.

METER REPAIRER.
WANTED, at the Reading Gas-Works, a steady and experienced METER REPAIRER. Used to both Wet and Dry Meters. The situation is a permanent one. Apply, stating age, experience, and wages required, to Mr. E. BAKER, Engineer.

WANTED, by a thoroughly experienced WORKING MANAGER, aged 31, a situation where remodelling or extension of plant is required. Has had large experience on holders, fitting up and erecting all kind of gas apparatus. Good carbonizer. Testimonials and references. Address No. 350, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE.
A Set of 8-in. Vertical Condensers, with Tar-Box and all connexions complete, containing about 180 ft. of pipes. May be seen and price obtained on application to H. and F. BAILEY, Engineers, EAST RETFORD.

FOR SALE, a Set of 6-in. Vertical CONDENSERS, with tar-box and all connexions complete. May be seen, and price obtained, on application to the Southbank and Normanby Gaslight and Coke Company, Limited, Southbank, YORKSHIRE.

TO BE SOLD, Four Cast-Iron Purifiers, 6 ft. square, with hydraulic centre-valve; also Ten 18-in. round, and Sixty-two 15-in. round Retort Mouthpieces, and Forty-seven 6-in. H-Pipes. Apply to W. WINSTANLEY, Manager, Gas-Works, NEW-CASTLE-UNDER-LYME.

HAMPTON COURT GAS COMPANY.
TO BE SOLD cheap, as they stand, Four Cast-Iron PURIFIERS, 8 feet square, with wrought-iron covers, wood sieves, columns, girders, and lifting apparatus complete; and 8-inch Hydraulic Centre Valve and connexions, all in good condition. Apply to Mr. E. PRICE, Engineer, Gas-Works, HAMPTON WICK.

GASHOLDER FOR SALE.
THE Directors of the City of Durham Gas Company are prepared to receive TENDERS for the purchase and removal of a 70 ft. by 20 ft. Single-Lift GASHOLDER, with 6 Cast-Iron Tripods. Contractor to bear every expense connected with the transaction. Tenders, sealed and endorsed "Tender for Holder," to be lodged with me on or before Wednesday, the 7th day of March, 1877.

JOHN SUMMERS, Secretary.

THE Sheffield United Gaslight Company are desirous of receiving TENDERS for the building of the whole or a portion of forty-nine settings of through and through RETORTS. The clay retorts, bricks, fire-clay, and all material will be provided by the Company, the contractor to find all labour necessary for the erection of the settings complete. Plans and specifications of the work may be seen on application at the Offices of the Company. Tenders per bed of seven retorts to be sent in not later than the 21st inst., addressed to the undersigned. The Directors do not bind themselves to accept the lowest or any tender.

THOS. ROBERTS, Manager.
Gas Offices, Commercial Street, March 1, 1877.

Now ready, price One Shilling, No. 4 (to be continued Monthly) of

A TREATISE ON THE SCIENCE & PRACTICE OF THE Manufacture and Distribution OF COAL GAS.

LONDON: WILLIAM B. KING, 11, BOLT COURT, FLEET STREET,
OR OF ANY BOOKSELLER IN TOWN OR COUNTRY.

For the convenience of persons resident in remote districts, arrangements have been made by the Publisher to forward the "Treatise" by Post, securely packed on a roller, at the cost of the number and postage only—viz., 1s. 2d. Monthly, or 7s. for the Half Year.

TO MANUFACTURERS OF GAS-ENGINES, AND APPARATUS FOR COOKING & HEATING BY GAS.

The Directors of the South Shields Gas Company are desirous of drawing the attention of their Consumers to the economy and advantages of Coal Gas for other purposes than that of Illumination—to Boiling, Stewing, Baking, Roasting, and all purposes of Cooking; for Heating Halls, Staircases, and Apartments; for Laundry purposes, Drying and Airing Clothes, and Ironing; for Heating Baths; for Trade purposes; and for producing Motive Power.

To further this object, the Directors invite the co-operation of manufacturers of apparatus for such purposes. It is proposed to have

A PUBLIC EXHIBITION

On the 9th, 10th, and 11th of APRIL next,
IN THE
FREE LIBRARY HALL OF THE BOROUGH;

to have the apparatus tested, to put some of it in action during the exhibition, and to award a silver medal to each of the successful competitors in the following classes:—

1. The most efficient and durable of cheap Portable Stoves for Boiling, Frying, and Grilling, suitable for a mechanic's home.
2. The most complete Family Gas Cooking Stove.
3. The best Gas Bath, Consumption of Gas, Expedition of Heating, and Price being observed.
4. The most simple Closed Apparatus for Heating Halls or Conservatories, either by Hot Air or Water.
5. The most cheerful Open Gas Fire with the least Consumption of Gas.
6. The cheapest efficient Gas-Engine.

Manufacturers may compete in all the classes, but not more than two prizes will be awarded to one manufacturer.

The award will be made by a Committee of three competent persons appointed by the Company. The space being limited, though 80 feet by 40 feet, the Committee reserve the right of selecting or rejecting apparatus offered for exhibition. All apparatus must be delivered and removed free of cost to the Company, who will not be held responsible for any loss or breakage, though every care will be taken of the same by the Company's servants, who will arrange, fix, and work the apparatus unless otherwise desired.

Any suggestions for promoting the success of this movement will receive the attention of the Company's Engineer, to whom all communications are to be addressed.

W. J. WARNER, Engineer.

Gas-Works, South Shields, Feb. 15, 1877.

D. BRUCE PEEBLES & CO.,
ENGINEERS,
FOUNTAINBRIDGE WORKS, EDINBURGH,
MANUFACTURERS OF WET AND DRY GAS-METERS;
Patentees and Sole Manufacturers of "PEEBLES' GAS-GOVERNORS,"
FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS,
OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.

"These Lamp-Governors are so superior that they are likely to supplant all others."—Dr. Wm. Wallace, F.R.S.E., F.C.S.

THE WIGAN COAL & IRON COMPANY,
LIMITED.

DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN;

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known
HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

A. B.—A gas or water company desiring to obtain a Provisional Order under the Gas and Water Works Facilities Act, 1870, must give notice by advertisement, during the month of October or November, of their intention to apply to the Board of Trade for the purpose. The Order, if granted, will be included in a confirmatory Bill in the next session of Parliament. The Board of Trade fee, on deposit of the Draft Order, is £35. The Board, on application, will furnish printed instructions as to all necessary steps to be taken by a company. No company is safe without an Order or a special Act.

N. T.—Your communication is under consideration.

J. H. asks: "Can a gasholder be interdicted as a nuisance under the Public Health Act in Scotland, by its being within a certain distance of dwelling-houses?" We think not, but a Court of Equity may be moved for an injunction to restrain the erection.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 13, 1877.

Circular to Gas Companies.

On inquiry, the communication made to the Metropolitan Board of Works by the Board of Trade, relative to the testing-stations of the Metropolitan Gas Companies, proves to be anything but

lengthy. It is a very short letter, the substance of which we published last week; but another brief notice is required. The communication opens with a reference to previous correspondence, of which we have no exact knowledge, and then it goes on to mention, that the Board of Trade had suggested to the Parliamentary Agents of the Chartered Company the introduction into the Bill they are now promoting, of "a clause or clauses" "dispensing with the necessity of specifying the station from which the gas is delivered, before the forfeiture to which the Company may have made themselves liable can be recovered." It is added, "that the Board of Trade do not consider the difficulty, to which attention has been drawn, of sufficient importance to render the introduction of a public Bill for the amendment advisable." This opinion, however, is not shared by the Metropolitan Board of Works, who, at their meeting last Friday, passed a resolution requesting the Board of Trade to introduce a short Bill. So far there would seem to be no disagreement as to the necessity for the enactment proposed; and whether it be made by an addition to the Bill of the Chartered Company, or by a separate measure, is a matter of little consequence. The important thing to be decided is, as we pointed out last week, the basis on which the amount of the forfeiture is to be calculated. We do not believe that any forfeiture is likely to be incurred for any defect designedly caused; but accidents will happen, Local Authorities are cantankerous, Magistrates are capricious, and Gas Companies are considered fair game for plunder; so it is very essential that any alteration in the law shall distinctly set forth the mode by which the fine for any default is to be computed. It is clear, that if we cease to specify the station making default, the forfeiture can no longer be calculated on the amount of gas sent out from, or made at, any particular station on a given day. A radical alteration is necessary. The present system of assessing the fine must be altogether abolished. For the future, it must be enacted that the forfeiture shall be a lump sum for every half candle in default, irrespective of the amount of gas manufactured. That, we think, will remove all difficulty, and satisfy every one. We shall not here suggest any sum of money in which we think it might be fair to mulct the Company. We content ourselves with pointing out the imperative necessity for the alteration of the law, which, as it now stands, cannot be applied to the Chartered Company, unless the testing-places be removed to the several manufacturing stations. If that be done, the law may fairly remain as it is.

The concluding part of the letter from the Board of Trade suggests that the permanent officials are not particularly well acquainted with the circumstances of the Metropolitan Gas Companies. After stating that the proposed clause or clauses will remove all difficulty, so far as the Chartered Company are concerned, it goes on to say that, "in the case of the Commercial and South Metropolitan Gas Companies, the only other Companies concerned, and whose manufacturing stations are not numerous, it appears to the Board of Trade that the difficulty, which must be but slight, must stand over for the present." Now, the South Metropolitan Company have but one manufacturing station, and there is no difficulty at all. The Commercial Company have two, and we have no doubt that the mains from each communicate. But, however that may be, we claim equal laws for all the Companies concerned. If the Chartered Company be relieved in the way indicated above, which we believe is the only way in which it can be done, the other two Companies must be relieved to an equal extent, and this can only be accomplished by the introduction of a public Bill. For once we agree with the Metropolitan Board on a gas question.

The specific announcement is made, that the Metropolitan Board are opposing the Bill promoted by the Chartered Company to relieve themselves of the "sulphur" difficulty, and we understand that the Corporation of the City of London will join in the opposition. Both Company and Authorities are, so to speak, furbishing their arms, and the contest, we believe, will be second in interest to none which has preceded it in the history of gas manufacture. Necessarily, it will be mainly a chemical fight; but we shall not now point out the lines which the opposing parties will adopt. The broad question is, Does "sulphur" in gas do harm to man or materials, and, if so, in what way does it do mischief? This, we believe, is the proposition that will be put before the Committee of the House of Commons; and since the evidence will be very conflicting, and it is likely that no member of the Committee will ever have heard of the matter before he is called on to consider it, the decision may be waited for with some curiosity.

Earl Camperdown's Bill, intended to effect a reform in the constitution of the Metropolitan Board of Works, as everybody expected,

fell through. This well-intentioned young nobleman is not yet in a position to carry any measure of organic reform. If he persevere and exercise discretion, he is certain some day to be a Minister of State, and then he will be in a position to use with advantage the knowledge he is acquiring to-day as to the working and constitution of our Local Authorities. The debate on the Bill was, however, so far satisfactory that it evoked a pretty general expression of opinion that the time had come when something ought to be done to improve the Municipal Government of London. Earl Beauchamp's objection to any alteration in the mode of election was characteristic. He saw clearly enough that, if the Board were elected by popular vote, the majority of the present members would be sent home to mind their private affairs. We think this would be an advantage to the Metropolis; but the noble Earl said it would be a "waste of experience." London would survive it. What an awful "waste of experience" was caused by the last general election, and yet the government of the country goes on, and men with great reputations can hardly be said to be missed. *Il n'y a pas d'homme nécessaire*, said a Frenchman—Voltaire, we rather think; and if some who chatter in Spring Gardens were sent to mind their own businesses, a positive gain would be accomplished. The Board may be congratulated on one thing. They have acquired the services of an eminently practical permanent staff, and new members might be safely left to the guidance of these gentlemen until they are able to run alone.

An objection to an increase in the number of members of the Board struck us as singular, since the anomalies of the present system of representation have been sufficiently pointed out by Mr. Scott, Chamberlain of the City of London, and others. Forty-six members of the Metropolitan Board may be said to rule over property of the rateable value of £23,000,000, while in the City of London 280 Aldermen and Common Councilmen look after the affairs of a community rated at about one-sixth of that sum. They do something more, we know; but that does not affect our argument. Talking, some years ago, with an influential member of the Common Council, we objected to the large number of Councilmen, and suggested that a reduction in the number would effect an economy—at all events, in the item of dinners. The reply astonished us. We were told that large numbers was the only safeguard against jobbery. We felt bound to believe the statement, and although we do not say that the safeguard is required, we should be glad to see it extended.

We may call attention to the modest inaugural address of Mr. Hutchinson, the President of the Manchester Association of Gas Managers, printed in another column, in consequence of his brave defence of the rights of his fellow-managers. There are several instances in which, when a gas undertaking has been transferred from a Company to a Local Authority, good and useful men, past the prime of life, have been turned out into the cold with very scanty compensation, to get a living as they best could. This, as Mr. Hutchinson says, is not as it should be. If the manager in office be not worthy of confidence, by all means let his services be dispensed with; but, if competent, and of good character, it is the grossest injustice to get rid of him in order to make room for some friend of a Councilman. The post of gas manager is, perhaps, the most harassing that a human being can occupy, but no one has any pity on the occupant, who is always represented as earning a "princely" salary, and living in ease and luxury. We have quite recently seen it alleged, in print, against a gas manager, as almost a crime, that he had bought a picture. That years of honest labour, with prudent habits, should have enabled a man to accumulate capital, and that self-cultivation should have developed a taste for art, would, by every right-minded person, be deemed meritorious. Not so, we are told, in the case of a gas manager. His "princely" salary, it is said, comes out of the pockets of the public (what salary does not? we should like to know), and therefore the purchase of a picture by a gas manager is a proof that the public are being plundered. And this in a London newspaper!!

It is a very small affair, but we may mention that the Ilkeston Local Board have proposed to buy up the Ilkeston Gas Company, by paying £12 for each share of £10, with £6 10s. paid up. The Company have, we understand, declined this offer.

Farnworth is another very insignificant place, but it has an ambitious Local Board, who are anxious to start gas-works in the face of a Gas Company. We are sorry, on some accounts, that the Local Government Board will step in to prevent a waste of the ratepayers' money, for one or two shocking examples of the evils of competing works, so far as they affect ratepayers, might be useful.

Gas affairs are still exciting a good deal of attention at Leeds. The magistrates have recently discovered that Sugg's "London" Argand, No. 1, is used in testing the illuminating power of the

gas. The Leeds Gas Act contains a section which provides that the gas shall be tested with a fifteen-hole Argand, or other approved burner. We believe that these last words fully justified the gas officials of the Corporation in substituting the "London" Argand for the Sugg-Letheby burner. That the former is an "approved" burner, is shown by the fact that its use has been prescribed in almost every Gas Act passed within the last three years. It would seem, however, that the Gas Committee of the Corporation have given way on the point, and that Leeds gas will, in future, be tested by the Sugg-Letheby burner. Now, in view of the proposed increase of illuminating power to eighteen-candles, this is a very important matter to the Corporation, and, seriously speaking, we do not believe that the consumers will be in the least benefited. They will continue to use "rusty" burners, and the eighteen or twenty candle gas, which the Corporation send out will, in the consumers apparatus, yield the light of twelve candles, and, it may be, fewer. Thus the increase will result in a sheer waste.

The Leeds Chamber of Commerce also appear on the scene, and raise objections to the quality of the gas, which, however, they do not press; but one member urged, rather offensively, that the works, having cost the Corporation a million of money, should be placed under the control of an eminent engineer, cost what it might. In Mr. Woodall, the Corporation have an engineer of large experience and unquestioned ability and character, and the best thing the Corporation can do is to follow his advice, cost what it may.

The worst is that Corporations, and Gas Companies also, sometimes, will tinker when they ought to make complete renewals. Look at Mr. Newbigging's report on the Coleraine works. Badly situated to begin with, they have been starved, and not developed according to the requirements of the town. The result has been a serious loss in several directions, the worst being a leakage of twenty-four per cent., in consequence of mains of inadequate dimensions and badly-laid services. The porous soil in which these latter are placed makes it advisable that when they are re-laid, in accordance with Mr. Newbigging's suggestion, they should be embedded in pitch, according to the mode now practised by the Chartered Company.

The gas undertaking of the Corporation of Hereford has in the past year yielded a net profit of £3504, and the Gas Committee very properly report that they think a reduction of price should be made. They propose to take off sixpence per 1000 feet for the supply of public lamps, and threepence per 1000 to private consumers who pay promptly. The reduction, it seems, will only make a difference of £700 in the profits of the current year, so it is clear that the price might have been further lessened. This thought occurred to some members of the Corporation, but the report of the Committee was unanimously adopted.

The Corporation of Stockport are also reducing the price of their gas fivepence per 1000 all round. Differential rates are charged according to the amount of gas consumed. We must say that the rates outside the borough look to us excessive, but probably they can be justified.

The reports of meetings we publish continue to show the prosperous state of gas undertakings. The Dover Company pay a dividend of seven-and-a-half per cent. The Directors have been selling new shares by auction, and have realized premiums of fifty per cent., and they are about to repeat the operation. We have not the Dover Gas Act before us, and, therefore, we cannot say positively, but to the best of our recollection it contains no clause compelling the sale of shares by auction. Under these circumstances, we are disposed to contend that the Directors can only sell new shares with the consent of the general body of existing shareholders. If they choose to waive their legal right to participate in new issues at par, all well and good; we may commend the act of self-denial. We feel bound, however, to stand up for the rights of the shareholders, and to point out that the Directors are acting *ultra vires*, when they sell new shares by auction without the consent of existing holders.

CLEVEDON WATER COMPANY.—The half-yearly meeting was held on the 27th ult.—Sir A. H. Elton, Bart., in the chair. The report stated that the receipts for the past year amounted to £1272 4s. 6½d., being an increase on the previous year of £38, allowing of a dividend of 4½ per cent., free of income-tax, leaving a balance of nearly £20 to be carried to the credit account of 1877. The whole of the company's machinery had been inspected, and was in good condition.

EASTBOURNE GAS COMPANY.—The half-yearly meeting of shareholders was held on the 26th ult.—Dr. Jeffery in the chair. The report, which we published on the 20th ult., was received and adopted, and a dividend of 10 per cent. upon the £20,000 original capital of the company, and a bonus of 5 per cent. upon the same capital on account of deficiencies in dividends of former years, was agreed to. At the close of the ordinary business, an extraordinary meeting was held, when it was agreed unanimously to raise the sum of £5000 on account of the capital of the company, by the creation and issue of 500 additional "B" shares of £10 each. It was further resolved that the new shares be offered first to the present shareholders in proportion to the number of shares held by them.

Water and Sanitary Notes.

NOTWITHSTANDING the reports to the contrary, we believe that the supply of water to Richmond is in a most unsatisfactory state, and that it is likely to remain so for an indefinite time unless the amount furnished by the Vestry be supplemented from some other source. The inhabitants are becoming very impatient, and we have reason to believe that overtures have been, or will be, made to the Southwark and Vauxhall Company to restore the supply. We hope the Company will meet the town in a liberal spirit, and not repeat past errors. It seems that one of the submerged pumps in the well of the Vestry has already been recovered, and this would appear to indicate that when efficient pumping apparatus is applied, the well will soon be dry again. It is considered, however, that the bore-hole is not yet clear, and that further efforts may eventuate in a much larger yield of water. But when the reservoir of the Vestry will be filled—until which time the supply cannot be satisfactory—nobody seems to know. A short time ago we were told that it contained only a few feet of water, having a very unpleasant appearance, and it was thought desirable to pump this out before more was put in. Whether or not this has been done we do not know. In any case, the process of filling the reservoir goes on very slowly, and the dog days may arrive before the inhabitants of Richmond get a full supply of water from the Vestry.

There seems to be a probability that the undertaking of the Bristol Water-Works Company will pass into the hands of the Corporation of that city. Negotiations have been for some time in progress. The Corporation offered ten per cent. perpetual Annuities, but this offer the Company declined. For some years after the works were started, we believe, the Company paid no dividend. Then a three per cent. dividend was declared, which has gradually increased, until for the last few years ten per cent. has been paid, and the Company are now in a position to commence the payment of back dividends. Under these circumstances the Directors asked for Annuities of twelve per cent., terms to which the Corporation have given a qualified assent. They offer ten per cent. for the next five years, after which they will pay the additional two per cent. Doubtless this arrangement will be accepted, and the Bristol Water-Works Company will disappear. Despite the somewhat onerous conditions, we believe the Corporation will, in a very few years, become well satisfied with the purchase.

It is hardly necessary to say that, under the circumstances, the Corporation will oppose the Bill of the Bristol District Water Company, who seek to start a competing supply in the city and suburbs. We feel satisfied that Parliament would never have sanctioned the scheme, but the opposition of the Town Council definitively settles its fate. We shall have occasion to refer to the proposed purchase at a future time.

We are glad to see that the Corporation of Newcastle have agreed to withdraw their opposition to the Bill of the Newcastle and Gateshead Water Company on conditions which have been accepted. The Company, in their Bill, propose to complete the Hallington reservoir, which is to hold six hundred million gallons, within four years, and the Swinburne reservoir, calculated to hold one thousand million gallons, within the next ten years. The Corporation are anxious to have the larger storage completed first, and the Company have agreed to modify their Bill, so as to make it incumbent on them to complete the latter reservoir in four years, and the first-named within nine years; the Company have further engaged to separate the domestic and trade supplies by the 1st of September next; and so the Corporation and Company shake hands.

The Association of Municipal Officers have once more tried to persuade Mr. Cross to assist them in getting the Municipal Corporations (Borough-Funds) Act repealed. The Home Secretary, however, does not see it. He fails to recognize, in an appeal to the ratepayers, any infringement of the principles of Local Self-Government. We regret the results of the application of the Act in one or two instances, as we do the results of an appeal to a popular vote on a good many occasions. As regards the particular question under consideration, we must protest against the principle laid down by these Associated Municipal Officers, that a Town Council once elected shall be free to deal with the ratepayers money as they please. The House of Commons claims no such privilege.

INSTITUTION OF CIVIL ENGINEERS.—At the monthly ballot on the 6th inst., Mr. Jos. Hepworth, manager of the Corporation Gas and Water Works, Carlisle, Mr. C. W. Jones, Gas-Works, Milan, and Mr. T. H. Martin, engineer and manager of the Gas and Water Company, Barnet, were elected as Associates of the Institution. There are now on the books 897 members, 1665 associates, 15 honorary members, and 440 students; together, 3017 of all grades—an increase of 203 since the same date last year, or at the rate of 7 per cent. nearly.

WATER ORDERS FOR 1877.

THREE Water Companies have applied to the Board of Trade for Provisional Orders to enable them to raise additional capital.

The *Bridport Water-Works Company* apply for power to raise £8000 additional capital, and to borrow £2000. If the money be raised by the issue of preference shares, the dividend is to be limited to five per cent.

The *Burgess Hill and St. John's Common Water Company, Limited*, apply for authority to raise £10,000 additional capital, without further borrowing power. The Order, if granted, will also extend the limits of the Company, so as to include Hurstpierpoint and Clayton.

The *Ruthin Water Order* will authorize the Ruthin Water Company to raise £4000 additional capital, and to borrow £1000. The Order provides that the Company shall, within three years, make such alterations and improvements in their existing works as the Ruthin Town Council shall approve, the works being executed to the satisfaction of an engineer appointed by the Council, one-half of whose remuneration is to be paid by the Company.

There is only one mixed Gas and Water Order.

The *Pickering Gas and Water Order* is applied for by a new (limited) Company, formed to supply the township of Pickering with gas and water. The share capital is not to exceed £10,000. The Order will authorize the acquisition of land, and the construction and maintenance of works. As regards gas, it will provide for the supply of fourteen-candle power, the charge for which is not to exceed 7s. per 1000 feet. But this curious provision follows:—"If at any time the undertakers shall raise the price of gas above 5s. per 1000 feet, and the Local Board of Pickering give notice that they consider the increased price too high, then, if within two months the Company and the Board do not come to some agreement, the question of price is to be referred to arbitration, as provided by the Public Health Act, 1875." The source of the water is to be a well at Kellhead, within the township. The water-rates and extra charges proposed are just about those usually allowed.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MARCH 5, 1877.

The Lowestoft Water, Gas, and Market, the East Worcestershire Water, and the North-East Worcestershire Water Bills were committed.

Petitions were presented against the Londonderry Gas Bill from Corporation of Londonderry, and against the North-East Worcestershire Water Bill from (1) Corporation of Droitwich, (2) Sharpness New Docks and Gloucester and Birmingham Navigation Company, (3) Promoters of East Worcestershire Water Bill, (4) Thomas Worthington, (5) Henry Wheeler Baker.

TUESDAY, MARCH 6.

The Londonderry Gas Bill was committed.

Earl DE LA WARR gave notice that, on Monday, March 12, he would call attention to the operation of the law with reference to the local government of the Metropolis, and move for return of the sums expended by vestries and district boards within the metropolitan district, exclusive of the City of London, upon paving, lighting, drainage, water supply, sanitary arrangements, and other works not under the jurisdiction of the Metropolitan Board, during the years 1874, 1875, and 1876.

HOUSE OF COMMONS.

MONDAY, MARCH 5, 1877.

The Newcastle and Gateshead Water, and the United General Gas Company (Limerick) Bills were read a second time, and committed.

The Examiners reported that the further Standing Orders applicable to the Bristol United Gas, and the Epsom and Ewell Gas Bills have been complied with.

TUESDAY, MARCH 6.

The Southend Gas Bill was read a second time, and committed.

The Sittingbourne Gas Bill was reported.

The Wakefield Gas, Wakefield Improvement, and Leeds Improvement Bills were referred to a select committee, consisting of Mr. Paget (chairman), Mr. Stopford Sackville, Mr. Herbert, Lord Tavistock, and Sir John Duckworth (referee); to meet on Tuesday, March 13.

The Middlesbrough Corporation Bill was referred to a select committee, consisting of Admiral Egerton (chairman), Mr. Halsey, Sir John Amory, and Captain Digby; to meet on Tuesday, March 13.

The Ramsgate Local Board, Ramsgate Water, Thanet Gas, Tunbridge Wells Water, and Kent Water Bills were referred to a select committee, consisting of Mr. Assheton (chairman), Mr. Smith, Mr. Bell, Mr. Dundas, and Mr. A. Bonham-Carter (referee); to meet on Wednesday, March 14.

The Longton Corporation and Rotherham Corporation Bills were referred to a select committee, consisting of Mr. Monk (chairman), Mr. Denzil Onslow, Mr. Balfour, and Sir George Campbell; to meet on Thursday, March 15.

THURSDAY, MARCH 8.

The Examiners reported that the further Standing Order applicable to the Crystal Palace District Gas Bill has been complied with.

A petition in favour of the Crystal Palace District Gas Bill was presented from Owners, &c., of property at Lower Sydenham.

Requisitions to withdraw their petitions against the Wakefield Improvement Bill were presented from (1) Lancashire and Yorkshire Railway Company, (2) Aire and Calder Navigation Company.

FRIDAY, MARCH 9.

A requisition to withdraw their petition against the Newcastle-under-Lyme Borough Extension and Improvement Bill was presented from the Stoke Fenton and Longton Gas Company.

The select committee on the Longton Corporation and Rotherham Corporation Bills was altered by the appointment of Sir Dudley Majoribanks (chairman) and Lord Muncaster, in place of Mr. Monk and Mr. Onslow.

LOANS FOR SANITARY PURPOSES.

Mr. WHITBREAD asked the President of the Local Government Board what was the amount of the loans for which the sanitary authorities had asked the sanction of the Local Government Board since the date of the last return presented to Parliament, distinguishing the amount required by the urban authorities and the amount required by the rural sanitary authorities.

Mr. SCLATER-BOOTH said the last published returns of loans to urban sanitary authorities showed that the sanction of the Local Government Board had been given to loans amounting to £1,835,797 to urban sanitary authorities. Since that time, although the accounts were not completed for the year 1876, sanction had been given to the urban authorities for the borrowing of £2,506,459, showing an increase of £670,662. In the case of the rural sanitary authorities, the amount, by the last returns, was £137,308, and during the year 1876, £200,692, showing an increase of £62,384.

Mr. WHITBREAD asked if the right hon. gentleman would inform him what had been asked for, and not what had been sanctioned.

Mr. SCLATER-BOOTH said that would take some time to ascertain, but he would endeavour to obtain the information.

SATURDAY, MARCH 10.

The petitions were withdrawn of the London, Chatham, and Dover Railway Company against the Ramsgate Local Board Bill; of the Corporation of Wakefield against the Wakefield Gas Bill; and of the Justices of the Peace for the West Riding of the County of York against the Wakefield Improvement Bill.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, MARCH 1.

(Before Vice-Chancellor BACON.)

BAKER v. CORPORATION OF WISBECH.

This was a motion to restrain the defendants, the Urban Sanitary Authority, by injunction, from causing or allowing sewage, or rather offensive matter, to pass from the drains of the bars of Wisbech into an open ditch on the west side of the plaintiff's house.

Mr. KAY, Q.C., and Mr. KEKEWICH appeared for the plaintiff; Mr. HEMMING, Q.C., and Mr. INGLE JOYCE appeared for the defendants.

Mr. KAY said the plaintiff, who was the occupier of Colville House, by the present motion sought to restrain the Urban Sanitary Authority from being an urban unsanitary authority. The plaintiff's grounds were bounded on the west by a road called Jail Lane, in which was an open ditch. On the termination of the open ditch was a sluice, from which the plaintiff obtained a supply of water for the fish-ponds on his property. About two years ago the defendants, without notice or authority from the plaintiff, put in two pipes at the upper or southern end of the open ditch, from which was discharged sewage matter. The sewage matter so sent into the ditch, polluted the water entering the fish-pond, and had killed all the fish. The plaintiff further stated that when the wind was blowing towards his house, it was impossible to have the windows open, in consequence of the stench coming from the ditch. On May 18, 1875, the plaintiff wrote to the mayor, complaining of the stench, and stating that unless the same were immediately remedied, he should be compelled to take legal proceedings. After some further correspondence, and the defendants not abating the nuisance, the plaintiff and his son endeavoured to stop up the pipes, and in so doing one was broken. The defendants thereupon summoned them for maliciously breaking the pipe, and the son was fined one shilling by the magistrates. Numerous letters passed between the parties relating to the nuisance, and the defendants stated that all nuisance would be removed as soon as certain works, then in progress, were completed. Upon such promise the plaintiff abstained from taking proceedings; but the nuisance not having been remedied, he was compelled to come to the Court for an injunction. The learned counsel then read the affidavits of medical and other gentlemen, stating that the nuisance from the open ditch had been brought to the plaintiff's residence within the last two years, and that the effect of the noxious gases emitted from the ditch was most prejudicial to health. The defendants did not deny that the sewage which came by the pipes into the ditch was a nuisance, but they said the nuisance was caused by the illegal acts of the inhabitants on the other side of the street, and that such nuisance was, therefore, not caused by any neglect on their part. But the plaintiff maintained that it was the duty of the defendants to prevent such illegal acts being committed. The defendants further relied on the 264th section, which stated that before any writ or process was issued against any local authority one month's notice in writing must be given of the cause of complaint, and that proceedings should be taken within six months of such notice. But that, he (Mr. Kay) submitted, only applied to an action for damages, and it had been so decided by the case of the *Attorney-General v. The Hackney Local Board*. In conclusion, he asked that an injunction might be awarded against the defendants in the terms asked for.

Mr. HEMMING, Q.C., said, before entering into the facts of the case he had a preliminary objection to make, upon which he would take his lordship's opinion. The section referred to by his friend stated that no writ or process should be issued or served without one month's notice being given, and that proceedings should be taken within six months after such notice. The notice given by the plaintiff was dated March 24, 1876, and the proceedings not being taken within the specified time, he submitted, was a fatal objection to the motion.

The VICE-CHANCELLOR said he did not entertain the slightest doubt that, if a notice was requisite, sufficient notice had been given. Notice was given of the nuisance, its receipt was acknowledged, and promises were given in plain terms that the nuisance should be abated, and upon such promises the plaintiff stayed his hand.

FRIDAY, MARCH 2.

The hearing of the motion was resumed this morning, when Mr. HEMMING said he had now to deal with the case upon the facts; and he thought when his lordship was in possession of the whole case, he would come to the conclusion not only that the local board had done their duty strictly according to their Acts, and in the wisest possible way, but that the plaintiff's case was one of the most unfounded that had ever come before the Court. In cases like the present, there was always a conflict of evidence on matters of opinion. The defendants witnesses stated that the nuisance had been much greater for 20 or 30 years before 1875 than it was at the present time, while the witnesses of the plaintiff stated that it had been more during the last two years than previously, and the plaintiff himself spoke of it as a pure stream until two years ago. It was proved that when the property belonged to the Commissioners of Sewers,

and was not under the control of the local board, the ditch carried not only surface drainage but sewage, and that upon the property being taken over by the local board, sewage was stopped from entering the ditch. Therefore, it was rather strange to find the plaintiff stating that the stream was pure when sewage entered it, but impure when the sewage was diverted. In support of the defendants case, the learned counsel read the affidavit of the town-clerk, which stated that for some years previously to 1847 the sewer, while in the possession of the Commissioners of Sewers, was an open ditch into which sewage entered; that in 1864 part of it was filled up by the local authorities, and that, within the last two years, certain works had been executed, which had the effect of wholly diverting the sewage from the ditch. Mr. Henry Pooley, surveyor of the borough, also gave evidence to the same effect. The learned counsel said the only reason why drainage of slops and the like into the ditch was not stopped a year ago was because the plaintiff opposed the commissioners, who were ready to fill up the ditch, put in a drain, and carry even the surface water off. The plaintiff insisted that the site of the ditch belonged to him; and but for that contention on the part of the plaintiff, no nuisance could now possibly exist. Mr. Ford and Mr. Easton, the engineer, had made affidavits to prove this. The plaintiff, in reply, denied this, and said, "All I required was that, as I had the same right to take in the open ditch to my frontage, as other adjoining owners have done, my frontage should be properly protected."

The VICE-CHANCELLOR said he could not see what this evidence had to do with the case before the Court.

Mr. HEMMING said he used it to say that the Court would not grant an injunction at the instance of a man who had opposed the abatement of the nuisance of which he now complained; because such nuisance was, in truth, not due to the defendants, but to the plaintiff. The plaintiff also made a definite claim to the site of the ditch before the justices in 1875, when the defendants were about to purchase the ditch and fill it up. It was not possible, under such circumstances, that the plaintiff could successfully come to the Court and ask for an injunction. The evidence showed that the defendants had prosecuted their scheme with the greatest vigour; that they were going on with the utmost despatch, and were so nearly finished that they had already diverted to their sewage farm every particle of sewage which was regularly poured into any drain, and which formerly went into the ditch. There was a little district of the town where there were a number of houses not yet connected with the sewers; but this defect would be remedied within a very short time, if directed by the Court to be done.

Mr. INGLE JOYCE, on the same side, contended it was proved by the evidence of the defendants that the ditch in question was, and always had been, a common open sewer, vested in the Commissioners of Sewers, over which the Commissioners of Sewers alone had authority; and there was no evidence on the part of the plaintiff which contradicted it. If the defendants were under a statutory liability to prevent the ditch from becoming a nuisance (which they were not), the plaintiff could only proceed in the manner pointed out by the statute, and the Court of Chancery had no authority in the matter which it could put in force against the defendants; and the plaintiff, if he could sue at all, could only do so at the instance of the Attorney-General as representing the public.

Mr. KAY, in reply, said the plaintiff objected to the plan proposed of filling up the ditch; but there was no difficulty in providing an alternative system, by which the nuisance could be got rid of. Indeed, the defendants own acts proved that no such difficulty existed. All that was necessary was, as a temporary measure, to take up two or three pipes, and put in some solid matter, through which their sewage would not soak. Thus the defendants had conclusively proved a case for granting an injunction.

The VICE-CHANCELLOR, in delivering judgment, said the case was a remarkably plain and distinct one. The plaintiff, it appeared, was the owner of a house called Colville House, and on the west side of his grounds was a ditch, into which the defendants, two years ago, caused to be inserted a pipe, connected with the drains of the borough under their control. Through this pipe sewage matter and other offensive matters passed, evolving noxious gases injurious to health. The defendants had promised to abate this nuisance, but, as yet, had failed to do so. Such was the plaintiff's case, and, if true, he had a right to the relief asked. The defendants, it appeared, had paramount powers by Act of Parliament over all drains and sewers in the district. The property of the ditch, at one time, was in the Commissioners of Sewers, but afterwards devolved upon the defendants, and they, finding the drain was in a defective state, took steps to remedy it; they filled up a certain portion, and made a system of drainage, which they said was perfectly effectual to drain the whole town, and would carry the filth to a place distant six miles from Wisbech. It was also said that the plaintiff was put out of Court by objecting to the works of the defendants; but that, in his lordship's view, had nothing to do with the case. The defendants made a drain for the purpose of carrying off surface water, but neglected to provide certain houses close by with a drain for carrying away the sewage, and consequently the inhabitants of those houses poured slops, &c., down the gulleys into this surface drain. The defendants said this was done without their knowledge or consent, but it should not be forgotten that it was through their neglect that this was done, and that they had provided the means for its being done; and they now claimed a right to pour that into the sewer running on the western side of the plaintiff's property. They then sought to shelter themselves under the pretext that, inasmuch as they made a drain for surface water, if anybody else had polluted the drain it was not the fault of the defendants, they not having consented to it, or permitted it willingly and knowingly. But that defence was answered by their having furnished the sewer. It was said the ditch was foul previously, but that was no reason why the defendants should make it worse. In his lordship's opinion, the plaintiff was entitled to an injunction restraining the defendants from causing or allowing sewage or other offensive matter to pass from the drains in the borough of Wisbech into the open ditch on the west side of his grounds.

Mr. HEMMING asked that the injunction might be suspended for three months, in order that the defendants might do the work necessary to prevent a continuance of the nuisance.

Mr. KAY said as it was a matter affecting the health of the plaintiff he must object to so long a time being given. If a month were given, and it were found insufficient, the defendants could apply for an extension of time.

The VICE-CHANCELLOR directed that the injunction should not be enforced until after the expiration of two months.

SATURDAY, MARCH 3.

In re THE NEW GAS COMPANY, LIMITED.

In this case a petition was presented by William Beale, of 370, Holloway Road, Middlesex, a shareholder, praying for a compulsory order to wind up the company.

Mr. KAY, Q.C. (with whom was Sir H. M. JACKSON, Q.C., M.P., and Mr. LATHAM), for the petitioner, stated that the company was formed under the following circumstances:—In the year 1872, William Denny Ruck obtained two patents for the United Kingdom for two processes for the manufacture of gas. One consisted principally in driving atmospheric gas

through petroleum spirit, and so producing what was called air gas, and the other consisted principally in manufacturing hydrogen gas by decomposition of water, and passing the hydrogen gas through petroleum spirit. Before the incorporation of the company, Ruck sold the patents to William Eckersley for £12,000, it being agreed between them that £10,000 should be paid in shares of a company to be formed for purchasing the patents, and £2000 in cash. The company, which it was now sought to wind up, was incorporated on the 24th of January, 1873, with a capital of £500,000, divided into 100,000 shares of £5 each, having for its object the acquisition of the patents. Two prospectuses were issued, one on the 24th of January, 1873, and the other on the 1st of March, 1873, and both, according to the petitioner, contained a great number of very exaggerated, false, and fictitious statements of the value of the patents, and also a statement that, in addition to the patents for the United Kingdom, the necessary steps had been taken to obtain patents for the same processes for upwards of fifty different countries. Immediately after the incorporation of the company, the patents for the United Kingdom were sold by Eckersley to the company for £125,000, £50,000 being paid in cash and £75,000 in fully paid-up shares. The petitioner alleged that Eckersley was only the agent of certain promoters of the company, the chief of whom was Albert Grant, the rest being his nominees, and that the difference between £12,000, the purchase-money paid by Eckersley, and £125,000, the purchase-money paid by the company, was divided between the promoters, so that they became owners of a largely preponderating number of shares in the company, and would, no doubt, object to a winding-up order. The petitioner was the registered holder of 240 shares, 200 of which he bought in the market without having any knowledge of the profits which had been made, by the directors and promoters, in the purchase of the patents. Upon the patents being applied to the manufacture of gas, they proved a total failure, the company discontinued the manufacture of gas, and the patents were allowed to lapse in September, 1875. So far as the petitioner knew, no foreign patents had ever been acquired by the company, but if they had been they had never been used, and had since expired. In the year 1876 the company made experiments with Coll's patent for the manufacture of gas, but the patent proving a failure, the experiments were relinquished in April, 1876, without the patent ever having been applied to the business of the company. The company, up to the present time, though without success, were endeavouring to earn profits, but not in the business for which they were originally formed. They acquired a concession for a certain number of years for lighting Tunis, in North Africa, with gas, and they intended to apply their patents for the purposes of the concession; but in consequence of the failure of the patents they had been obliged to light Tunis with common coal gas, which they were actually doing at a loss. They had also entered into a contract, of which four years still remained unexpired, to light Paddington Station and Hotel with gas manufactured by their patents, but in this, as in the previous case, they had to use common coal gas. The working of the Paddington Station and Hotel contract showed a small apparent profit in the balance-sheet, but the petitioner stated that such profit was made out irrespective of the cost of managing the company, and this far exceeded the profit. Moreover, the profit was only shown by neglecting to take into account the annual depreciation of the property and plant employed in the contract, which if taken would show a large annual loss to the company. In December, 1875, the company borrowed £5000, on a mortgage of all their property, at 7 per cent. interest, and on the first instalment of interest becoming due default was made. Thereupon a creditors petition was presented for a winding-up order, but before the petition was heard, the company, for certain valuable considerations given by them, procured a new lender to take an assignment of the mortgage debt and securities, and the whole property of the company now stood mortgaged to secure the debt of £5000, and an arrear of interest. The company were unable to pay such debt and interest except by means of a sale of their only remaining assets—viz., the Tunis concession and the Paddington contract. The petitioner submitted that if the company were now wound up the concession and contract might be of considerable value to purchasers competent to obtain renewals of them, which the company were unable to do for want of funds, and that a sale might be effected on terms advantageous to the shareholders. He submitted that within the meaning of the Companies Act, 1862, the company had suspended business for the space of a year, and that it was just and equitable that it should be wound up.

SATURDAY, MARCH 10.

Mr. ARMITSTEAD and Mr. HARRY GREENWOOD, appearing for shareholders and creditors, supported the petition for a winding-up order.

Mr. HEMMING, Q.C. (with him Mr. MACNAGHTEN), in opposing the petition, said the sole question, in his opinion, was whether the petition stated a case, which under the provisions of the Joint-Stock Companies Act entitled the petitioner to a winding-up order. As he opposed strictly by demurrer, his clients had not filed any affidavits, relying on the authority of the case of the *Weir Engine-Works Company, Limited*, reported in 10th Equity. The learned counsel then went *seriatim* through the paragraphs of the petition, as reported above, and submitted that the statements did not come within the provisions of the Joint-Stock Companies Act. Misrepresentation in a prospectus was not a ground for a winding-up order, proper remedies being obtainable in an action at law against the persons who made the misrepresentation, and fraudulent representations were not alleged. As he understood, the ground on which the order was asked for was, that if a company were registered with a number of objects, one of them being the most prominent, and if after registration a prospectus was issued dwelling on the face of it upon that prominent object, but mentioning on the back all the other objects, then that was a ground for saying that as soon as the prominent object of the company was abandoned, the company were incapable of carrying on business, and must be taken to have abandoned their business altogether. The 9th section of the Act of 1862 stated that "the memorandum shall contain the objects for which the company is established." When a memorandum was registered, it irrevocably defined the objects of the company, and those objects could neither be enlarged nor diminished. The objects for which the present company was formed were clearly stated in the memorandum, and also on the back of the prospectus, and the company had not departed from those objects, as was stated in the petition, because the memorandum stated that the company was formed not only for the acquisition of Ruck's patent, but for the acquisition of any gas patents in the world, oil refining, acquiring existing gas-works, to construct gas-works, to form any company for purchasing gas-works, and for various other things. Therefore, so long as the company had any possibility of carrying on gas business in any shape or way, it was impossible to say that the object for which the company was started had failed. The substratum of the petition was that the company could not carry on business after the failure of Ruck's patent; but, as he had pointed out, that was not their only object, and that being so, he submitted the petition was clearly demurrable.

Mr. WHITEHORNE appeared for shareholders holding in the aggregate about 1000 shares, and objected strongly to any winding-up order being made. He maintained that the statements contained in the petition were wholly irrelevant, and only inserted for the purpose of prejudice.

Mr. SWANSTON, Q.C. (with him Mr. GROSVENOR WOODS), appeared for Mr. Gatliff, a secured creditor for £5000, and various other creditors, and also opposed the petition. He said the creditors were perfectly content to allow the company to continue business, believing that by so doing all debts would be paid in full. The petition was filled with the grossest charges; and it was well known that those who used "black paint" needlessly, did so at the risk of having their petition dismissed with costs. It was said that the company was formed for working Ruck's patent, but the objects of the company were very much larger, and it was proved that, although they could not carry on Ruck's patent, they could carry on, and were carrying on, another business within the objects of the company. Those objects could alone be learned from the charter which was the constitution of the company. The prospectus had nothing to do with the question—the Court could only look to the Articles of Association, and read them according to the ordinary rules of construction. So doing, he contended the Court would dismiss the petition. The company were now lighting the town of Tunis and the Paddington Station; they were not doing this at a loss, and the majority of shareholders and creditors desired the company to continue business.

Sir H. M. JACKSON, Q.C., in reply, said the single point for determination was whether the business, such as it was, carried on by the company, was or was not within the Memorandum of Association. It was usual, in cases where it was suggested that improper gains had been made by the promoters, and that they objected to investigation, to find that the counsel for those gentlemen were not only instructed to declaim against the impropriety of making such assertions, but were also armed to the teeth with evidence to displace the assertions made by the petitioner. But in the present case no such evidence was forthcoming, and therefore the statements must be taken to be true.

The VICE-CHANCELLOR, in delivering judgment, said the Legislature had provided a particular code of law applicable to the case of Joint-Stock Companies, and the 79th section prescribed the circumstances in which the Court would interfere. He had no inclination to restrict the power which that clause gave to the Court, and he thought the distinction had always been clearly observed, that the Court would exercise its discretion wherever it appeared "just and equitable" that it should be done. One of the heads under which it would be "just and equitable" was where the company had suspended business for twelve months, in which case the Court would exercise its judicial discretion for the benefit of persons who invited its assistance. He had to inquire, therefore, whether, upon the allegations contained in the petition, and supported by evidence, he could make an order for winding up the company. It must be borne in mind that what had been most aptly called the charter of the company was contained in the Articles of Association; that was the contract between the parties by which the petitioner was bound as much as any other shareholder of the company. That contract was in excessively wide terms. It was said there was no case made upon the petition which would justify the Court in applying the authority of the 79th section, for there had been nothing done which was *ultra vires* of the stipulations contained in the memorandum, nor in any degree opposed to the purposes and objects of the company; nor any travelling out of the powers which, by the Memorandum of Association, were conferred. Without assuming anything that was not clearly in evidence, he thought he might say that at the time, when the project was launched, there was a notion that gas could be produced in a better and cheaper manner, by the patent taken out by Ruck, than ever before. But, although the memorandum referred to Ruck's patent, it had a much wider scope. It could easily be conceived that persons who were enamoured of Ruck's invention, conceived also that more advantageous results might be produced by some other mode. The first stipulation, therefore, described the objects for which the company was established,—namely, to acquire, by purchase or otherwise, patents for improvements in making gas for lighting and heating purposes; for making machinery and apparatus which might be deemed expedient to carry into effect any patent acquired by the company; and more especially the letters patent granted to Ruck. It was not only Ruck's patent, but any other which they might acquire, and they were to supply gas in the United Kingdom, and carry on business as oil refiners and distillers; to acquire concessions and deal with minerals and mineral oils, and sell and dispose of them upon such terms as they might think fit; and so on, showing that the objects were extremely wide. Persons had a notion that by the manufacture of gas, by Ruck's patent especially, a company should be formed with all the abundant powers which were given to them, and that was the contract which the petitioner entered into, to which he was referred in the prospectus, and by which he was unquestionably bound. The prospectus, no doubt, described Ruck's patent in very florid and perhaps extravagant terms, and pointed out the prospect of great advantage to be derived from it. Upon that, persons consented to take shares, and by the stipulations in the Memorandum and Articles of Association they were bound. The petitioners complained of many things; amongst others, the conduct of the promoters or their agents, and the manner in which the business had been carried on. If they had any right to complain respecting the manner in which the purchase-money was procured, it was not by means of a winding-up petition that they could assert that right, or urge that complaint. All they could do upon the petition was to show that the business had been suspended for twelve months, or that circumstances existed which made it discreet, just, and equitable that the Court should interfere and put an end to the partnership. The allegations of misconduct had nothing to do with the winding-up order. But it was said that Ruck's patent had entirely failed in the year 1874, and the matter was allowed to drop; that no foreign patents had been acquired by the company, and the substratum of the company was, therefore, lost before September, 1875, and had never been recovered. That word "substratum" occurred in Lord Cairns's judgment in the case of the *Suburban Hotel Company*. But could it be said, having regard to the stipulations of the articles, that because Ruck's patent had wholly failed, and no other patent had been acquired, the business of the company, which was described in general terms, had gone—that the substratum had failed, since it appeared that the business of making and selling gas was actually now being carried on? Then it was said that the company were endeavouring to earn profit, though without success, but not in the business for which they were formed. He could not say that the business which they were now described as carrying on was not the business for which they were formed, which was generally for the purchase, sale, and manufacture of gas. The company were, therefore, doing that for which they were formed, because they were lighting the town of Tunis and also the Paddington Station with gas. There was a suggestion that the business at Tunis and Paddington was not profitable, but if the business carried on was within the terms of the Articles of Association, that it was carried on at a loss was no reason why the Court should interfere. There was no allegation that the company was insolvent; but it was said that if the company were now wound up there would be some advantage arising to the shareholders, and that the company would now consent to a winding-up order but for the preponderating influence of the promoters. If the preponderating influence was so great, then the consequences which attended all partnerships must ensue; the partnership must go on, and the Court could not interfere. The statement in the petition showed that the company had not suspended business for

Dr. Whitmore's report on the composition of Thames companies and other waters supplied to Marylebone during February:—

	In Grains, per Gallon.		In Parts, per Million.			In Degrees.	
	Total Solid Matter.	Loss by Incineration.*	Chlorine.	Free Ammonia.	Albumenoid Ammonia.	Hardness.	Hardness after boiling Fifteen Minutes.
West Middlesex	20.88	0.96	1.16	.010	.088	14.2	3.1
Grand Junction	22.48	1.04	1.21	.006	.092	15.3	3.4

* The loss by incineration represents the amount of organic and other volatile matters contained in the Imperial gallon (70,000 grains) of water.

During the month the water supplied by the West Middlesex Company, as seen through a glass tube 2 feet in length, was perfectly clear and bright; the water supplied by the Grand Junction Company was also bright and clear. The condition of the water in the Thames was very much better than in the previous month.

DOVER GAS COMPANY.

The Half-Yearly Meeting of Shareholders was held on Tuesday, the 6th inst.—Mr. W. R. MOWLL in the chair.
The following reports and statements of account were submitted:—

Ladies and Gentlemen,—In order to raise the sum of £1000 mentioned in our last report as required to complete the payments in respect of the new gasholder, we sold by auction, on the 23rd of November, the remaining 200 shares created on May 10, 1876, calling up on them the sum of £5 per share. The remainder of the value of those shares, £2037 15s., will be available for working capital, as presently mentioned. The shares maintained their full increased value, selling at the average price of £15 3s. 8d. per share.

The new gasholder was brought into use in the month of November, and has been in work throughout the winter.

There has been a considerable increase this half year in the consumption of gas, and we again have the pleasure of recommending you to declare the usual dividend at the rate of 7½ per cent. per annum.

It is now our duty to state to you the arrangements we propose for the carrying on of the works after the 30th of June next, when the contract with Messrs. Anderson and Jones will expire.

We propose that the secretary's and manufacturing departments should remain distinct, as they are at present—the secretary corresponding with the shareholders, and the manager superintending the manufacture and distribution of gas and the collection of the gas-rental from the consumers, both officers being directly responsible to the directors.

Under the advice of our engineer, Mr. Kirkham, we have fixed the salary of the manager at £500 per annum, and he will be an officer of the company upon the usual terms of engagement.

As your directors, when the management and responsibility of carrying on the works devolve on them, will have a very considerable increase in their duties, it is only reasonable that they should be paid for their services in the same way that directors are paid in other companies. We have made inquiries ourselves, and have also received a report from Mr. Kirkham as to the amounts paid by way of remuneration to boards of directors of other gas companies similarly circumstanced, but we are desirous that the question should remain over till the next half-yearly meeting, when the effect of the alteration in our duties will be more apparent.

The secretary's duties will be also increased under the new system, and the amount of his salary will have to be reconsidered when the effect of such increase is seen.

We are advised that a sum of about £6500 will be required as working capital when the works come into our hands. Towards providing this sum, we propose to call up the £2037 15s. remaining unpaid upon the shares sold on the 23rd of November. And we expect to have also on the 1st of July about £2400 in hand in respect of the surplus profit accounts and of the depreciation-fund.

But beyond these two sums there will be a balance of £2000 or thereabouts required, and to meet this we recommend you to create 200 new shares of £10 each, to be sold as your directors find a necessity for the money.

A resolution will be submitted to you at the ensuing meeting, for carrying this recommendation into effect.

Engineer's Report.

Gentlemen,—I beg to report that the buildings and apparatus at your several stations have been maintained during the past half year in good repair and efficient working order.
(Signed) T. N. KIRKHAM.

21, Abingdon Street, Westminster, S.W., Feb. 16, 1877.

Managers Report.

Gentlemen,—We have been enabled to supply about 9 per cent. more gas this winter as compared with last year. We provided a large quantity of canal coal last autumn, which we have used liberally, enriching the gas 25 to 30 per cent. in excess of the parliamentary standard.

Since the new purifiers have been in use there have been no complaints of nuisance. The mildness of the winter and the stoppage of the traffic on the South-Eastern Railway between Dover and Folkestone have checked the sale of coke.

One-fifth of the retort-house has been idle this winter.
Dover, Feb. 6, 1877. (Signed) ANDERSON AND JONES.

Dr. Cash Account for the Half Year ending Dec. 30, 1876.		Cr.	
RECEIPTS.		PAYMENTS.	
Balance brought forward	£1,273 14 10	Dividend	£1,762 10 0
Of managers on account of rental	2,213 6 3	Rates and taxes	404 15 8
New shares	2,320 0 0	Interest on loans	247 18 2
Premium on ditto	1,000 0 0	Chandler, for purifier gear	158 5 0
Scrip for ditto	5 0 0	Salaries	88 11 0
		Law expenses	73 12 4
		Petty cash	27 19 0
		Rents	5 0 0
		Directors fees	200 0 0
		Jennings, for valves	18 0 0
		Cutler and Son, on account of gasholder	1,732 16 0
		Stiff, on account of tank	1,700 0 0
		Walker, balance for purifiers	130 10 0
		Terson and Son, sale of shares	13 17 0
		Balance	248 6 11
	£6,812 1 1		£6,812 1 1

Revenue Account.			
Anderson & Jones, for manufacture of gas, &c.	£5,965 2 5	Discount over-estimated last half year	£9 9 8
Lighting and cleaning lamps, &c.	209 5 0	Rental for half year	8,190 2 8
Balance	3,301 13 5	Public lamps	1,276 8 6
	£9,476 0 10		£9,476 0 10

Profit and Loss Account.			
Rates and taxes	£399 15 2	Balance of revenue account	£3,301 13 5
Salaries	88 6 0	For scrip	5 0 0
Law expenses	42 4 2		
Petty cash	33 8 3		
Rents	5 0 0		
Depreciation	334 2 6		
Interest on debentures	246 17 9		
Balance	2,156 19 7		
	£3,306 13 5		£3,306 13 5

Balance-Sheet.

Old capital converted into stock	£21,945 0 0	Amount expended on permanent works	£70,409 18 3
New Shares Act of 1860	18,055 0 0	Managers	3,301 13 5
Ditto, 1864	9,820 0 0	Bankers	248 6 11
Statutory mortgages	10,000 0 0	Ditto on deposit	1,200 0 0
Sundry liabilities	522 0 5		
Premium on new shares account	1,983 12 9		
Surplus profits	3,721 10 1		
Depreciation account	6,955 15 9		
Balance of profit and loss	2,156 19 7		
	£75,159 18 7		£75,159 18 7

The CHAIRMAN, in moving the adoption of the report, said: The shareholders will notice in the first clause that when we wanted to raise the sum of £1000 to complete our payment in respect of the new gasholder, 200 new shares were created, and we called up on them a sum of £5. The remainder of the value of these shares we reserve as working capital, which we shall want by-and-by. It must be exceedingly gratifying both to the board and shareholders to know that the £10 shares maintained the full increased value to which they have risen within the last few years, and that they realized an average price of £15 3s. 8d. The new gasholder was brought into use in November, and has been in use throughout the winter. There has also been a considerable increase in the consumption of gas during the past half year. That of itself is very gratifying, but even without that we should have been in a position to pay the usual dividend of 7½ per cent., which we have been paying now for some few half years past. We can pay it this half year grandly, without having to sweep up the corners of our earnings for the purpose. It is also stated in the report that our arrangements are made for taking the works into our management on the 30th of June next, when the contract with Messrs. Anderson and Jones will expire. It is with no little pleasure I inform you that all the negotiations, so far, have been carried on in the most satisfactory way. Messrs. Anderson and Jones will be dealt with in a liberal way in taking over the plant they leave on the works, and we have every reason to think that when the 30th of June comes, and the town is lighted on the 1st of July with gas made under our own direct management, the town will be thoroughly well satisfied. Our proposals are these—the secretary's and the manufacturing departments will remain distinct, the secretary corresponding with the shareholders, and the manager superintending the manufacture of gas and the collection of gas-rental, both officers being directly responsible to the directors. By the advice of our engineer, Mr. Kirkham, we have fixed the salary of Mr. Jones at £500. He will be an officer of the company on the usual terms of engagement. As I said before, I have great pleasure in saying again, that, looking at the large stake Mr. Jones and his family have in this company, we felt that instead of going into the market and endeavouring to get a manager at the lowest possible salary, it was due to Mr. Jones that we should make him a liberal offer. We did so. Mr. Jones accepted it in the same liberal spirit, and we all cherish the earnest hope, and I may go further and say a full confidence, that we shall work amicably together. The report goes on to say: "As your directors, when the management and responsibility of carrying on the works devolve on them, will have a very considerable increase in their duties it is only reasonable that they should be paid for their services in the same way that directors are paid in other companies. We have made inquiries ourselves, and have also received a report from Mr. Kirkham as to the amounts paid by way of remuneration to the boards of directors of other companies similarly circumstanced." We had two objects in taking this course. The one was that we did not want to fix the amount of our remuneration on any mere rule of thumb. We claim, as all other boards of directors claim, that taking the responsibility and the anxiety of managing a large company such as this, it is only right that we should be paid. On the other hand, the amount of time and attention it will be necessary to bestow has yet to be discovered by us. Further, then, we cherish to ourselves the conviction that the gas in the future will be at least as economically made as it has been in the past. We also expect that we shall be enabled to give an article of a higher illuminating power, and these things will involve probably more expense than at the present moment we are aware of. We were most anxious that the shareholders should not suppose we had any intention of asking for a salary for ourselves till we had established the fact that the salary had been earned. I may put that line of thought in other words, and say—I must, perhaps, be a little cautious in the way in which I put it—our present conviction as a board is this, that we would sooner not receive one farthing for our services than be paid by any diminution in the dividend earned by the working of the company. Now, we wish this to be distinctly understood, because I think perhaps one or two of the shareholders had a notion that we wanted to pay ourselves first and see after our brother shareholders afterwards. As the mouthpiece of the board, I venture to say that such a conviction does us an injustice. We want first to keep this company in the prosperous condition in which we find it at this moment, and if we succeed in doing that, we shall ask the shareholders to pay us fairly for our services. The secretary's duties will also be increased under the new system, and the amount of his salary will have to be considered. As to the last clauses of the report, if it should so turn out that we only want £500, we shall only raise £500; but in order to be in the financial position a large company like this ought to be, of having plenty of ready money to go into the market and purchase our goods for cash, and so on, and get the full benefit of discounts on our contracts on the most favourable terms, we ask this afternoon for power to raise an additional capital of £2000. Now, that is just an elaboration of what the report which you have heard says. I desire further to add, that the directors do not anticipate conducting this company upon mere common sense. They intend to avail themselves of the highest professional skill which the gas world affords, and having the benefit of that professional skill, they will apply their own common sense, and then we hope we shall be like the skilful navigator when his compass is all right, and shall continue to sail the ship of this company into harbour, to give satisfaction to the consumers of gas, and bring the full dividend to the shareholders. I beg to move that the report of the directors be received and adopted, and a dividend at the rate of 7½ per cent. be declared.

Mr. BOTTLE seconded the motion, expressing his conviction that the company were in as good a position as any in Kent.

The motion was carried unanimously.

The CHAIRMAN next moved—"That 200 new shares of the company, each of the nominal value of £10, be and the same are hereby created."

Mr. STONE seconded the motion, and it was agreed to.

This concluded the formal business.

Mr. JONES said his modesty had kept him in his seat, as he had hoped that some other shareholder would have risen to propose a vote of thanks to the chairman and directors for their services. He should be happy to submit a motion to that effect.

Mr. DRUCE seconded the motion, which was carried.

The CHAIRMAN, in reply, said that, speaking for his colleagues, he would say it afforded him great pleasure to receive this vote of thanks. They

could not shut their eyes to the fact that the company were now in a position of great prosperity. A very few years ago the shares only realized a small premium, something like 2s. 6d. a share.

The SECRETARY (Mr. G. Fielding): They were sold without any premium for a long time.

The CHAIRMAN said that for some time the shares stood in the market at par, but now they were at 50 per cent. premium. This was a very satisfactory result, but it had not been arrived at by any mere rule of thumb. It was really the result of several things that had taken place at the board, of which the outside public knew nothing. So far as they could speak with reference to the future, they could say that the dividend of 7½ per cent. would be continued. Again, for several months past there had been no complaints of any nuisance arising from the manufacture of gas, and hence they drew the inference—they hoped a fair one—that it had been reduced to a minimum, and was consequently, in the eye of the law, no nuisance whatever. The price charged to consumers was as low as in any town in the immediate neighbourhood; and, all these things considered, the directors felt highly pleased by the vote, believing that the shareholders were only giving them what they were entitled to. They trusted in the future they would continue to enjoy their full confidence in the management of the company.

The proceedings then terminated.

STOCKPORT CORPORATION GAS SUPPLY.

At the Meeting of the Stockport Town Council on the 1st inst.—the MAYOR (Mr. H. Bell) presiding,

The minutes of the Gas Committee were brought up and read. The committee recommended that the price of gas inside the borough be reduced from 4s. to 3s. 7d. per 1000 for consumption under 500,000 cubic feet, and 3s. 6d. per 1000 exceeding 500,000; outside the borough, that the price be reduced from 4s. 8d. to 4s. 3d. per 1000 under 500,000, 4s. for over 500,000 and under one million, and 3s. 11d. over one million. These reductions to take effect from Jan. 1 last.

Alderman WILKINSON moved, and Alderman PEARSON seconded, the adoption of the minutes.

Mr. BROWN asked whether he understood that there was a further reduction to large consumers under the new arrangement.

Alderman WILKINSON said the discount to large consumers was reduced.

Mr. BROWN said he and others in the council thought this was a very large and liberal allowance made to the general public, and the price ought to be the same all round. There was no reason why there should be a further reduction of a penny because certain parties happened to consume large quantities. The gas cost a certain sum per 1000 to make it, and they could afford to sell it at a certain price. No doubt the Gas Committee had carefully decided on the price—that is, 8s. 7d.—and why should they go further than that, and allow a penny to large consumers? There was an advantage given to the large consumers which they were not entitled to. Therefore he proposed that the minutes pass with the exception of that relating to reduction in the price to large consumers.

Mr. THORNLEY said he took the same view as Mr. Brown, and would therefore second the motion.

Mr. HOPE thought it a very unwise thing to alter the decision of the Gas Committee. They had come to a very careful conclusion as to what could be done in the way of reducing the price. It must not be forgotten that, last April, when the matter was under discussion, the discount to large consumers at that time was 4d., and it was reduced to 2d. Although it was the practice in some towns—such as Oldham and Manchester, and Bolton, he believed—not to make any reduction at all, still he knew some large consumers in the borough felt it to be a great grievance in having the discount altered on the last occasion. As there was some little saving in the way of collecting the accounts, he thought the penny in this instance would not be giving the large consumers too much. He thought the minutes should be allowed to pass.

In reply to Alderman Nield, it was explained that the discount of 1d. was allowed on all the gas consumed by those who took over half a million feet, and not alone on the quantity above that amount.

Mr. PARKES held that the prices were based on a fair commercial principle. It was the custom in all commercial circles for large consumers to have goods at a less cost than small consumers. He thought the Gas Committee were enabled to save a large sum for the small consumers in purchasing large quantities of cannel, and, as Mr. Hope had stated, the cost was less for collecting from large consumers, and there was less waste and risk. They lost a large sum of money with the small, and very little with the large consumers. Therefore he thought the discount was a just principle to go upon.

Mr. NELSTROP: How many consumers in the town get this benefit?

Alderman WILKINSON: I cannot tell you in the borough; there will not be a very great many. I did not expect the question to be asked, and, therefore, have not the particulars.

Alderman PEARSON contended it was a reasonable thing that a mill-owner whose gas bill came to £300 or £400 a year should have some compensation for paying from the meter, or from the time it entered his premises; for by the pipes traversing yards, and going from one place to another, there was leakage.

Alderman WILKINSON, in reply, said the question had been fairly well considered in committee time after time, and he must decidedly object to the minutes being referred back.

Mr. BROWN, in response to the request of several members of the council, withdrew his amendment with the consent of the seconder, and the minutes were passed.

HEREFORD CORPORATION GAS SUPPLY.

At the Meeting of the Hereford Town Council, on Thursday, March 1—the MAYOR (Mr. Ralph) presiding,

The Gas Management Committee presented their annual report, of which the following is the principal portion:—

The accounts for the year ending the 31st of December last, as made up by Mr. Capner, we lay before the council. In addition to the information therein contained, we give the following comparative statement showing the results of the working under different heads:—

	For Year ending Dec. 31, 1875.	For Year ending Dec. 31, 1876.
Coals carbonized	4,964 tons. . .	5,123 tons.
Gas produced	51,318,000 feet. .	53,629,000 feet.
Gas lost or unaccounted for . .	5,936,133 . . .	5,683,323 . .
	or 11' 54 p.c. . .	or 10' 59 p.c.
Average make of gas per ton of coal carbonized	10,337 feet. . .	10,466 feet.
Maximum quantity made in 24 hours	268,000 . . .	282,000 . .
Maximum quantity delivered in 24 hours	256,000 . . .	293,600 . .

The average illuminating power of the gas during the past year has been equal to 14.55 standard sperm candles, consuming at the rate of 130 grains per hour in com-

parison with Sugg's new "London" standard Argand burner, consuming 5 cubic feet of gas per hour.

Having reference to the result arrived at by the auditor, that a sum of £4892, gross profits, was made during the year, and that a sum of £3504 remained after paying the interest on the mortgage debt, coupled with the fact that a contract has been made for the supply of coal at a reduced price, we think the time has arrived when some reduction may be made in the price of gas. We, therefore, recommend that a reduction be made to the extent of 6d. per 1000 feet in respect of the supply to the public lamps, and 3d. per 1000 feet in respect of the supply to private consumers, provided payment be made within six weeks after the commencement of each quarter.

The following is the report of Mr. Capner, the auditor, above referred to:—

"Hereford, Feb. 26, 1877.
"Gentlemen,—In accordance with your instructions, I have examined and audited the accounts connected with the management of the gas-works for the past year, and herewith beg to hand you statement of same. In their preparation I have endeavoured to follow the method previously adopted, so as to facilitate references and the comparison of details with those of the previous year. You will be gratified to learn that the business has been conducted at a considerably increased profit, a result which must give satisfaction to the citizens generally. The rental has been increased by about £500, and this, coupled with the large reduction in the price of coal, has mainly conducted towards obtaining this result. With the accounts before you I need not here enter further into detail, but will simply quote the increased profit and the surplus balance carried forward to new account, 1877, viz.:—

Profits for 1876	£4892 8 0	Surplus balance, 1876 . .	£2405 7 9
" 1875	3841 8 3	" 1875	976 18 10
Increase	£1050 19 9	Increase	£1428 8 11

"With regard to the method of keeping the accounts, I would venture to suggest that, as soon as practicable, the expenditure book should be so extended as to include items disbursed on capital account, with a view to obtaining a complete record of all payments made during the year. In addition to this I consider it desirable that some system of balancing half yearly should be adopted, and that the office staff prepare and furnish a statement of their transactions for the periods ending the 30th of June and the 31st of December in each year. I am informed that this plan is now in general practice by gas companies, and I think commends itself to all connected with accounts of a complicated nature. My acknowledgments are due to your manager and his clerk for their courteous assistance during my investigation. (Signed) J. W. CAPNER.

"The Committee, Corporation Gas-Works, Hereford."

Dr.—Capital Account, Dec. 31, 1876.

To Loan, 1872, repaid to July 6, 1875	£2,828 2 8
Do. 1872, ditto July 4, 1876	1,028 15 11
Do. 1875, ditto ditto	50 0 0
Balance unpaid	£3,906 18 7
	52,593 1 5
	£56,500 0 0

Cr.—Capital Account.

By Cost of works and expenditure to Dec. 31, 1875 . .	£55,716 8 4
Amount subsequently expended	55 7 2
	£55,771 15 6
Less abatement on account of mains	£39 3 7
Less sale of old materials	20 0 0
	59 3 7
Balance of capital account	£55,712 11 11
	787 8 1
	£56,500 0 0

Dr.—Profit and Loss Account.

To Coals consumed, cost	£3,569 18 11
Purifying	112 13 5
General repairs—wear and tear	638 12 3
Repairs to mains and services	16 11 3
Lamp lighting and repairs	192 18 1
Gas-making wages	636 3 5
	£5,166 17 4
Salaries	£340 0 0
Rates, taxes, and insurance	467 7 11
Stationery, printing, &c.	38 8 2
Law expenses	0 18 6
	846 14 7
Total expenditure	£6,013 11 11
Net revenue account, for balance transferred . . .	4,892 8 0
	£10,905 19 11

Cr.—Profit and Loss Account.

By Gas-rental, for public and private lights for 12 months, Dec. 31, 1876. .	£9,755 5 6
Residual products, less cartage and expenses, viz.:—	
Coke	£695 18 2
Tar, liquor, &c.	334 4 5
	1,030 2 7
Fittings account, profit thereon	73 0 7
Abatements	47 11 3
	£10,905 19 11

Dr.—Net Revenue Account.

To Interest paid on mortgage to June 30, 1876	£1,161 15 4
Ditto accrued and owing to Dec. 31, 1876	1,136 6 9
Ditto paid on additional loan of £1500	£32 4 8
Ditto ditto ditto	31 0 7
	63 5 3
Ditto charged by treasurer	£8 18 2
Less allowed on deposit account	5 2 4
	3 15 10
Capital account for sale of old materials	20 0 0
Loan redemption-fund, for balance transferred to credit account . .	1,078 15 11
	£3,463 19 1
Balance, surplus, to new account	2,405 7 9
	£5,869 6 10

Cr.—Net Revenue Account.

By Balance brought from last account	£976 18 10
Ditto ditto profit and loss account, being profits for twelve months to Dec. 31, 1876	4,892 8 0
	£5,869 6 10

Dr.—Loan Redemption-Fund.

To Cash paid—	
Instalment on loan, 1872	£1,028 15 11
Ditto ditto 1875	50 0 0
	£1,078 15 11

Cr.—Loan Redemption-Fund.

By Net revenue account, amount transferred	£1,078 15 11
	£1,078 15 11

Dr.—General Balance-Sheet.

To Capital account for balance unexpended	£787 8 1
Sundry tradesmen and others, amounts due for coals, fittings, &c.	643 12 9
Interest accrued and unpaid on mortgage to Dec. 31, 1876	1,136 6 9
Amount due to treasurer	155 4 9
	£2,723 12 4
Net revenue account, balance at credit	2,405 7 9
	£5,128 0 1

Cr.—General Balance-Sheet.

By Amount owing by debtors for gas and meter rental, including the quarter's rental ending Dec. 31, 1876	£2,872 6 2
Less deposits received	£12 10 0
Less paid in by collector	1 0 1
	13 10 1
	£2,858 16 1
Debtors for residuals, viz.—	
Coke	£401 4 2
Tar	120 9 2
Lime	12 0 0
Liquor	30 7 6
Fittings	286 0 5
	850 1 3
Stock of materials on hand, Dec. 31, 1876, viz.—	
Coals	£289 5 0
Fittings and general stock	525 7 9
Purifying materials	6 10 0
Coke	30 4 6
Tar and ammonia	20 0 0
Gas	10 11 6
	881 18 9
Cash on deposit at bankers	500 0 0
Cash in hands of manager	37 4 0
	£5,128 0 1

The CHAIRMAN moved the adoption of the report, and congratulated the council on the satisfactory result of the last year's operations. The profit realized was so handsome that the committee felt justified in recommending a reduction for the March quarter to private consumers of 3d. per 1000 feet, and of 6d. per 1000 feet in the public lamps. That was exactly one-half the increase made by the corporation when they became the owners of the gas-works. At that period a discount of 6d. per 1000 feet was taken off for private customers; the lamps were charged 3s. per 1000 feet, and the public 4s. The lamps were now charged 3s. 6d., and to private consumers the rate would be 3s. 9d. The committee would incur a loss of £700 by this step, but they felt that they would have left a pretty good margin. It was clear they must shortly incur considerable expenditure in increasing the works, to meet the constantly increasing demand for gas. They did not, therefore, think it desirable to make any further reduction in the price of gas at present; but they hoped that, perhaps by the end of the year, they might be able to go back to the original price, and give the full discount of 6d., as was the case when the corporation took the works. From a calculation of what the cost for coal had been since the corporation had taken the management of the works, he found that there had been an average increase of something like 50 or 60 per cent. He thought, therefore, that everybody would be highly gratified by the result presented in the report. The city was benefited last year to the extent of £2500 by the gas-works, for a profit had been realized on them of between £1400 and £1500, and nearly £1160 had been paid off the principal.

Mr. JAMES, in seconding the motion, said he had always contended, and he believed the principle was now thoroughly admitted, that it was the duty of the Gas Management Committee to charge a fair commercial price for gas, and to do it independently of any result which might follow on the finances of the city. When they recollected the price paid for the works when they were purchased by the city, and that that proceeding was sanctioned not only by a large majority of the board, but by a large majority out of doors, there was no need to question whether in the purchase they gave a fair price for the works or not. The gross profits last year amounted to between 8 and 9 per cent. on the amount invested, and it must be remembered no allowance had been made for a depreciation-fund, which, if the works were in the hands of a private company, would be necessary. If they made that reduction, they were earning on their capital something between 7 and 7½ per cent. Looking at the matter from that point of view, he did not see that the purchasers could say that the money was badly invested when they got 7½ per cent. on their money; that was to say the money being borrowed at 4½ per cent., there was a clear profit of 3 per cent. He did not think any one, investing his money as he would, could expect anything better than that. The Legislature, as they knew, had said the makers of gas might get, if they could, as much as 10 per cent.; 7½ per cent. could not, therefore, be an unreasonable sum to obtain from the consumer. Viewed in that light, he thought it might fairly be said that justice had been done to both parties—the purchaser and the consumer. If the reduction in the price of coal continued, the committee hoped to further reduce the price of gas, and were very anxious to take the matter into consideration, and see what further reduction, if any, could be made. He wished it not to be understood that he was sanctioning the holding out of any reduction, for considerable expense they would, perhaps, have to meet stared the committee in the face. He hoped, however, the gas consumers would be satisfied with the small mercies that had been meted out to them.

Alderman ANTHONY: On what principle do you make a distinction in the reduction of 3d. to the private consumer, and 6d. on the public lamps?

The MAYOR said they were increased 1s. in the first instance, and half the charge had been taken off each.

Alderman ANTHONY asked for a return of the prices of the different tenders that had been sent in. He noticed that they were not inserted in the report, and he moved that a return of the tenders be presented to the board. He wished to know likewise why the committee had entered into a two years contract for coal at 7s. 4d. per ton. He thought that was a very ill-advised step in the face of a falling market. It was just possible that a tender might have been obtained at 6d. per ton less.

The MAYOR said there was no objection to the tenders being published with the report, but it was an unusual proceeding, and not adopted with the other committees. In entering into a contract for a two years supply, the committee felt that that was the best thing to do under the circumstances, for they did not think it likely that coal would be much cheaper, and the price was certainly the lowest at which they had ever been able to enter into a contract. The price could not possibly be much lower, and there was a probability that it might be much higher. It was a fluctuating contract, subject to the rise and fall of wages.

Mr. SHELLARD fully concurred in the course recommended by the chairman, the Mayor, and which met with the general approval of the committee. It was thought, too, that coal would not much decrease in price, and so a two years contract was entered into. Whether they had taken this step rightly or wrongly the result would determine.

Alderman ANTHONY: From my observation, we could well retard the

lighting of the lamps at least half an hour. The lamps are lighted in the public streets half an hour before twilight.

Mr. LLANWARNE, That's a question for the Lighting Committee, not the Gas Committee.

Alderman CAM was very glad to find that at last the Gas Committee were agreed to give a little bonus to the consumers, because, in his opinion, they ought to have been considered first of all, and the committee appeared to have considered them last. They ought to receive the greatest reduction. He believed the council had already increased the salaries of almost all the officers connected with the gas-works, and now they were going to benefit the ratepayers by reducing the price of gas 6d. for the public lamps, and at the fag-end they took off 3d. for the consumer's benefit. Legally the consumer should be first considered. Some hope was held out that at the end of the year the committee might give a further reduction, and he hoped their forecasts would come true. He, like Alderman Anthony, had observed the mode of lighting the street-lamps, and he was perfectly satisfied that between the lighting and extinguishing, at least three-quarters of an hour might be saved. Very frequently he saw, in his own street, gas blazing away in full sunlight, and it was often the case that he met men returning from lighting the lamps over Ailstone Hill and Hampton Park at a time when they ought to be beginning the work. He was perfectly satisfied that three-quarters of an hour might be saved in the four-and-twenty hours.

In reply to a question, Mr. DAVIS, the gas manager, said he did not think it was twelve months since the list of times for lighting was last revised.

Alderman ANTHONY: In consequence of that revision I have taken particular notice of what has occurred during the last six months, and I am certain that, although perhaps you might not extinguish them earlier, you need not light them so soon.

The MAYOR said the Gas Management Committee were not responsible for the time at which the street-lamps were lighted and extinguished, and he might perhaps be permitted to say, too, that the highly satisfactory result obtained by the Gas Committee last year was in no small measure to be attributed to Mr. Davis, the manager, and to the way in which the accounts were collected. Mr. Cam had observed that the servants connected with the gas-works had had their salaries raised, and that the last persons considered had been the private consumers. In reference to that remark, he begged to say that the salaries paid at the Hereford Gas-Works were less than those paid at any other gas-works he knew of.

Alderman CAM said he had not mentioned the subject with any intention of finding fault, but had merely called attention to it as a fact.

The MAYOR, continuing, said that Mr. Davis had certainly obtained better results than had been obtained at other gas-works, and they were indebted to him and the other officers to no small extent for the profit they had made. Mr. Capner had stated to him that in the arrears there was scarcely a difference of £5 from last year. With reference to the reduction of 3d. only to the private consumers, taking the price off the public lamps really amounted to much the same thing as reducing the charge to the private consumers, inasmuch as the taking 6d. off the public lamps would probably be the means of preventing a city rate being required, and the private consumers would have to pay to a city rate.

Mr. JAMES: How about those who do not consume gas? That would be a very different thing.

The MAYOR: But the principal ratepayers do consume gas.

Alderman CAM: We ought not to work our gas-works or water-works with the intention of getting a surplus. The first thing is to give the consumers a reduction before you relieve the ratepayers.

Mr. LLANWARNE apprehended that Alderman Cam's principle could hardly be worked out logically. The property belonged to the ratepayers, and was paid for with the ratepayers' money. Legally, of course, everybody was entitled to look after himself first, and the ratepayers' duties first related to themselves, and it would appear that the committee had accordingly first looked to themselves—that was to say, to the interests of the ratepayers.

After some further conversation, the report was adopted.

On the report of the Lighting Committee being brought up,

Mr. GRUNDY urged that an alteration be made in the present mode of lighting the lamps, and that the burning of the gas on bright moonlight nights be obviated. As a heavy ratepayer—perhaps the heaviest in the room—he thought something should be done to check this wasteful expenditure.

Alderman ANTHONY advised Mr. Grundy to leave the matter in the hands of the committee, and promised that he himself, as chairman of the committee, would take care the subject should be dealt with.

Alderman BOSLEY moved the adoption of the report. He said perhaps Mr. Grundy was not aware the subject had been before the board over and over again, and the question had frequently been considered by the council. But they had to govern the lighting of about 500 lamps, and it could hardly be expected that uniformity in their lighting and extinguishing could be arrived at. Nights so bright as the previous one did not often occur.

Alderman ANTHONY seconded, and expressed his intention to bring the subject before the committee.

Mr. SHELLARD did not wish a one-sided impression of the discussion to go forth to the public. Hitherto the statements that had been made had been calculated to create an impression that the council had been for a series of years wasting the property of the ratepayers by allowing the lamps to burn on moonlight nights. He could hardly go back to a period in the history of the council when this subject had not again and again cropped up and been considered and re-considered in all its bearings. Did time permit, a number of reasons could be furnished, by which it could be shown that the great saving Mr. Grundy anticipated would follow from a change in the mode of lighting the lamps was more apparent than real, for there were a great many set-offs and drawbacks to be taken into account. No doubt the committee would give the subject every consideration, and he trusted they would take into their counsels, not only their own private judgments, but those also of the surveyor and gas engineer.

The report was adopted, it being understood that the chairman would introduce the question shortly.

ABINGDON GASLIGHT AND COKE COMPANY, LIMITED.—The fourteenth annual general meeting was held on the 1st inst. The report and balance-sheet showed such satisfactory results of the past year's operations as justified the recommendation of a 10 per cent. dividend, payable on the 22nd inst. Votes of thanks were unanimously passed to the board, the chairman, E. S. Copeland, Esq., and to Mr. John Ely, the secretary and manager.

DERBY GAS COMPANY.—The half-yearly meeting was held on the 28th ult., when the usual dividend of 10 per cent. on the original shares, and 7 per cent. on the new shares was declared, after payment of which there was a balance of over £1500 to be carried forward. The directors were authorized to dispose of the Traffic Street premises of the company. After the ordinary business, the meeting was declared "special," and a resolution to make a further call of £6 5s. on the new shares was agreed to.

COLERAINE (IRELAND) GAS-WORKS.

The following is the substance of a Report by Mr. T. NEWBIGGING, Consulting Gas Engineer, Manchester, recently presented to the Commissioners of Coleraine on the condition of the gas-works, which are the property of the town:—

Gentlemen,—Agreeably to your instructions, I have made a careful examination of your gas-works, and the general circumstances of the supply of gas to Coleraine. I beg to report as follows:—

The retort-house floor being below the flood level of the river adjacent (the Bann) is disadvantageously situated for the economical production of gas. It is invariably flooded once a year, or oftener, the water at times rising sufficiently high to extinguish the furnace fires, the consequence being the sudden formation of a large volume of steam filling the benches and penetrating the brickwork.

This, in addition to the difficulty of maintaining the supply of gas, cannot but prove less or more injurious to the iron retorts and their settings, and quite prevents your having recourse to the use of clay retorts in the present house, as the first occurrence of a flood of this character would prove utterly ruinous to the whole of such retorts that might be at work at the time. Besides this, there is a constant lodgment of water underneath, and in the foundations of the benches, causing the consumption of an excess of fuel to evaporate the moisture which is always present, and maintain the heat of the retorts.

The retort-house is only in an indifferent condition. The roof is composite in character, being constructed partly of wood and partly of iron. The employment of timber here is objectionable on account of the risk of its destruction by fire.

The retort stock is not in good condition. In the depth of winter, when the consumption of gas is greatest, the whole of the retorts are required to be at work; but this is owing to inadequate storage room for gas in the holders.

I recommend the erection of a new retort-house with wrought-iron roof, on the higher vacant land belonging to the Commissioners, adjoining the present works, out of reach of the periodical floods of the Bann. Space should be left for the extension of the building as required in the future. I recommend the adoption of clay retorts as being entirely suited to your purpose. Their first cost is less than the iron ones; they are more durable, and being capable of standing a greater heat, will produce more gas per ton of coal carbonized.

The condensing arrangements are very inadequate. There is neither scrubber nor washer, and the gas passes to the purifiers, and even into the holders and mains, charged with particles of tar, clogging the lime contained in the purifiers, rendering it impossible to purify the gas satisfactorily, besides materially increasing the cost of such imperfect purification as is effected.

I would not advise that the present condenser, which is of the battery or organ form, be dispensed with, but that it be put in proper repair, and that its use should be supplemented by the erection of an additional condenser.

The purifiers are about adequate in size, but badly arranged, and the water-lutes for the covers much too shallow. They should be 18 inches deep at least.

The gasholder-tanks and holders are in satisfactory condition. The storage room for the gas, however, is deficient to the extent of 45 per cent. of the day's production. The effect of this is to cause more retorts to be kept at work than are required under normal conditions, in order that the supply of gas for the night, which the present holders are unable to afford, may be maintained. In the daytime some of the retorts are frequently standing off uncharged, because the holders are incapable of containing all the gas they could produce during the day; and as the heat has to be maintained notwithstanding, there is a constant waste of fuel (coke with you is worth 20s. per ton, and this is a serious consideration), wear and tear of retorts, and extra labour required; all of which, with sufficient storage capacity in the holders, might be obviated. Another holder is required for economical working.

Station-meter and governor are in effective working condition.

In the absence of a plan of the street-mains, I could only form an estimate of their length by going over the whole district. Their diameter ranges from 8 inches down to $\frac{1}{2}$ inch. The use of mains of the small diameter of $\frac{1}{2}$ and 2 inches is extremely objectionable, and is rarely resorted to in well-conditioned gas-works. It is an unfortunate circumstance for Coleraine that they were so extensively adopted by the first engineer of the works. Their cost in laying, in proportion to the diameter, is heavy. The size of the joint bears a very large proportion to the area of the pipe, increasing the risk of leakage. They are easily fractured, and, when drilled for the insertion of service-pipes, are so weakened at those points as to be liable to break and cause escape of gas. In addition to that, a heavy pressure has to be maintained to force the gas through them during the hours of supply, the result being a considerable loss by leakage. The service-pipes are of wrought iron, and range from $\frac{1}{2}$ inch diameter upwards. A large number of these have been in use for many years without renewal. I recommend, in all cases where such small pipes exist in any of the streets of the town, that they be taken up and replaced by pipes of larger diameter, not less than 3 inches diameter for the mains, and $\frac{3}{4}$ inch diameter for the services, and larger as the exigencies of the consumption may require.

The meters in use are generally of the wet description. The wet are preferable to the dry, save under exceptional circumstances. I recommend that you should make a thorough and careful inspection of the meters. Every one of these, without exception, should be disconnected and cleaned with fresh water repeatedly poured into them and out again. This can be done without taking the meter to pieces; but whenever a meter is found to have been long in use (say over ten years), or defective in any way—or when there are more lights supplied through it than the size of the meter fixed is intended to supply—it ought to be replaced by another in good condition and of the proper size. The whole of the meters should be inspected and watered, if required, twice during each quarter.

I observed, during my visit of inspection, that you have the common iron burner very generally in use. I would advise you to get a supply of various suitable burners from approved makers (names of makers and description of burners are given), and distribute them freely amongst the consumers, or offer them for sale at a merely nominal charge. You will be astonished at the improvement they will effect in the general lighting.

There is great irregularity in the public lamps. Some of them consuming quite 6 or 7 cubic feet per hour, and yet affording but an indifferent light. A governor should be affixed to each; this would improve the light and reduce the consumption. The lamps are of tinned iron plates. This is false economy. They are constantly in need of repair, owing to their rapid decay by exposure to the weather; lamps made of sheet copper, tinned over, are much to be preferred. The old system of lighting by means of a ladder is in use. You should adopt the lighting-rod. It enables a man to do the work more expeditiously, and with greater ease, besides getting rid of the danger of accident attending the hurrying through the streets at dusk with a ladder.

In the absence of a photometer, I estimated the illuminating power of the gas to be about 15 or 16 candles, which is very satisfactory, taking into

consideration that no cannel, but only the ordinary gas coal, is used. The gas was free from sulphuretted hydrogen, but ammonia was present in very large proportion. I have explained how this latter impurity may be removed.

Your unaccounted-for gas, as near as I could ascertain from the figures furnished to me, is about 24 per cent. of all that is produced. This is much in excess of what it ought to be. There need be no difficulty in a place like Coleraine, advantageously situated as it is for lighting, in bringing it down to 10 or 12 per cent. It arises from several causes. These are principally as follows:—

1. Owing to a want of adequate condensing power, the gas in winter, when the make is heavy, passes through the apparatus without being sufficiently reduced in temperature, and in this state it is measured by the station-meter into the holders, where, and in the street-mains and services, it undergoes subsequent condensation or contraction of its bulk. This is not an actual loss of gas; but it shows a larger make per ton of coal than is really the case, and the distribution suffers at the expense of the production.

2. The pressure in the mains, both in the daytime and during the hours of consumption at night, is heavier than is necessary under proper conditions of supply.

3. I have already alluded to the inadequate size of the great bulk of your mains. They are a fruitful source of loss, for the reasons I have explained. But it is to the renewal of the wrought-iron service-pipes you must look for a material reduction in your present leakage. The porous nature of the soil in which the pipes are embedded tends to hasten their decay. I strongly recommend that you should at once systematically set about the renewal of all service-pipes that have been in the ground for more than six years. Do not let any question of expense prevent this from being done immediately; the result will amply repay you for the outlay that will be incurred. All the pipes before being laid should be carefully covered with two good coats of tar; and when placed in the trench, any parts of the metal that have been laid bare in the screwing of them up should be painted with tar afresh.

4. There is a considerable waste going on in the consumption by the public lamps. Apply governors to these, as I have already explained.

5. I understand that the gas which is consumed in the town-hall is not registered by meter, but passes direct from the service-pipes to the burners, although upwards of 50 lights are occasionally in use here. This is a mistake, all gas consumed (except such as is supplied to the public lamps), even that which is burned in the gas-works, should be registered through a meter and brought into the quarterly account. It is only by so doing that you can properly assess your leakage. It is not satisfactory simply to make an estimate of the consumption.

Your sale of gas per ton of coal carbonized amounts to only about 6500 cubic feet. This is the result of your defective carbonizing on the one hand, and the excessive leakage on the other. There is no reason why, with improved working, you should not sell 8000 cubic feet per ton, which is a very moderate computation.

In conclusion, I would suggest the early carrying out of the alterations and improvements I have named. Perhaps you will not have a more favourable opportunity than the present. Ironwork of every description is probably at its lowest point as regards price. It would also, in my opinion, be exercising a wise foresight if you could enter into a contract for a two or three years supply of coal at present prices, only, however, to be delivered as required. It is to be anticipated and hoped that coal and iron will soon increase in value.

(Signed) THOS. NEWBIGGING.

WISBECH WATER COMPANY.—The annual meeting was held on the 26th ult., when a dividend of 5 per cent. was declared.

COLCHESTER GAS COMPANY.—The half-yearly meeting was held on the 27th ult. The accounts showed a balance of profit amounting to £2393, and dividends at the rate of 10 per cent. on the old, and 7 per cent. on the new shares were declared.

BARTON DISTRICT LOCAL BOARD GAS SUPPLY.—At the meeting of the Barton and Eccles Local Board, on the 5th inst., the clerk reported that a deputation from a sub-committee appointed by the board to deal with the question of the gas supply had waited upon the Gas Committee of the Salford Corporation with respect to the gas supply of the district. The matter was put before the committee by the several gentlemen forming the deputation, and eventually the deputation received from the committee an intimation that, so far as in their opinion was right, they would concede to the board what was asked, but that they could not enter into any further discussion on the subject until the propositions or representations of the board had been reduced to writing. The deputation accordingly withdrew and deliberated upon the matter, and passed certain resolutions, which were embodied in the following extract from the minutes of the sub-committee:—"Whereas complaints have been made to the local board of the impurity of gas supplied, of defective light, and of the excessive rate of charge for such gas (and the board believe such complaints to be well founded); and whereas the said local board have appointed a sub-committee with instructions to represent these complaints to the Gas Committee of the borough, and have empowered them to take the steps necessary to obtain a proper supply of gas, of proper illuminating power and purity as required by their Act, and an even pressure; and the said sub-committee have this day had an interview with the Salford Gas Committee, and have stated verbally the grounds of complaint, and asked for a remedy, and have pointed out the extreme difficulty which the Salford Gas Committee would have to supply the Barton district satisfactorily, considering the physical conditions of the district, and the fact that the gas-works are 60 feet higher than the average level of this district, and that the district beyond Barton (some parts of which are upwards of 200 feet higher than the level of Barton) are supplied by three outlets through their district; and the committee have on the invitation of the Gas Committee made suggestions for the consideration of the Gas Committee; and whereas the Salford Gas Committee have requested the sub-committee to reduce their suggestions to writing; it is ordered that the clerk do inform the Salford Gas Committee as follows:—That it is the opinion of this committee that before the Salford Gas Committee expend any portion of the £160,000 which they have resolved to expend on their gas-works, and works to supply this district (and especially so after the admissions made in their engineer's report, which was adopted by the council), it is desirable and necessary that they should satisfy themselves that it is practicable to satisfactorily supply the district with gas, the opinion of this committee being that it is not practicable. Ordered, that on the assumption that it is practicable, the clerk suggest—1, the provision of a gasholder in the district, the disconnection of the supply-mains with the high-lying districts beyond, a reduction in the price, and a reduction in the differential rate between the consumers in the borough and in the local board district; 2, the provision of a holder in the district, and the supply of gas in bulk by the Salford Gas Committee, on terms to be arranged; 3, as is most desirable, the Salford Corporation be asked for their consent to the introduction of a Bill to enable the board to supply its own district with gas, and recompensing Salford for its outlay in respect of the district."

PROPOSED PURCHASE OF THE BRISTOL WATER-WORKS COMPANY.

A Special Meeting of the Bristol Town Council was held on Wednesday, the 7th inst.—the Mayor (Alderman Edwards) presiding—to receive the report of the committee appointed by the corporation on the 1st of January, when it was resolved—“That the council is of opinion that it will be for the interest of the city to acquire the undertaking of the Bristol Water-Works Company, providing the purchase can be effected upon equitable terms,” and it was referred to a committee of nine members to negotiate with the directors with that object in view.

The following report was now presented, and having been previously printed and circulated, it was taken as read:—

To the Council of the City of Bristol.

Your committee, before they deal with the important subject referred to them, think it advisable, so far as they understand the facts, to preface this report with a brief statement of the circumstances under which the company had its origin, and its progress to the present time.

It will be remembered that, prior to the year 1846, Clifton and the higher parts of the city were chiefly supplied with water from the Richmond Hill and Sion Springs, and the lower districts from a few public springs and fountains, aided in both cases by private wells.

Efforts were from time to time made to improve the means of supply, and in 1846, after a long parliamentary contest with the Society of Merchant Venturers, the present company was incorporated, with powers, since extended by subsequent Acts, to supply with water the city and county of Bristol, the parishes of Bedminster, Brislington, Long Ashton, and Abbot's Leigh, in the county of Somerset, and St. George, Westbury-upon-Trym, Stapleton, Horfield, and Henbury, in the county of Gloucester.

The company are required to supply water constantly from five in the morning until nine in the afternoon of every day in the months of April, May, June, July, August, and September, and from six in the morning until nine in the afternoon of every other day in the year, subject to a further limitation, in case of unavoidable accident, or drought, frost, or repairs.

Provisions are also made to supply water for trade and other purposes, and to maintain reservoirs to compensate the districts from which part of the water is derived.

The works of the company, besides compensation and other reservoirs, comprise two large stores and one compensation reservoirs at Barrow, with reservoirs at Bedminster and Clifton, supplied from the river Chew and other springs, and from the Midgal and Chelvey springs at Chelvey, in the county of Somerset. The store reservoirs at Barrow extend over 66 acres of land, and contain 350 million gallons of water, being a quantity sufficient for 70 days use, assuming the maximum consumption to be at the rate of 5 million gallons per day. From these sources a daily supply of between 4 million and 5 million gallons is now furnished to the district, and important works are in progress to increase the supply from the Chelvey and other springs, and to duplicate the mains from thence to the city. These works will add very largely to the resources of the company.

The rates to be taken by the company were fixed by the Act of 1846 at a pound rate on the annual value of the premises assessed, and varied from 5 per cent. on houses valued at £5 a year to £2 10s. per cent. on properties exceeding £200 a year, on houses valued at not exceeding 10s. per annum for water-closets and baths, but including, by the Act of 1862, horses and carriages, if kept for private use. In consideration of the new works undertaken in 1862, the rates were then increased by an addition of 1½ per cent. per annum upon the annual rack-rent or value of dwelling-houses in the parishes of Brislington, Ashton, Abbot's Leigh, Stapleton, and Horfield, and of 1 per cent. per annum on houses in any part of Bristol or of the parish of Westbury-upon-Trym, and afterwards by Henbury, which are supplied with water from any reservoir which is itself supplied by pumping.

In 1865 the company, being in embarrassed circumstances, arising from the extraordinary drought of the preceding summer, obtained powers to construct the additional works described in section 14 of the Act of that year, to raise further capital for their undertaking, and to impose a still increased rate, amounting to 1 per cent. per annum on the rack-rent or value of every house supplied by them with water within the limits of their Act of 1862.

The following is a statement, which your committee believe is correct, of the capital of the company granted by their several Acts, distinguishing the description of stocks, the amounts thereof created and raised, and the balance still unissued:—

Description of Stocks.	Amount Authorized.	Amount Raised.	Balance to Issue.
Debtenture stocks under Acts of 1846, 1853, and 1872			
Mortgages under Acts of 1846, 1853, 1862, and 1865	£140,000	£134,000	£5,680
4000 £20 4½ per cent. preference shares, Act 1862, fully paid up	80,000	80,000	Nil.
4000 £20 4½ per cent. preference shares, Act 1865, fully paid up	80,000	80,000	Nil.
5 per cent. preference stock, Act of 1850	100,000	100,000	Nil.
8000 ordinary shares of £25 each, Act 1846, fully paid up	200,000	200,000	Nil.
8000 ordinary shares of £20 each, Act 1872, £8 paid (on the above, a call of £2, £16,000, making £10 paid, is due on the 31st of March).	160,000	64,000	96,000
Under the Act of 1872 there is power to issue mortgages or debtenture stock to the extent of £40,000, but this power can be only partly exercised until the ordinary 1872 shares are fully paid up	40,000	Nil.	40,000
	£800,000	£658,320	£141,680

Subjoined also is another statement compiled from the annual reports of the company, showing the total amount of water-rates received by them from 1846 to 1876 inclusive, and of the dividends paid from 1846 to 1875. The dividend for the present year is not yet declared, but your committee are informed that, after meeting all engagements, it will be at the former rate of 10 per cent. on the paid-up share capital, leaving an unappropriated balance of not less than £6000.

Year.	Total Water-Rates.	Dividend.
1846	—	—
1847	£1,399	—
1848	2,420	—
1849	4,100	—
1850	5,646	—
1851	7,727	—
1852	10,622	—
1853	11,705	—
1854	12,161	—
1855	13,796	£0 14 0 per cent.
1856	14,925	0 16 0 "
1857	15,596	1 2 0 "
1858	16,122	1 8 0 "
1859	16,932	1 18 0 "
1860	17,910	2 6 0 "
1861	18,686	2 12 0 "
1862	20,533	3 2 0 "
1863	22,213	3 12 0 "
1864	22,320	2 18 0 "
1865	23,514	3 0 0 "
1866	25,945	4 0 0 "
1867	30,544	4 12 0 "
1868	35,870	5 16 0 "
1869	37,093	6 12 0 "
1870	40,761	7 14 0 "
1871	43,728	9 0 0 "
1872	45,121	10 0 0 "
1873	46,941	10 0 0 "
1874	51,329	10 0 0 "
1875	54,098	10 0 0 "
1876	56,772	Not declared.

The council will not fail to observe the steady and progressive increase in the water-rates, which have gradually advanced from £1309 in 1847 to the large sum of £56,772 in 1876. Your committee, having regard to the rapidly increasing population, not only in Bristol, but of the important suburbs which are within the limits of the company, see no reason why such increase should not be maintained.

The application of revenue is defined by the Act of 1865, section 12, as follows:—

1. In payment of the repairs, &c., and working expenses.
2. In payment of the interest upon the money borrowed under the Acts of 1846 and 1853.
3. In payment of a preferential dividend of 5 per cent. per annum on £100,000 5 per cent. preference stock created under the Act of 1850.
4. In payment of the interest on £34,000 borrowed under the Acts of 1853 and 1862.
5. In payment of interest on moneys borrowed under the Act of 1865.
6. In payment of any preferential dividend created or to be created under the Act of 1862.
7. In payment of any preferential dividend on any new shares or stock created under the Act of 1865.
8. In payment of a dividend not exceeding 10 per cent. per annum on the ordinary shares or stock of the company.
9. In payment of such a further dividend on the ordinary shares or stock of the company as may at any time be necessary to make up the deficiency of any previous dividend or dividends, when such previous dividend or dividends shall have fallen short of 10 per cent. per annum.
10. In the payment of a dividend on the £100,000 5 per cent. preference stock under the Act of 1850, in addition to the preferential dividend of 5 per cent. per annum, provided that such dividends shall not together exceed the rate of 10 per cent. per annum.
11. Any surplus, after the satisfaction of the purposes aforesaid, shall be invested and form a reserve in the manner and for the purposes in that behalf provided by "The Water-Works Clauses Act, 1847."

Such purposes (sections 76 to 79) are the formation of a reserve-fund to meet contingencies, with a provision (section 80), if the profits are more than the amount prescribed, for making a rateable reduction in the price of water.

The latter is a contingency upon which your committee, with reference to the appropriation of revenue before set out, do not congratulate the council.

Under these circumstances, it appeared clear to your committee that the chief question between them and the directors would arise under section 12, sub-section 9, of the Act of 1865. The tables already cited show that the company for several years after its formation paid no dividend to the proprietors, and that it is only since 1872 that the dividend has amounted to 10 per cent. Hence there is a very large sum to be made up to the proprietors of the ordinary share capital of £200,000 created by the Act of 1846, amounting, as your committee have been informed, to about £317,000, which those proprietors will be entitled to receive, if the resources of the company are adequate to the payment, before any claims can be made by the holders of the sum of £100,000 preference stock referred to under sub-section 10, and before the public can receive any relief in the water-rates, under the contingencies provided for by sub-section 11.

It is clear also that any claims under sub-section 10 are to be postponed until the unissued stock of the company, as well as their unexercised borrowing powers so far as the company find it necessary to issue and exercise them, are provided for and the dividends thereon paid.

The committee, for these reasons, consider that any claims under sub-section 10 have no appreciable value, and they refer now to the fact, because it will explain more fully that part of the negotiations which your committee have had with the directors.

It is unnecessary for your committee to assure the council that they fully appreciate the responsible duty entrusted to them, and that they have undertaken it with a deep sense of its importance, not only to the pecuniary, but to the personal, sanitary, and commercial interests of the citizens.

For some years past Parliament has favoured the transfer of the undertakings of water companies to municipal and sanitary authorities, and further facilities for the purpose are contained in the Public Health Act, 1875.

This principle appears now to be so well settled, that Parliament, in the last session, granted compulsory powers to a municipal body for the purchase of the works of a private company. It should also be added that most of the large towns in the kingdom possess their own means of water service; and that, even when large prices have been paid for the undertakings, the purchases have generally proved remunerative.

Upon a full and careful view of these facts, your committee, on the 31st of January last, informed the directors that the committee, acting for the council, were willing to negotiate with the company for the purchase of their undertaking, and would be glad to know if the company would sell, and if so, on what terms.

In reply to this communication, an answer was received from the secretary of the company referring to a previous letter from him on the 20th of January, in which he stated that it having been decided by a large majority of the council that it would be for the interests of the city to acquire the undertaking of the company on equitable terms, the board considered that it rested with the committee to name the bases upon which they proposed to treat for the transfer of the works to the corporation.

This resolution was considered by your committee on the 7th of February inst., when they determined to request an interview with the directors, and to propose to them at such interview as the bases of terms for the purchase by the corporation of the undertaking of the company:—

1. To assume the responsibility of the preference and debtenture stocks of the company on the terms on which these stocks are now held by the proprietors, and to guarantee to them the respective interest and dividends thereon on the security of the city.
2. To guarantee a like dividend of 10 per cent. per annum to the holders of £200,000 ordinary share capital.
3. To guarantee a like dividend of 10 per cent. per annum to the holders of the additional share capital of £160,000 authorized by the Act of 1872, or on so much thereof as from time to time shall be paid up, with provisions for calling up the balance of such capital at times to be agreed on between the parties.
4. These proposals to be subject to the approval of the council, and also to an investigation to be made by the committee as regards the works of the company, and their sufficiency for the present and future supply of the city, and also as regards their financial position.

These resolutions were communicated to the directors and elicited the following reply, dated the 21st of February:—

Resolved—That the board having considered the resolution of the committee appointed to negotiate for the purchase of the undertaking of the Bristol Water-Works Company, dated Feb. 7, 1877, express their willingness to submit the same to the shareholders of the company, provided there be added thereto the following terms:—

1. The payment to the proprietors of the £200,000 ordinary stock of the company of an annual sum of £4000, in consideration of their statutory right to arrears of dividend as given by the Bristol Water-Works Act, 1862, confirmed by the 12th section (sub-section 9) of the Bristol Water-Works Amendment Act, 1865.
2. That proper provisions be made for the protection or compensation, as the case may be, of all the officers of the company.
3. That a joint committee of both sides be appointed to go into the various points of detail not covered by the various resolutions.

Your committee on the 22nd of February considered the additional terms proposed by the directors, and resolved—

That they will submit to the council, and recommend them to approve, the terms proposed by the committee in their resolution of the 7th of February, for the purchase by the corporation of the undertaking of the Bristol Water-Works Company, with the additions made to such terms by the directors of the company, as stated in their resolution of the 23rd of February inst., it being understood that the committee do not propose, under circumstances that may hereafter arise, that a further dividend should be paid over and above the preferential dividend of 5 per cent. per annum to the holders of £100,000 preference stock created by the company's Act of 1850, and referred to in the Act of 1862, section 31, sub-section 8.

It should be observed that this reference is not correctly quoted, as the 31st section of the Act of 1862 was repealed, and replaced by section 12 of the Act of 1865, to the same effect, as already cited.

On the 26th of February a further resolution of the directors was received by your committee, stating—

That the board having been informed that the committee appointed to negotiate for the purchase of the water-works had resolved to recommend the council to accept the terms referred to and named in the board's resolution of the 21st of February, but that the committee did not propose that a further dividend over and above 5 per cent. per annum should at any time be paid to the proprietors of the £100,000 5 per cent. preference stock, suggested that the claims (if any) arising in respect of such preference stock, should they not be previously settled, be satisfied by the corporation, in the event of their recognition being thought proper by Parliament.

It now only remains for your committee to commend this important subject, the most weighty and important that has engaged public attention since the acquirement by the corporation of the Dock Estate in 1843 to the impartial and attentive consideration of the council. Better terms for the city than those now proposed cannot be made with the company; but although the conditions are onerous, your committee believe them to be fair as between the parties, for, notwithstanding all that has been said, and may be said, as to the great concessions made to the company, whereby their present independent station has been attained, still it must be remembered that if they have now a season of prosperity, they have also had seasons of adversity, and that they hold their undertaking by a parliamentary title which the Legislature is not likely to interfere with by compulsion.

(while the company observe the conditions they have undertaken), except at the full value of the property.

Your committee suggest that the best plan for the council to adopt will be, to decide generally whether it is expedient or not that the negotiation should be proceeded with, on the principles stated, without at present entering into matters of detail. If the council decide in the affirmative, your committee think that the same question should be submitted at as early a date as possible to the shareholders of the company. If both parties agree to the proposals, your committee, on being instructed to that effect by the council, will negotiate details with the directors, reporting again, as soon as definite terms are settled, to the council for their approval.

Your committee in any case will be glad to receive instructions how to proceed with the competing Bill of the Bristol District Water Company, now before Parliament. A petition against the Bill, both on merits and clauses, has been settled and deposited by the Parliamentary Bills Committee, but except to provide for some questions that relate to the breaking up of the streets, the committee do not feel justified either in supporting or opposing the principle of the Bill until it has been further considered by the council.

Your committee have, however, no hesitation in saying that, if the council decide to proceed with the proposed purchase, it would be most embarrassing to them, as the municipal authority acting only in the public interest, if competing powers within the same district were granted to private parties, more especially as such parties appear to be for the most part unconnected with Bristol, and would doubtless deal with the undertaking, if they acquired it, in the interests only of their own shareholders, or perhaps as a speculation to be disposed of on terms of profit, either to the present company or the corporation.

Your committee regret the length of this report, but it is difficult to condense it, with due regard to the intricate points raised, and to the importance of the duty now devolving on the council.

Council House, Bristol, Feb. 28, 1877.

GEO. WM. EDWARDS, Mayor.

Alderman BAKER moved—"That, subject to the postponement of the annual payment of £4000 for a period of five years, the report now read be approved, and that it be referred to a committee to make arrangements for the transfer of the undertaking of the Bristol Water-Works Company to the Corporation on their terms stated in the report, subject to the inquiries referred to in section 4 of the resolution of the committee of the 7th of February last, and also to a satisfactory settlement of the details not covered by the various resolutions; that the committee report their proceedings herein for future consideration and approval."

Mr. WHITWELL seconded the motion.

The TOWN-CLERK intimated that a deputation of ratepayers desired to be admitted, in order to present resolutions on the subject of the proposed purchase, drawn up at public meetings of the ratepayers, and that Mr. Brown, one of their body, should be heard in support of them.

After some conversation on the point,

The TOWN-CLERK advised the council that the parties had no legal right to be heard, and he suggested the adoption of the following motion—"That this council decline to receive the deputation, or to hear their advocate, Mr. Brown; but if the resolutions referred to be presented by a member of the council, they shall receive their careful and impartial consideration."

The motion was unanimously agreed to, and the discussion of the report was proceeded with.

Mr. MATTHEWS handed in memorials that had been adopted at public meetings held at Colston Hall and the Athenæum, protesting against the purchase of the water-works.

The TOWN-CLERK read the memorials, which were ordered to be entered on the minutes.

Mr. MILLS moved, and Mr. TOWNSEND seconded, an amendment to the motion for the adoption of the report, to the effect that the further consideration of the question be postponed until that day month.

After a long and ably-conducted debate, the amendment was lost by 22 votes to 12, and the motion was put and carried. It was also resolved to oppose the Bristol District Water Bill now before Parliament, on the grounds raised in the report.

ARREST OF THE DEFAULTING OFFICER OF THE COLNEY HATCH GAS COMPANY.—The *Otago Daily Times* of the 3rd of January states that, on the arrival of the *May Queen* at Port Chalmers, after a long and eventful voyage, the absconding assistant secretary of the Colney Hatch Gas Company, William Henry Wood, was arrested by London detectives who had been sent out for the purpose. It will be remembered that the culprit left England in September last in company with a young woman, not his wife, and that an investigation of his accounts showed that he had fraudulently appropriated to his own use £600 or £700 belonging to his employers. Information having been given at Scotland Yard, and it having been ascertained that he had taken passage in the *May Queen*, the telegraph was set to work, and early in December the police authorities of Dunedin received intimation of the absconder, with orders to arrest him on his arrival. In the meantime Detective Dalton was despatched to Melbourne by the clipper ship *Kent*, and thence made his way to New Zealand in the steamer *Tararua*, expecting to find the capture had been effected. The *May Queen*, however, made a long passage, and hence the detective arrived before her, and, with Sergeant Hanlon, the officer in charge of the Port Chalmers Police, met the ship and arrested his man. Amongst the property found upon Woods was a draft upon the Bank of New Zealand for £450. On the same day he was taken before the magistrates, and Detective Dalton having given the necessary formal evidence, Woods was committed to the Dunedin Gaol to await the arrival of the Governor's warrant for his transmission to England.

SOCIETY OF ENGINEERS.—At the meeting on Monday evening, March 5, in the Society's Hall, Westminster Chambers—Mr. T. Cargill, C.E., president, in the chair—a paper was read by Mr. J. Walter Pearse on the Mechanical Firing of Steam-Boilers. The author first pointed out some of the disadvantages of hand stoking, and observed that so far back as 1813, mechanical firing was proposed. In 1822, Mr. J. Stanley invented a stoker with crushing rollers and a single horizontal fan, to which, in 1834, he added rocking fire-bars. In 1833, Mr. Jukes patented his first stoker, and in 1841 he invented the endless chain of fire-bars, modifying it again in 1842. In 1863, Messrs. Wilson and Smith brought out their furnace in which the fire-bars were made to travel backwards, carrying the fuel from a hopper to the back of the grate, an arrangement which was improved upon by Messrs. Vicars and Smith in 1867. In 1870, Mr. Dillwyn Smith patented his stoker, in which the fuel is fed on to distributing-fans revolving horizontally. This arrangement was improved upon, in 1870, by Mr. J. F. Deacon. Further additions were subsequently made by Mr. T. Henderson. The Henderson stoker was then described by the author. In it the supply of fuel is effected in the same way as in the Dillwyn Smith machine, but the fire-bars are made to move by simple gear connected with the stoker. Every other bar rises and falls, while the rest slide to and fro, the effect of this action being to clear off the clinker. The Frisbie feeder, improved by Mr. J. M. Holmes, is for slow combustion and intermittent feed. The coal is thrust up underneath, and in the middle of the fire, so that the gases evolved are consumed on passing through the incandescent mass. This stirs the fire and propels all clinker to the circumference of the circular revolving grate. Mr. Holroyd Smith's "Helix" fire-feeder gives a continuous feed from below, by means of a screw working in a casing connected at its upper side with a trough, which takes the place of one or two fire-bars. The saving effected by these stokers was stated to be twofold—first in the quality of the fuel used, and next in the quantity consumed, a reduced first cost being also incurred, owing to smaller boilers and fire-grates serving for a given power, with more perfect combustion.

GAS AFFAIRS IN AMERICA.

REPORT OF THE GAS COMMISSIONERS IN RELATION TO THE SUPPLY OF GAS TO THE CITY OF BOSTON.

(Continued from p. 316.)

Comparison of Companies.

In comparing the results obtained by those companies manufacturing coal gas, so as to arrive at intelligent conclusions in regard to the cost of the gas, we have especially taken into consideration the amount of gas made per ton of coal; the cost of the coal per ton; the labour employed in the manufacture of the gas; the amount of gas sold per mile of pipe main, which gives us in a measure the comparative cost of distribution; and the quality of the gas, since it is evident that gas of a poor quality can be made cheaper than that of a good quality.

It may be assumed that the investment is a proper one, or, if it is not, that fact ought to militate against the company; and that all valuable improvements in gas machinery have been adopted, since it is evident that improvements which increase the amount of gas made per ton of coal increase the profits of the company. And we may therefore assume that any deficiencies, which are found to exist, result from bad management of the funds, or at the works. Unfortunately we are not authorized to make public all of the items of information which we possess, since in most cases some of them have been given to us in strict confidence, but we have ourselves been enabled to make satisfactory comparisons, and arrive at satisfactory conclusions, which are given herewith.

We have also compared the cost of the manufacture of gas in many of the gas companies in the United States with that in the principal European companies, the published accounts of which we have. From these reports the cost of manufacture can be accurately determined, and the calculations in the following table have been made from them. These published accounts we consider of great importance, and shall refer to them again in the last section of this report. The table also contains those items concerning the manufacture of gas in some of the United States companies which have not been given to us confidentially. In the case of the Philadelphia Gas Company, however, all the items can be given, since the calculations have been made from the published account.* This account of the Philadelphia Gas Company is very interesting, since the works are managed under the direction of the city officials, and are, therefore, subject to political influence to a greater or less extent. On examining this account, we are struck at once by the fact that the price of the gas is much lower than that in any of the other cities, while the cost of the gas is much higher. This diminished price with increased cost can be partially explained by the fact that more than five-sixths of the cost of the works has been paid off by the establishment of sinking-funds and the accumulated profits. The account of these works will be spoken of later in reference to the management of gas undertakings by municipal authorities.

In the following table the cost of labour includes merely the wages and salaries at the works; working expenses include labour, purification, maintenance of works, and wear and tear of works; the cost of manufacturing includes the cost of coal and the working expenses; the total cost of the gas includes all charges except interest on the capital.

Now, in comparing the management of the Boston Gas Company with that of other coal gas companies, we find, in the first place, that their coal has cost more on the average, per 1000 cubic feet of gas, than that of any other company delivering more than 50 million cubic feet per year, except the Lowell, Mass., and Manchester, N. H., companies, whose freight is 1.00 dol. more per ton than that at Boston. The same is true of the Dorchester Gaslight Company, whose freight and extra handling make the coal cost much more than in Boston. This is undoubtedly due to the use of the expensive Albertite as an enricher, the price of which in 1875 was more than 25.00 dols. per ton. The ordinary caking coal cost about 6.75 dols. per ton. We should expect with the use of 5 to 7 per cent. of Albertite, which yields about 15,000 cubic feet per ton of a very rich gas, a much larger average yield per ton of coal than we find for the year 1875. In fact, the yield per ton is less than that of any of the other companies of which we have record, except those of Philadelphia, Dorchester, Jamaica Plain, Manchester and Concord, N. H., Milwaukee, Wis., and Columbus, O. In the last two places very cheap coals are used, which yield only small amounts of gas, and in Philadelphia no enriching coal whatever is used. This small yield is probably due chiefly to the use of iron retorts with the Albertite, as has already been mentioned, and during three months of the present year, 1876, while only clay retorts were being used, the yield was about 10,500 cubic feet per ton of coal. The influence of the Albertite on the quality of the gas is seen by the high illuminating power, which is higher than that of any of the other companies using coal alone.

The leakage or unaccounted-for gas in Boston is very small in comparison with most other coal gas companies. This would naturally be expected, on account of the thickly settled district supplied by the Boston Gas Company, which distributes a larger amount of gas per mile of pipe main than any other company in the United States of which we have a record. Hamburg is the only European city with which Boston can be compared in reference to leakage, since that is the only one in whose accounts we find both the items of leakage and miles of pipe main; and by comparing the two it will be seen that the condition of the mains in Boston is superior to that of those in Hamburg. The smaller proportion of unaccounted-for gas in the New York Mutual works may partially be explained by the higher specific gravity of the gas, the amount distributed per mile of pipe being about the same as in Boston. The small per centage of leakage in Lowell and Roxbury, where only about 1,500,000 cubic feet are distributed annually per mile of pipe, can only be explained by the superior condition of the mains. We find also that the cost of labour is rated at a slightly higher figure in Boston than in most of the other large cities. In Philadelphia, however, labour costs about 10 cents more per 1000 cubic feet than in other companies. In Europe labour in general is much lower than in this country, so that we expect to find the labour account of the European gas companies smaller than our own.

In the Hamburg Gas Company the cost of labour is about 17 cents. per 1000 cubic feet of gas sold, which is accounted for by the higher price for labour in that city than in the other cities. Thus, the report of the Hamburg Company gives the rates of wages as 0.81½ dol. for an ordinary day labourer, 1.22 dol. for an inexperienced hand in the works, and 1.47 dol. per day for an experienced hand in the works. These rates are about double those in the other European cities, and they are not far from being one-half of those in this country. It may be said, however, in explanation of the slightly higher rate of labour in the Boston Gas-Works, that the company are very much embarrassed by a lack of room, so that a larger number of men is required than if the ground and buildings could be economically arranged. In one instance a piece of work requires six men, which could be easily performed by two with a different arrangement of the yards and buildings.

In regard to the distribution, about the same may be said as of the labour. The cost of distribution is rated higher than that of any of the

* Forty-first Annual Report of the Trustees of the Philadelphia Gas-Works, January, 1876.

TABLE.*

	Boston.	Roxburg.	Charlestown.	Dorchester.	South Boston.	Jamaica Plain.	Brookline.	Salem.	Lovell.	Fitchburg.	New Haven, Conn.	Hartford, Conn.	Manchester, N. H.	Milwaukee, Wis.	Columbus, O.
	1875.	1875.	1875.	1874.	1874.	1874.		1874.	July 1, 1874, to July 1, 1875.	1873.					
1. Amount of gas made.	688,000,000	90,498,590	62,994,000	30,641,292	55,204,120	15,000,000	24,000,000	33,000,000	78,348,000	8,659,000	112,000,000	100,000,000	54,000,000	70,000,000	60,000,000
2. Amount of gas sold.	631,000,000	82,364,818	51,643,000	24,159,399	46,921,573	13,200,000	20,000,000	28,000,000	71,629,000	7,398,000	103,040,000	93,000,000	50,000,000	55,000,000	51,000,000
3. Amount of gas unaccounted-for.	Per cent.	8.99	18	21 1-6	12	12	18	15	8 1-2	14 1-2	8	7	7	20	15
4. Amount of coal used.	71,872	8,959	5,850	3,295	5,421	1,800	2,500	3,800	7,768 1-2	900	10,500	10,000	6,000	12,000	10,000
5. Amount of gas made per ton of coal.	9,572	10,101.4	10,768	9,299	8,333	8,333	9,600	10,000	10,085	9,621	10,666	10,000	9,000	5,833	6,000
6. Amount of gas sold per ton of coal.	8,780	9,193.5	8,828	7,332	8,655 1-2	7,333	8,000	8,484	9,220	8,220	9,813	9,300	8,383	4,583	5,100
7. Annual cost of coal.															
8. Cost of coal per ton (average).															2.40
9. Cost of coal per 1000 cubic feet of gas made.															
10. Cost of coal per 1000 cubic feet of gas sold.															
11. Annual cost of labour.															
12. Cost of labour per 1000 cubic feet of gas sold.															
13. Total working expenses per 1000 cubic feet of gas sold.															
14. Total cost of manufacturing.															
15. Cost of manufacturing per 1000 cubic feet of gas sold.															
16. Number of miles of pipe main.	112	51 1-2	32	34 1-2	22 1-2	20	38	24	41	9	60	66	26	50	32
17. Amount of gas sold per mile of pipe main.	5,633,928	1,599,316.7	1,613,844	700,272	2,083,403	660,000	526,316	1,166,606	1,747,043	822,000	1,717,233	1,409,091	1,934,615	1,100,000	1,593,750
18. Cost of distribution per 1000 cubic feet of gas sold.															
19. Cost of gas delivered per 1000 cubic feet of gas sold.															
20. Received for residuals per 1000 cubic feet of gas sold.															
21. Cost of gas (less residuals) per 1000 cubic feet of gas sold.															
22. Prices charged for 1000 cubic feet.	2.50	2.70	3.00	4.00	3.00	4.00	3.60	3.50	2.50	3.50 to 4.00	3.00	3.00	Aver., 2.50	3.00	Aver., 2.58 1-2
23. Illuminating power.	18 to 19	17 1-2	17	16 1-2	0.410	17	17 1-2	15	16	15	16	16	17	15	16-17
24. Specific gravity.	0.475	0.422	0.385	0.411	0.400	Not given.	350,000	300,000	500,000	63,000	1,000,000	750,000	100,000	650,000	400,000
25. Capital paid in.	2,500,000	600,000	500,000	400,000	440,000	Not given.	350,000	300,000	500,000	63,000	1,000,000	750,000	100,000	650,000	400,000
26. Bonds issued.	500,000			77,272.18	40,000		140,000	90-91	64-86	66-66	95-23	75-00	16-66	54-16	40-00
27. Capital per ton of coal carbonized.	34.80	66.97	85.47	121.39	81.16		17.50	10.71	6-98	8-11	9-70	8-06	2-00	11-82	7-84
28. Capital per 1000 cubic feet of gas sold.	3.96	7.28	9.68	16.55	9.37										

	Albany, N. Y.	Washington, D. C.	N. Y. Mutual.	Philadelphia.	London (Chartered).	S. Metropolitan.	London.	Commercial (London).	Manchester, Municip. Cor.	Halifax (City Corporation).	Rochdale (City Cor.).	Hereford (City Cor.).	Berlin.	Hamburg.	Paris.
	1874.	1874.	1875.	1875.	1874.	Last Six Months, 1874.	Last Six Months, 1874.	Last Six Months, 1874.	1874.				July 1, 1873, to July, 1874.	1874.	1874.
1. Amount of gas made.	88,000,000	251,688,000	547,800,000	1,873,192,000	4,669,725,000	418,963,000	567,707,000	476,086,000	1,778,437,000	246,912,000	231,496,000	48,197,334	1,827,508,676	721,751,928	5,673,689,557
2. Amount of gas sold.	82,000,000	238,882,500	509,463,700	1,575,939,618	4,167,008,000	380,574,000	521,486,000	422,763,000	1,778,437,000	218,942,900	204,000,000	41,871,132	1,641,328,461	721,943,674	5,673,689,557
3. Amount of gas unaccounted-for.	Per cent.	6.8	7	15.8	9.66	8-2	7-2	10.4	...	11-32	11-8	13-1	10	14-4	...
4. Amount of coal used.	8,800	22,980	38,000	267,596	471,416	43,878	54,110	48,386-19	...	25,591	22,596	4,646	185,285 1-2	72,506	...
5. Amount of gas made per ton of coal.	10,000	10,976	10,395	8,559.6	9,306	9,616	10,492	9,889	...	9,648	10,084	10,371	9,856	9,954	...
6. Amount of gas sold per ton of coal.	9,318	10,418	9,684	7,201	8,539	8,673	9,637	8,738	...	8,555	8,886	9,012	8,658	8,521	...
7. Annual cost of coal.				1,465,264.48	3,294,059.20	221,536.32	333,478.91	273,453.83	907,670.53	96,980.17	141,030.09	37,995.03	1,923,717.81	508,754.85	3,374,059.00
8. Cost of coal per ton.				6.714	6.99	5.05	6.16	5.65	...	3.77	6.17	8.18	7.14	7.01	...
9. Cost of coal per 1000 cubic feet of gas made.				0.78	0.70	0.53	0.59	0.57	...	0.39	0.61	0.72 1-2	0.72 1-2	0.70	...
10. Cost of coal per 1000 cubic feet of gas sold.				0.93	0.79	0.58	0.64	0.65	...	0.44	0.69	0.91	0.82	0.82	...
11. Annual cost of labour.				582,332.24	412,705.90	51,228.28	59,417.11	45,625.56	144,048.31	29,127.08	16,194.87	5,180.25	146,116.84	103,818.00	354,947.00
12. Cost of labour per 1000 cubic feet of gas sold.				0.369	0.11	0.13	0.11	0.18	...	0.13	0.08	0.12	0.09	0.17	0.06
13. Total working expenses per 1000 c. ft. of gas sold.				2,384,559.26	2,292,018.24	292,294.13	453,087.93	379,124.94	...	0.29	0.45	0.28	0.217	0.36	0.25
14. Total cost of manufacturing.				1.51	1.03	0.76	0.87	0.90	...	0.62	0.84	1.19	1.080,624.00	731,109.00	4,780,588.00
15. Cost of manufacturing per 1000 c. ft. of gas sold.				653	...	...	...	...	...	...	...	...	1.181	1.181	1.011 1-2
16. Number of miles of pipe main.	36	116	110	2,413,383.7	2,413,383.7	...	...	...	...	...	...	...	...	...	...
17. Amount of gas sold per mile of pipe main.	2,270,000	2,059,332	4,631,455	2,413,383.7	2,413,383.7	...	...	...	...	...	...	...	...	...	...
18. Cost of distribution per 1000 cub. ft. of gas sold.				0.22	0.05	0.07 1-2	0.06	0.07	...	0.11	0.07	0.04	0.04	0.12	0.05
19. Cost of gas delivered per 1000 cub. ft. of gas sold.				2.15	1.18	0.94	1.11	1.04	...	0.92	1.12	1.33	1.17	1.80	1.30
20. Received for residuals per 1000 c. ft. of gas sold.				0.16	0.304	0.35	0.33	0.29	...	0.25	0.16	0.30	0.59	0.59	0.38
21. Cost of gas (less residuals) per 1000 c. ft. of gas sold.				1.99	0.88	0.59	0.78	0.75	...	0.67	0.96	1.03	0.76 1-2	1.21	0.72
22. Prices charged for 1000 cubic feet.	3-25	2.50	2.75	2.30	1.367	Aver., 0.827	Aver., 1.23	Aver., 1.09	...	Aver., 1.09	1.34	...	Aver., 1.19	1.54	Aver., 1.51
23. Illuminating power.	17	16 1-2	19	16.61	16	...	...	...	...	...	18-19	...	16-17	14	...
24. Specific gravity.				0.729	0.413	...	...	...	...	...	...	...	...	0.398	...
25. Capital paid in.	250,000	350,000	2,500,000	17,673,600.00	2,065,350.00	3,970,383.00	2,439,000.00	...	...	...	...	...	...	...	18,060,000.00
26. Bonds issued.	28.41	15.26	65.79	4,409,170.00	36.21	47.52	73.37	50.40	...	...	29.81	...	...	...	12,883,727.00
27. Capital per ton of coal carbonized.	3.05	1.46	4.90	1.86	4.09	5.47	7.61	5.77	...	...	...	...	...	...	...
28. Capital per 1000 cubic feet of gas sold.									...	...	...	...	...	...	...

* With regard to most of the companies, we have the replies to questions 7 to 15 inclusive, and 18 to 21 inclusive, but are unable to make them public on account of the confidential manner in which they have been given. + On hand June 1, 1874, 104,150,977 cubic feet.

other companies whose figures in this respect we have, when it ought to be smaller, on account of the large amount of gas sold per mile of pipe. As a partial explanation of this, it may be said that the Boston Gas Company keeps men constantly employed at its own expense to answer calls made by the consumers in reference to leaky fixtures, tight stopcocks, &c.; which is not done by any other gas company, so far as we are aware. In the European cities the cost of distribution is very small, much smaller than in this country, on account of cheaper labour and cheaper material. This fact may be seen by comparing the cost of distribution in those cities with that in Philadelphia, where it is almost as small as in any of the United States Companies from which we have accurate reports.

These items, the cost of coal and labour, and of distribution, are the principal ones which go to make up the cost of the gas, being nearly three-fourths of the total cost at the burner, not including interest on the capital. From the total cost of manufacture must be deducted the receipts from the sale of residuals—that is, the coke, tar and ammonia,—the sale of which brings a greater or less revenue, according to the location of the company. In Europe the manufacture of the residuals forms a very important branch of the gas industry; in many places the receipts from the sale of these being equal to much more than one-half of the cost of the coal. In most works in this country the ammoniacal liquor cannot be utilized, and the coke and tar sell for a much less price than in Europe. The receipts for residuals in the Philadelphia works amounted to 16 cents per 1000 cubic feet sold, which is not far from the average in this country, so far as we have been able to learn.

In regard to the price charged to consumers, it will be seen by reference not only to the above table, but also to the list of the prices charged by nearly all of the gas companies in the United States, that the citizens of Boston are served better than those of any city, with the exception of Allegheny City, Penn.; Ashtabula, O.; the People's Company, Cleveland, O.; Cincinnati, O.; Lowell, Mass.; Morris, Ill.; Philadelphia and Pittsburgh, Penn.; Providence, R. I.; Shelbyville, Ind.; Tidionte, Penn.; Washington D. C.; Wheeling, W. Va.; and Washington, C. H., O. Detroit, Mich., is omitted from the list. In Detroit portions of the city supplied by both companies enjoy a low price, 1·00 dol. being charged by the new company, and 50 cents by the old; but in those portions supplied only by the old company the price is 3·00 dols. Of the above cities all but Lowell, Detroit, Providence, and Philadelphia are either supplied with pure petroleum gas, or are situated in close proximity to the coal regions, where coal is very cheap. Of these four, Detroit has, as mentioned, cheap gas in one portion of the city only, on account of competition; and in Philadelphia the manufacture of gas costs more than it does in Boston, the low price being due to the fact that but small profits are necessary for the payment of interest on the capital. In Lowell and Providence the prices are the same as in Boston. It is worthy of note that in all of the large cities, New York, Brooklyn, Chicago, &c., which are supplied by more than one company, the price of gas is higher than in Boston. The reasons for this will be discussed in speaking of the results of competition in the supply of gas to large cities.

It will be noticed that there is a very great difference in the different companies in regard to the proportion of capital to the business done—the amount of capital per ton of coal varying in the United States companies from 10·95 dols. (Philadelphia), or omitting that company, since it is a municipal one, from 15·26 dols. (Washington, D. C.) to 140·00 dols. (Brooklyn, Mass.); and per 1000 cubic feet of gas sold from 1·46 dol. (Washington) to 17·50 dols. (Brooklyn). This must be due to a great extent to improper investments or expenditures, and is the great argument against any monopoly being in the hands of a private corporation, and in favour of its management by municipal authorities; since a corporation having a monopoly has the power to charge such a price as may be necessary to pay its dividends, and has therefore no inducement to diminish its capital, but, on the contrary, to increase it. The average capital and borrowed money in the London companies in 1873 was 34·24 dols. per ton of coal carbonized, and in 1874 it was 39·79 dols. per ton of coal, and 4·54 dols. per 1000 cubic feet of gas sold.

After the lengthy hearing before the Board of Aldermen, previous to our appointment, our inquiries were naturally directed towards the manufacture of gas from petroleum and naphtha, especially the Gale and Rand process. After a visit to the New York Mutual Works, we proceeded to Saratoga, where this process was first put into operation for the purpose of lighting a city. The Saratoga Company tried it for two years, but, as we were informed by the treasurer, without success, since it was found impossible to make gas under the Gale and Rand patents from petroleum alone (mixed with air) which would not be variable. On some nights it was of good quality, while on others great complaint was made on account of its inferior illuminating power. Petroleum was, therefore, finally abandoned, and coal gas again used.

At the New York Mutual works we found everything appertaining to the manufacture of gas to be of superior order and under the best of management, and through the courtesy of the superintendent we received all attention and information. These works were established in 1873. The stock of the company is owned by large capitalists of New York, and it is no doubt owing to their influence that the company was so successful in gaining a favourable position in the city in competition with the other long established companies. The capital stock was nominally 5 million dols. but only 2,500,000 dols. were paid in, and 500,000 dols. in bonds issued. During the first year many obstacles were encountered in making the petroleum gas, both in the distillation and the carbonizing. At first a large amount of air was added, so as to dilute it until the proper candle-power was obtained; but experience soon taught them that the less air added the better, and also that naphtha was better for gas purposes than petroleum.

At the time of our first visit to these works, July 14, 1875, the naphtha was placed in a boiler, under which was an open fire, and boiled. The vapour was then conducted through a 2-inch iron pipe nearly to the further end of the retort, which being kept at a nearly white heat, quickly decomposed the vapour to a fixed gas. This gas was mixed with 14 to 15 per cent. of air, the mixture passed through the station-meter, and then mixed with the coal gas, which had been purified in the usual manner, and measured by a separate meter. The mercantile gas thus obtained consisted of about 70 per cent. of coal gas, and 30 per cent. of mixed naphtha gas and air; or 70 per cent. of coal gas, 25½ per cent. of pure naphtha gas, and 4½ per cent. of air. Since then the amount of air has been still further diminished. This small proportion of air is added merely to keep the mixed gas of a uniform strength, the quality being tested every half hour with a jet photometer, so that any sudden variation is detected at once, and a little more or less air added to correct it.

In this way a gas was furnished to the consumers very pure and of a high illuminating quality. It contained, at the time of our examination, only traces of ammonia (about one-quarter grain in 100 cubic feet), and less than 9 grains of sulphur in 100 cubic feet. Its specific gravity averaged 0·729, and its illuminating power between 20 and 21 candles. The superintendent informed us that he intended to keep the illuminating power about 20 candles, but that it varied between 19 and 21 candles.

On account of its high specific gravity, it is subject to a lower per centage of leakage (the unaccounted-for gas being only about 7 per cent.) and

the consumer finds such a saving at the burner as to materially reduce the amount of the gas bills. This fact was ascertained by inquiring of several large consumers of the New York Mutual Company's gas. At the Fifth Avenue Hotel, the Everett House, and the St. Nicholas Hotel the proprietors expressed themselves as perfectly satisfied with the quality of the gas, as well as the reduced amount of their consumption.

Since much had been said at the hearings before the Boards of Aldermen of Boston and Lowell about the smoky qualities of the New York Mutual gas, we obtained from the treasurer of the Manhattan Gaslight Company a list of the names of those parties who were said to have returned to them after having given the New York Mutual gas a fair trial, and we interviewed them personally.

We found that the statements concerning the smoky qualities of the Mutual gas, as given in evidence at the hearings before mentioned, were hardly just, inasmuch as in most cases where such complaints were made it was found that the parties had taken no precautions against burning too large a volume of gas, and the rooms were in most cases low and poorly ventilated. The smoking was due entirely to the fact that the Mutual gas was a rich gas, 19 or 20 candle power, and not at all to the fact that naphtha gas was one of its constituents. The same effect would have been produced by a pure coal gas of the same illuminating power.

Not satisfied with the inspection of stores and hotels, we desired to see a dwelling-house where the Mutual gas was burned, and accepted the invitation to visit one, which perhaps contains as fine frescoes and as delicately tinted walls as any dwelling-house in New York City. Here, although we found large chandeliers (one containing 50 burners) and bracket-lights in such positions that the slightest smoke would have discoloured the frescoes and walls, we did not, in any instance, after carefully inspecting the house from basement to attic, find the slightest discoloration from smoke. After so severe a test as this, we were forced to conclude that the Mutual gas, with proper burners, is fully equal in point of cleanliness to that of any other manufacture; and, indeed, we were surprised to find that any gas could have been burned in such exposed positions for more than two years without some deposit. It is not, of course, necessary, in enriching with naphtha, to add so much as to bring the illuminating power to 20 candles. A gas of 18 candles would be as acceptable to the consumer as one of 20 or 21 candle power, and would be less liable to smoke than a coal gas of equal illuminating power, burned through the same burner and under the same pressure.

The New York Mutual Company distribute, through about 110 miles of pipe main, about 509 million cubic feet of gas per year, at a cost to the consumer of 2·75 dols. (reduced in 1876 to 2·50 dols.) per 1000 cubic feet. The Boston Gas Company have about 112 miles of main, and deliver 631 million cubic feet, at a price of 2·50 dols. (reduced April 1, 1876, to 2·25 dols.) per 1000 cubic feet. The gas unaccounted-for in the case of the Mutual Company is about 7 per cent., and in that of the Boston Company about 8½ per cent., so that with the actual capital paid in by the Mutual Company, 2,500,000 dols. with 500,000 dols. bonds, and the Boston Company's capital and bonds being of the same amount, we have two gas companies so nearly equal in respect to capital, capacity of works, and compactness of their districts, that we may safely compare one with the other, without any other prejudice than may arise from superiority of the process of the manufacture, or from the economy thereof.

Since it is a very difficult matter to make up the cost and delivery of gas in detail of costs of material, labour, &c., while comparing one company with another, inasmuch as information given us touching upon net cost of manufacture was confidential, and as each company has a different manner of figuring, we will, for the sake of comparison, presume that neither company has any annual surplus after paying the dividends, and so get at the supposed cost of gas to the company by deducting the amount of dividends and taxes *pro rata* per 1000 cubic feet from the average price of gas to the consumer. Thus, for the New York Mutual Company:—

	Dols.
20 per cent. dividends paid on capital, 2,500,000 dols. (paid in)	500,000
6 per cent. interest on bonds, 500,000 dols.	30,000
Taxes in New York, say	50,000

With delivery of 509 million cubic feet 580,000

Gives for each 1000 cubic feet sold 1 14

Average price for gas at 2·75 dols. per 1000 cubic feet, less
10 cents. per 1000 cubic feet for discounts, street lights 2 65

And we have the supposed cost per 1000 cubic feet 1 51

At the hearing before the Board of Aldermen in Boston, the evidence given by J. L. Kennedy, of the New York Mutual Company, confirms this result thus:—

	Dols.
Cost of coal per 1000 cubic feet	0 75
Labour	0 25
Distribution	0 20
Leakage, "which is high"	0 15
Taxes, 18 cents per 1000 cubic feet, would give 90,620 dols. in place of about 50,000 dols. canal coal for enriching, per 1000 cubic feet	0 20
	1 73
Less residuals	0 23
	1 50

And from information in our possession we feel assured that the result is even more favourable than here represented; but we do not feel authorized to give further details in proof thereof.

(To be continued.)

QUALITY OF THE NEWCASTLE-ON-TYNE GAS.—Mr. John Pattinson reports the following as the results of his examinations for the month of February of the quality of the gas supplied to the borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Date.	Illuminating Power in Sperm Candles.	Grains of Sulphur in 100 Cubic Feet of Gas.	Sulphuretted Hydrogen.
Feb. 2.	14·0	6·83	Nil.
" 6.	14·4	6·84	"
" 9.	13·9	5·56	"
" 13.	14·9	9·15	"
" 16.	14·6	7·87	"
" 20.	14·5	9·12	"
" 23.	14·3	8·18	"
" 27.	14·1	6·88	"

A Sugg-Letheby standard Argand burner is used in testing. According to Act of Parliament the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas.

MANCHESTER DISTRICT ASSOCIATION OF GAS ENGINEERS.

The Seventh Annual and Twenty-ninth Quarterly Meeting of the above Association was held at the Mitre Hotel, Cathedral Gates, Manchester, on Saturday, Feb. 24, at three p.m.—Mr. JOHN STORER, president, in the chair.

The minutes of previous meeting were read and confirmed, and the following gentlemen elected members, viz.:—

Mr. Joseph Hepworth, Gas Engineer Carlisle.
 „ W. A. Walker, „ „ Elland.

The following report of the committee was then read:—

Gentlemen,—Your committee, in presenting their seventh annual report, have again the pleasure to state that the operations of the Association continue to be highly satisfactory.

During the past year we have had an increase of eight members, which brings our total strength to seventy, all of whom are *bonâ fide* engineers and managers of gas-works. The funds of the Association are in a very prosperous state, as will be seen from the statement of accounts which has been supplied to each member. The papers read during the past year have been of sterling excellence, and the committee tender their thanks to the members for good attendances, and also especially to those members who have contributed papers.

The thanks of all the members are especially due to the retiring president, John Storer, Esq., for the very efficient manner in which he has discharged his duties during his term of office, and also for the hospitable manner he entertained the members at their excursion to Alton Towers on Sept. 1, 1876.

At our May meeting the members accepted the invitation of Mr. Jacques, ex-president, to visit the Stockport Corporation Gas-Works, and also to inspect the plans of their new gas-works at Portwood. The members expressed their gratification at the inspection, and the thanks of the Association were given to Mr. Jacques for his kindness.

Your committee cannot conclude this report without expressing their deep sorrow at the death of Mr. Joseph Wood, the late engineer of the Bury Gas-Works. Mr. Wood was one of the pioneers of the British Association of Gas Managers, was a vice-president of the same, and also was the first president of our own association, and an active member to the time of his decease. The late Mr. Wood's sterling character, honesty of purpose, and true good-heartedness, endeared him to every member of our Association. By his departure from amongst us our Association lost a highly respected and valued member, and ourselves a faithful friend. "To know him was to love him."

The election of officers for 1877 resulted as follows:—

President—Mr. John Hutchinson, Barnsley.

Treasurer—Mr. James Paterson, Warrington.

Hon. Secretary—Mr. William Longworth, Dukinfield.

Three Members of Committee { Mr. Robert Hunter, Stalybridge.
 { Mr. David Clarke, Ashton-under-Lyne.
 { Mr. William Smith, Hyde.

Auditors { Mr. John Cockcroft, Littleborough.
 { Mr. John Henry Lyon, Macclesfield.

The new PRESIDENT (Mr. John Hutchinson) having taken the chair, delivered the following address:—

Gentlemen—Having done me the honour of electing me to the office of President of the Manchester District Association of Gas Engineers for the present year, I beg to thank you most sincerely for the marked confidence you have unanimously shown in placing me in such a high position. I feel there are many gentlemen present who have charge of far larger gas undertakings than myself, and who, from their position and extended experience, are more eligible and likely to undertake, and successfully carry out, the duties devolving on this chair, than your humble servant. However, as it is your wish, I gladly accept this office of distinction, at the same time assuring you that during my term of office it will always be my aim and endeavour to so conduct your affairs, as to be creditable to myself, and practically useful to the members generally. Although I feel I am not the best possible person to deliver an address, I think most of you will give me credit for having the interest of the Association at heart.

In introducing the business before us, it becomes my duty to make a few remarks (which I will do as briefly as possible), principally with the view of calling the attention of the members to some little events now passing in the gas world, which may form interesting subjects for discussion; also to the utility and prosperous state of our own Association.

As regards the latter, I think we may safely congratulate ourselves on its increased popularity, and upon the interest taken in this local Association by gentlemen whose profession brings them into intimate connexion with all matters that relate to gas or gas undertakings. This will equally apply to the increase of members, and to the very satisfactory state of the funds, particulars of which have already been given in the report of the committee just read. All this tends to show the high esteem in which this and similar institutions are held by those interested in gas matters. Its practical value to its individual members cannot be over-rated, for it is well known that numerous young, hardworking, and aspiring gas managers have received much valuable information by being able to exchange ideas (often to their mutual advantage) with their brother members in other towns; and this has directly benefited their employers and the public. Nor should it be overlooked by the consumers of gas throughout the country that this constant communication and diffusion of technical knowledge, freely given to each other, must necessarily have an indirect, yet a very important influence on the general reduction in the price of gas, thus clearly benefiting the public.

Yet, while we notice the above gratifying facts connected with this Association, there are others that demand our attention. There are losses as well as gains to be taken into consideration. Gas engineers, like other mortals, cannot live for ever. I notice that, during the past year, we have lost one of our oldest and most esteemed members by death—I refer to the late Mr. Joseph Wood, engineer of the Bury Gas-Works. We all deeply feel the loss. His professional abilities were well known to be of the highest order. To his memory I think I cannot do better than quote a few words already in print: "Mr. Wood's sterling character and genial disposition secured for him the esteem of his professional brethren; to know him was to love him." He was in the 45th year of his age.

I often think if the public only knew what a gas manager in a large town has to undergo for their comfort—the constant daily and hourly application required of him, and the unrelaxing tension he is always under—they certainly would be more guarded and charitable in their remarks about that very useful, yet often abused, individual. Another thing I may mention. It is becoming the fashion to take over old and well-established gas undertakings into the hands of local authorities. This is commonly effected after sufficiently harassing the directors into a tacit consent, and the manager, after spending some 20 or 30 years of the best portion of his life in the honourable service of the gas company, is quietly set aside, or, if taken into consideration at all, it is at an estimated value similar to worn-out old grate-bars.

This is not at all as it should be. There are cases now on hand, and there may be some members here present who have suffered from these changes, and if this Association is of any real practical use at all, I think it should be to support and protect the mutual interest of each deserving member; and to take care that such an interference with his prospects in life should not be unnecessarily harsh, or be agreed to without due and ample compensation. I am sorry to see the occupation of a good and sterling old gas manager is rapidly becoming a thing of the past, as decision of character is nearly out of the question; there are so many deterring forces to contend

against. For instance, in the new order of things, under local authorities, he cannot order, in some cases, even sixpennyworth of besoms, however urgently needed to keep the premises clean, without an order signed by the town-clerk, borough accountant, chairman, solicitor, and councillors. All this is very humiliating to an energetic, pushing man. And I think you will all agree it will be very detrimental to the interest of the consumer wherever persisted in. If an engineer or manager be appointed, let him maintain and fulfil his proper position, and then I have no hesitation in saying that the results will be much more satisfactory.

I may here notice that several interesting papers have been read during the past year by the members. Amongst these was one "On Proportional Capacity of Gas Apparatus," by Mr. Samuel Hunter. This was a paper of much interest to gas engineers, and is still on our books for discussion. I did hope that it would have taken place to-day, but I am informed that Mr. Hunter is unable to attend from ill-health. I also much regret the absence, from the same cause, of our worthy honorary secretary, Mr. W. Longworth, who is always ready and willing to give any assistance in his power.

I cannot pass over without mentioning the very numerous and extensive actual and proposed enlargements to many of the gas-works in the counties of Lancaster and York. This activity is the more remarkable considering the generally depressed state of trade.

I was much pleased to have the opportunity during the past year of inspecting the competing plans for the new gas-works of the Manchester Corporation, and was struck with the absence of any material change in the proposed apparatus depicted therein for rapidly generating gas. It was certainly a grand array of first-class drawings for works of great magnitude, the full particulars of which have been duly recorded in the JOURNAL OF GAS LIGHTING.

I wish also to notice Messrs. Körting Brothers Steam-Jet Gas-Exhausting Apparatus, which I am of opinion is really an acquisition to any modern gas-works. My friend, Mr. Whitaker, manager of the Wakefield Gas-Works, informs me that he has one now in full operation in conjunction with Messrs. Körting Brothers steam scrubber, and that he is very much pleased with it, demanding, as it does, no skilled labour on the part of the attendant, and only requiring the number of ports to be adjusted on setting down or putting on of additional retorts. He states very positively that by its use there is no decrease in the illuminating power of the gas, but a positive gain of one candle, which I find is confirmed by other engineers. The apparatus is coming into very general use, as it requires no attention after being adjusted, thus saving engine-men's wages, &c.

Messrs. Pelouze and Audouin's condenser appears a very admirable apparatus, and one which will commend itself from its comparatively small cost, and the very little space it occupies. I am not at present aware of one in operation in England, but if so, shall be glad to hear details respecting its practical working.

I have pleasure in bringing before your notice a model of a fastener for retort-doors, recently patented by our worthy ex-president, Mr. Storer. This fastener is certainly a step in the right direction, and its simplicity and efficiency will most surely tend to its adoption in every gas-works.

In conclusion, no doubt you will have observed an advertisement in the JOURNAL OF GAS LIGHTING for Feb. 20, 1877, page 279, in which it is stated that the indefatigable engineer, Mr. W. J. Warner, of the South Shields Gas Company, is about to inaugurate a public exhibition in that town of the most suitable and efficient apparatus for the application of gas to various domestic and other uses, such as cooking, &c., from the small requisites of a mechanic's home to the elaborate requirements of a gentleman's mansion; the heating of water, air, or other means of keeping hothouses properly heated by the most constant and easily regulated method; the application of gas for heating any room by open fireplace, &c.; and last, but not least, its use as a motive power. This, and similar exhibitions, including a collection of the best burners, are, I think, very much needed, and would, undoubtedly, do much to disabuse the public mind as to the supposed inferior quality of gas said to be supplied by some companies, the complaints in most cases being the direct result of the employment of very inferior burners. If the best class of appliances are made known, and become familiar to the public, they will be better appreciated, and day consumption encouraged. Mr. Warner desires me to say to the members of this Association that though the advertisement is addressed to manufacturers of apparatus, it is not intended to exclude any one from exhibiting any suitable apparatus coming within the range of the classes named. This movement is decidedly one in the right direction, and I wish it every success. The consumption in the above-named appliances, being mostly in the daytime, will be of still further benefit in utilizing our mains during a period when they are, as yet, little drawn upon.

I notice with much pleasure the daily-increasing sale of gas-engines (particularly those patented by Messrs. Otto, Langen, and Crossley), which are, without doubt, the cheapest and most handy motors at present in the market for powers from $\frac{1}{2}$ to 3 horse.

With these few remarks, I now close my address, thanking you for the very patient and attentive hearing you have accorded to me.

Votes of thanks were accorded to the ex-president (Mr. Storer) and to all the other officers, and, on the conclusion of the business, the members sat down to an excellent tea, and a very pleasant evening was spent.

BURSLEM AND TUNSTALL GAS COMPANY.—An extraordinary general meeting of shareholders was held on the 1st inst. to "receive and decide upon the report of the committee appointed as per resolution passed on the 17th of January, 1876." Mr. A. Shaw, chairman, presided. The committee, in their report, recommended that in recognition of the valuable services of the directors and auditors, who had successfully carried the undertaking through times of great financial distress, and had brought it to its present position, the sum of £1600 should be awarded to them. The recommendation was agreed to.

PICKERING GAS AND WATER COMPANY.—The first annual meeting of this company was held on the 28th ult.—Mr. J. Watson in the chair. There had been a previous meeting of directors, when the tariff for supplying the water to the town was agreed to. The report was read by Mr. J. D. Whitehead, the secretary, from which it appears that the company are rapidly pushing forward their works, the pumping-engine having been erected, and the reservoir nearly ready, and the company will be able to supply the town with water in the course of a few weeks. The building of the gas-works has been commenced close to the North-Eastern Railway, and a siding laid down to the railway, and the company expect to be ready to supply the town from the new works before next winter. The chairman, in his opening remarks, said it had been found necessary to enlarge both the size of the gas-works and the reservoir, owing to the great number of applications the company had received from parties wishing to be supplied, and probably before the next meeting there would have to be a call of about £2 per share. The engine commenced to pump water into the reservoir on that morning, and during the day the hose was attached to the different fire-plugs in the town, and all were found to work satisfactorily.

GAS-GOVERNORS.

At an Ordinary Meeting of the Philosophical Society of Glasgow, held on the 21st ult., Mr. D. BRUCE PEEBLES, engineer, Edinburgh, by special request, read a paper on "Gas-Governors, with Peebles's System of Controlling their Action." It was very fully illustrated by diagrams, apparatus, and by means of some beautiful experiments. As most of the facts and arguments embodied in Mr. Peebles's paper have already appeared in the pages of the JOURNAL OF GAS LIGHTING, it is not necessary that we should reproduce them on this occasion; we therefore content ourselves, by giving a summary of the discussion which followed the reading of the paper.

The CHAIRMAN (Dr. Andrew Fergus, one of the vice-presidents of the society) highly complimented Mr. Peebles on the great value of his paper, and on the beauty and convincing character of the experiments, and in the name of the society thanked him for the same. He then called upon

Dr. WALLACE, Gas Examiner for the city, who opened the discussion. Having congratulated the lecturer on the interesting nature of his discourse, and the beauty of his demonstrations, remarked that it appeared to him that there were three points in Mr. Peebles's invention. First, there was the enclosure of the governor in an air or gas tight cylinder, doing away with the liability to accidental escape, which, by tilting, occasionally occurs with ordinary station-governors, sometimes attended with disastrous consequences. Secondly, the control of the governor was effected by a small instrument which could be placed at any distance without interfering with the certainty of the effect. Thirdly, the regulation was effected by means of a few weights, which were so small that they could be carried about in the waistcoat pocket, instead of by the ponderous counter-balances they had been accustomed to see in gas-works. As regarded the necessity for reducing the pressure in order to develop the illuminating power of coal gas, and to prevent unnecessary leakage, that had been amply demonstrated by Mr. Peebles.

Mr. MAYER said he had either read or heard that street-lamp regulators, of which Mr. Peebles had supplied some thousands to the Police Board of Glasgow, had been condemned by the authorities as being unreliable. If that was really the case, which he would be very sorry to learn, it would be well that they should hear the reason why. He was glad to see two members of the Town Council present, one of whom (Mr. Dron) was a member of the Corporation Gas Committee, and he thought it would be well if those gentlemen could state the facts of the case, and answer the question—"Why were the lamp regulators condemned, was it on account of proved inefficiency, or was it due to the fact that some other invention was to be favoured?" He said he might inform the society that there were no fewer than four gas managers present, all of whom should be asked to discuss the important subject brought forward by Mr. Peebles. Doubtless they were all well able to do so. They were—Mr. Stewart, of the Greenock Corporation Gas-Works; Mr. George Hislop, of Paisley; his brother, Mr. James Hislop, of the Partick, Hillhead, and Maryhill Gas-Works, who was a member of the society; and Mr. Key, manager of the Tradeston Station of the Glasgow Corporation Gas-Works.

The CHAIRMAN remarked that the society would be very glad to hear the opinions of all the gentlemen named, and he called upon

Mr. SAMUEL STEWART (Greenock), who said he had a very high opinion of Mr. Peebles's gas-governors. A great many governors had, from time to time, been introduced to the notice of the public, but he thought that of those now before gas managers, Mr. Peebles's was the best he had yet seen. It was evident, from the drawings before them, that although gas-governors had been brought out in which the gas had been applied on the upper side of the bell, to give the required pressure, yet in no case had that been so effectually done as with the governor invented by Mr. Peebles; and certainly they were entirely indebted to him for the very beautiful invention by which the larger governor could be controlled by a smaller one at any distance from it. That was an invention of the very greatest utility, not only in gas-works, but also in the houses of private consumers, and one that he anticipated would be largely adopted. He might add that he expected shortly to be able to introduce one of Mr. Peebles's governors into his works for controlling the gas supply of the town, as he had the greatest confidence in the mechanism. With respect to the necessity for using governors, Dr. Wallace had told the society, on a previous occasion, that "to consume gas efficiently it must be burnt at a very low pressure." The pressure thrown by the gasholders at the works from which the gas was supplied, was usually much in excess, and in order to check it station-governors were employed; but, notwithstanding, towns subject to great variations in level, such as Greenock, would occasionally have a very excessive pressure in some parts. Even in towns perfectly level, it was evident that, to give a sufficient supply to the outskirts of the town, those consumers near the works would be subject to a much greater gas pressure than was proper for the efficient combustion of the gas and to prevent waste. It was manifestly unfair that, because a consumer happened to live near the works, or in an elevated part of the town, he should be subject to a loss, arising from imperfect combustion, in consequence of excessive pressure. Hence arose the absolute necessity for having the gas supply all over a town, high and low, east and west, north and south, adjusted to a level pressure, which could only be done properly by district governors. But when the pressure had been rightly adjusted, it followed of necessity that, in order to give all the consumers a sufficient supply, there must be in every street a pressure in excess of that required for efficient combustion, and that must be controlled by means of a governor intelligently adjusted, and fixed on the meter of the gas consumer. The governor must be adjusted to a minimum pressure to give the required light when the maximum number of burners were lighted, and then, afterwards, the governor would control the gas supply so as to keep it at the minimum pressure, whatever might be the number of burners lighted, whether few or many.

Mr. JAMES DEAS, Memb. Inst. C.E., asked Mr. Stewart if he used district governors in Greenock?

Mr. STEWART replied that he did not. He had there a system of valves, and the mains in the higher levels had been proportionately reduced. He had also valves on each end of the mains in each street, which enabled him to keep the pressure very much under control. But it was evident that valves would only control the gas pressure effectually during the time of the maximum consumption, for the moment the consumption began to decrease, then the pressure would begin to increase on the outlet side of the valve until, as consumption fell off, it would equal that on the outlet side of the valve. The same thing happened when consumers turned the tap on the meter to suit their consumption of gas—an expedient which did very well for a time, until a number of the lights were turned out, when pressure began immediately to increase, until it reached something like that in the street. The only true remedy for excessive pressure was governors on the street mains and in consumers houses.

Mr. G. R. HISLOP (Paisley) said he had very much pleasure in contributing his quota of general testimony in favour of Mr. Peebles's system of gas-governors. He was especially pleased with his patent station-governor, as represented in one of the drawings, and as proof of that fact he had already purchased several of them for country gas-works, which had, so far, afforded him entire satisfaction. In the scale of magnitude he had been advancing step by step, as it were, but he hoped to be able shortly to procure one for

his own works, or, with the utmost confidence, recommend to others the use of such governors of any magnitude. With regard to Mr. Peebles's lamp-governors, he might say they had for some time had them in use in Paisley, and certainly nothing had occurred to give rise to any feeling of dissatisfaction in his mind (such as was hinted at by Mr. Mayer with regard to Glasgow), or resolution to discontinue their use. He was not informed as to how they were managed in Glasgow, or how long they had been in use as affecting their present condition; but, undoubtedly, governors were like other instruments or machines in being liable to get out of repair somewhat. They required occasional examination and readjustment, and if they received such overhauling at moderate intervals of time, it seemed to him to be all that was necessary; indeed, he was quite satisfied with the working of the governors referred to. Reverting to the station-governor, Mr. Hislop thought that it was a very beautiful arrangement, whereby the pressure upon the town was regulated and controlled by the initial pressure of the gasholder instead of by weights, and at any distance from it. On that account alone the governor was almost sure to gain favour and find general adoption, and he concluded by saying that he had much pleasure in having had the opportunity of expressing the favourable opinion which he had formed of it.

Mr. JAMES HISLOP (Maryhill) remarked that it was now more than a year since Mr. Peebles made him acquainted with his new patent station gas-governor. The bell was completely enclosed in an air-tight vessel, which was acted upon by the initial pressure of the gasholders, and the flow of gas was regulated in a very ingenious and most perfect manner by one of his patent house-governors, and in that way the station-governor was not affected by the variation of pressure in telescope gasholders, as was the case with nearly all the ordinary cone governors. He believed that Mr. Peebles had hit upon the only true method of constructing a gas-governor—one provided with an adjusting medium that was capable of being placed either upon it, or at any distance from it; and he had no hesitation in saying that it was to Mr. Peebles alone that they were indebted for the novel and all-important invention which that gentleman had brought under the notice of the society. On reflection, it occurred to him (Mr. James Hislop) that, with the adjusting medium referred to, a station-governor could now be looked upon in the light of a steamer upon a river—having its wheels or helm in various positions as found most suitable. The invaluable improvements described by Mr. Peebles might not be appreciated to their full extent for a little time, but he was quite confident that their value would soon be realized, and that the inventions would be adopted not only by all gas manufacturers, but also by the consumers of gas generally. He thought they ought to feel very grateful to Mr. Peebles for coming such a distance to exhibit so many elegant designs of gas-governors, and for the very instructive paper which he had delivered thereon.

Mr. W. R. W. SMITH said that, with reference to the remarks made by Mr. Mayer regarding the street-lamp regulators in Glasgow, there were two sides to the question, and he felt induced to put forward the other side. He was one of three members of the Watching and Lighting Committee of the Police Board to whom had been remitted the duty of inquiring into the actual value of the lamp-regulators, and their fitness to discharge the duty expected of them. The sub-committee referred to had taken a walk through the streets one night, and had selected eight of the lamps from which they gave orders for the regulators to be removed and taken to Dr. Wallace to be examined and reported upon by him. He (Mr. Smith) understood that they were then all found to be inefficient for the performance of their duty. So far as he was himself concerned, he admired the invention very much; so much, indeed, that he had one in his own house, where he found it to work admirably, and he would strongly advise all other gas consumers to follow his example in that respect. But he thought that Mr. Peebles was not doing justice to himself in regard to the lamp-regulators. His opinion was that they suffered in their regulating power by being placed inside the lamps, where the heat was so great as to interfere with the quality of the leather forming the diaphragm of the regulator, and he urged the propriety of placing the regulators outside the lamps.

Mr. ST. J. V. DAY, C.E., said he had been particularly interested in Mr. Peebles's paper, and, in respect of the experimental illustrations of the effect of the system of controlling gas-governors, which Mr. Peebles had brought before the society, there could be but one opinion, and that a most favourable one. But, in regard to this question of controlling the action of a governor, Mr. Peebles seemed not to be aware of what had been done, a considerable time before the date of his own patent, in France. In his paper Mr. Peebles had shown that the proposal to control the action of the governor by admitting gas above the bell or diaphragm originated with Mr. Brothers, but Mr. Brothers admitted the gas from the inlet side. A little later Mr. Cathels devised a governor, in which the gas was admitted to act on the bell or diaphragm from the outlet side. In both of these cases the controlling gas was stationary, and varied with the inlet pressure in the former, and with the outlet pressure in the latter. Both of them were manifestly defective. But by letting a little gas flow continuously through a pipe into the chamber containing the bell, and providing that pipe with a stopcock, the area of opening in which could at any time be varied, it was obvious that any pressure requisite for the proper control of the governor at any time could be obtained in the bell chamber. He exceedingly regretted that it appeared from the tenor of Mr. Peebles's paper that Mr. Peebles was unaware this same method of control—viz., by the continuous flow of gas through a small pipe or orifice regulated by a stopcock—had been introduced by M. Giroud, the French gas engineer, who was well known in connexion with the beautiful rheometer bearing his name. He held in his hand M. Giroud's treatise, entitled "*De la pression du gaz d'éclairage et des moyens à employer pour la régulariser*," published so long ago as 1872, and at pages 72 and following of which, this method of control was fully described. Indeed, on Plate VIII. of that work, M. Giroud's governor (*valve souterraine*) was shown with the small passage for admitting the gas into, and the small pipe and stopcock for regulating its flow out of the bell chamber.

Mr. DRON remarked that the Gas Committee still had the matter of the lamp-regulators under consideration, and that in the meantime they had resolved on having several district governors, so as to assist in saving a large amount of the gas which was known to go to waste through leakage, owing partly to ill-regulated pressure on the mains, and which amounted in Glasgow to 18 or 19 per cent. It would be well, he thought, if Mr. Key, one of their station managers, whom he was glad to see present, would give the society the benefit of his opinions upon gas-governors. He understood Mr. Key was the inventor and patentee of one, and this showed that he had given very special attention to the subject under discussion.

Mr. JAMES HISLOP, in answer to Mr. Smith's remarks about the inefficiency of the street-lamp regulators, said he believed that the fault lay with the position in which the regulators were placed. The custom was to put them inside the globes or lamps; but some which he had fixed outside the lamps, in order to prevent the action of the heat upon the diaphragm, he had found to work well. In one of their districts (Hillhead), where a large number of the regulators were used, the same difficulty was experienced as that complained of in the city. He reminded the

authorities that the regulators had been placed inside the lamps, rather than outside, as he had advised. The answer was that the regulators were all inside the lamps in the city, and, therefore, the authorities thought that they were perfectly justified in supposing them to be right.

Dr. WALLACE remarked that out of the eight lamp-governors which had been submitted to him for examination, on behalf of the Watching and Lighting Committee, only five were of Mr. Peebles's manufacture, and that out of those five there were four which acted perfectly.

Mr. WILLIAM KEY (Tradeston Gas-Works) said that, in discussing the general duties of station gas-governors for street supply, they might lose sight of the leading and very important feature of the station-governor invented and described by Mr. Peebles. As shown on the diagram, that mechanism was designed to act as a safety-governor, to prevent serious accidents, such as had happened from time to time, causing the destruction of a large amount of valuable property, and the loss of several lives. Mr. Dron, in asking him to state his experience of gas-governors, had mentioned that he (Mr. Key) had patented a safety governor; but as it was not his governor that was under the consideration of the society, he would state what had happened to himself nearly three years ago, by way of showing the importance of making and using safety station-governors. While acting as manager for a gas and water company in England, one of his governors—a common one—which regulated the supply from one of the works, through a 15-inch pipe, was placed in a house having gauges to show the pressures, as also a gas-bracket on one of the walls. Small composition gas-tubes were led to these, and whether some acid had corroded one of the tubes, or a rat had cut it in quest of water, would always remain a matter of conjecture. However, during the early hours of a certain morning, gas escaped in the governor-room till it was filled by a very explosive mixture of air and gas. At 5.30 a.m. it was the duty of one of the men to go to that room and put on pressure by the governor for the morning consumption and supply of the mills, &c. Proceeding with an ordinary naked flame lamp on his usual round, on opening the door of the governor-room a terrific explosion took place, followed by an alarming blaze of gas. The bell of the governor was torn asunder at all the joints, and the cone and the weights detached. They might fancy what the scene was like, when he informed them that the gas got free vent into the atmosphere from a 15-inch pipe connected with the largest gasholder. As there were no means of turning off the gas from the holder, it blazed in a terrific manner till it was gradually got under by filling the gas-main with water, by playing a fire-hose pipe into it, and by buckets at another point. He (Mr. Key) must express the opinion that such gas-governors as the one shown upon the diagram, marked "Ordinary Governor," would soon be reckoned as things of the past, as he believed that no thoughtful and prudent gas manager would adopt, at the present day, any governor for his gas-works but such as was arranged, so that large volumes of gas could not escape, even should the bell be destroyed or tilted. It had been remarked, by a previous speaker, that the system of regulating and putting pressure on large governors, adopted by Mr. Peebles, had previously been invented and patented in France. Should that be the case, and even should other parts of the governor have been formerly invented, still he thought it was to Mr. Peebles that was due the credit of having designed and brought about such beautiful results, by arranging the whole of the parts in such a way as, he was sure, had never previously been brought before the public. Mr. Peebles had succeeded in making a fine instrument—one which, it was to be hoped, would not be too fine for practical working. He might say that in his experience it was necessary to examine and readjust every lamp-governor once a year, using for that purpose a graduated 5-foot gasholder, such as had been used by Mr. Peebles in his experiments. Possibly the reason why Dr. Wallace found one-half of the governors which he had examined in a good, and the other half in a bad condition, was that the latter had been fixed and left unexamined for a number of years. If Mr. Peebles directed his attention to the production of a lamp-governor such as had already been spoken about, in the same way as he had done with the large governor, which took him five years to bring to such perfection, he (Mr. Key) had no doubt that he would be successful.

Mr. PEEBLES replied at some length. He said he would prefer not to say anything about the governors in the Glasgow street-lamps, as that might savour of "shop," which he did not wish to talk before such an audience. Still, it was desirable that he should make a remark or two on that subject. With reference to what Mr. Smith had stated, he would remark that it was just possible that some of the lamp-regulators had been found out of order, and not fulfilling their functions aright; but it should be remembered that there were amongst them some of the earliest that were made by his firm, and that they had now greatly improved upon the original form. Furthermore, it was possible that the Gas Committee's workmen, who had examined the regulators complained of, had not been careful as to the kind of leather which they had used for the new diaphragms, or the kind of oil with which the leathers were treated. Referring to the remarks of a previous speaker, on M. Giroud's inventions, he said he knew the rheometer well, and he had no hesitation in characterizing it as a beautiful instrument. Whether or not it was a perfect instrument was another thing. He had been called upon to substitute a number of his own most improved lamp-regulators for Giroud's rheometers, which he thought was a fact that told in favour of the former. However, if the street-lamp regulators in Glasgow were not found to be reliable in use, he would say by all means get quit of them, particularly if Giroud's or any others were better than his, and would stand well for six or eight months, or a longer time. Notwithstanding what had been said by Mr. Day regarding the alleged priority of Giroud's invention over his district governor, he held that his invention was altogether independent of that referred to. After Mr. Peebles had thanked the society for giving him such a patient hearing, and for the complimentary remarks made regarding his inventions, the proceedings terminated.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been no change of any importance during the past week in connexion with the iron trade or its allied industries, except that in several respects there has been a somewhat more marked depression. This dulness has been intensified by the stoppage which has occurred at Wakefield, and by the rumours which prevail as to the stability of two or three firms in this district. In the pig iron trade there is considerable weakness in prices, and a general inclination on the part of vendors to accept rather less money for deliveries in the immediate future, although some of them may not be inclined to enter into forward contracts on the same basis. The drop averages 1s. 6d. to 2s. on certain brands of pig, and for the most part affects forge pig of Yorkshire, Lincolnshire, and some classes of Derbyshire brands. This tendency is also increased by the low tone of the Scotch pig iron market, and by the considerable increase of stocks in other districts.

In consequence of this state of things there is a proportionate weakness in the quotations for castings of all kinds, including pipes for gas and water purposes, which may just now be bought to advantage. Despite this current depression, however, many persons in the trade have an idea that

there will be an improvement all round after Easter, with an attendant hardening of prices. This view is to a certain extent confirmed by the comparative activity of the Bessemer steel trade here and elsewhere.

In the merchant iron departments the amount of business doing is exceedingly limited, the production being now mostly hoops of special brands, bars for steel converting, and a few lots of plates for ship and other purposes.

There is very little alteration in the general condition of the fuel market, which remains dull in every direction. All the larger sorts of coal are neglected, whether for household or other purposes, a fact which, nevertheless, results unfavourably for those who have to use small slack for engine uses. This slack is now becoming very scarce, and is being held at rather more money by both colliery owners and merchants. At present it ranges from 3s. to 6s. per ton at the pits, but I hear of a lot of 1100 tons being sold here at slightly over the higher of these rates.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

With the exception that the more wintery weather of the last couple of weeks or so has caused a better demand for house-fire classes of coal, there is not much change to notice in the condition of trade in this district. In coals for gas making purposes there is very little doing beyond what is required for the supply of contracts. Common coals still move off only very slowly, the demands both for ironmaking purposes and shipping, being extremely small. There has, however, been a little more going off for export, and some of the large steamship companies have been taking rather more steam coal recently, but notwithstanding this, both the coasting and the foreign trades are very much below the average, and the complaint is that coalowners in other districts, where wages have been reduced more nearly to the old level, have an advantage over the Lancashire colliery proprietors, who are still paying a comparatively high rate of wages, considering the prices now ruling in the market, and are therefore losing a great deal of their legitimate trade, the Lancashire coasting trade having fallen off fully 50 per cent., whilst many of the foreign markets are being supplied from cheaper sources, chiefly Yorkshire and the North of England. For slack, prices continue stiff, but as common classes of burgy are a drug in the market, there is a disposition amongst consumers to fall back upon this description of fuel, rather than pay more money for slack. The average pit prices remain much about as under:—Arley, 9s. 6d. to 10s. 6d.; Pemberton four-feet, 8s. 6d. to 9s. 6d.; common coal, 6s. 6d. to 7s. 6d.; burgy, 5s. to 5s. 6d.; and slack, 3s. 6d. to 4s. 6d. per ton. Supplies, however, are generally abundant in the market, and there is a good deal of underselling to secure orders, especially in the common classes of coal.

The iron trade is without improvement, and the demand continues exceedingly limited, whilst north country iron is offered in this district at such extremely low prices, that the local makers are still completely shut out of the market; Middlesbrough foundry pig iron, delivered here, being offered at 52s. 6d. per ton, whilst local makers will not take less than 56s. to 57s., less 2½ per cent. In the finished iron trade there is no material change; works, as a rule, are still only going from hand to mouth, but quotations remain at £6 15s. to £6 17s. 6d. for Lancashire, Middlesbrough, and Sheffield bars, and £7 for Staffordshire ditto, delivered into the Manchester district.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England is not materially changed. As reported last week, the appearance of cold weather had tended to make the house coals firmer. That has been maintained, and prices have been a little better. The demand for best gas coal is pretty regular, and prices ranging from 8s. to 9s. per ton, less 2½ per cent. discount, may be deemed the regular quotation. The demand for medium qualities of gas coals can only be deemed poor. It is a sort of coal which is very abundant in the market, and as the difference between best and medium is only about 1s. a ton, and as the cost of freight is about the same, the gas companies prefer best. Manufacturing coals and coke are in very little demand. The iron trade is extremely dull, and so long as it is so there will be no revival of business in second-class coals of any kind. Prices are extremely low. The steam coal trade shows no improvement. If anything, prices are a little worse, the pits, without exception, are working short time, and a considerable number of pitmen remain out of employment.

Rates are a little higher to London. Steamers were stopped by the rough weather a couple of days last week, but, upon the whole, trade in seaborne coal has been pretty open. The shipments would not be short of an average for the week. Freight among small coasting sailing ships has been limited. There have been few offers from merchants except at low rates. Little is comparatively doing for the Sound ports and the lower ports of the Baltic.

A good deal of pig iron has been shipped to the Continent, and as far away as California. Machinery and other work is also being placed aboard steamers to go abroad, but there is not a very great business in that direction. The fire-brick trade to France and Germany is rather dull.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The inhabitants of Pathhead and Ford, near Kirkcaldy, in Fifeshire, have recently been considering the propriety of having a gas supply undertaking of their own. Colonel Dewar, of Vagrie, has offered ground on a suitable site for the erection of the gas-works, and a committee have been appointed to institute inquiry as to the probable cost of such an undertaking as is contemplated, the views of the proprietors in the district, and the likelihood of their taking shares and becoming consumers.

In the Burgh of Armadale, near Bathgate, there are loud complaints as to the quality and price of the gas, as the town is in the centre of a district which can boast of an abundant deposit of gas coal. It is, naturally enough, alleged that if any gas company can manufacture gas with economy it is that of Armadale. The directors are strongly urged both to lower the price and raise the quality of the gas. Unless they do so, it is proposed to call a meeting of gas consumers, and elect a committee having the power to appoint what the miners call a "justiceman," whose duty will be to keep a daily register of the quality of the gas, and to inspect the indexes of the meters when requested to do so. It is thought that there will be no difficulty in obtaining the necessary funds to pay the "justiceman."

The last examination of the Edinburgh Company's gas showed an illuminating power of 28.26 candles, that of the Leith Company being 26.65 candles.

At the usual monthly meeting of the Town Council of Glasgow, held last Thursday, there were submitted the minutes of the Corporation Gas Committee, which set forth that there had been under the consideration of the committee a scheme proposed by Mr. Foulis for dividing the city into districts, and putting down a governor in each of them, in order to regulate the pressure over the area embraced within each district. After full deliberation, the sub-committee resolved to instruct Mr. Foulis, as an experiment of the scheme referred to, at once to proceed with the formation of Pollockshields and neighbourhood into a district, and to regulate

the pressure over the same by a governor put down at the Tradeston Gas-Works. Further, they resolved that after the experiment had been tested in that district they should visit the same, and thereafter consider what report they should make to the Works Committee on the subject. Mr. Foulis stated that the cost of making the experiment in the Pollockshields district would not exceed £60.

The Finance and Gas Committees of the Glasgow Town Council have had the following motion remitted to them, on which they are to report:—"That, recognizing the great importance of providing open spaces or squares in the centre of the city, for the benefit of those residing in closely-built localities, we remit to the Finance Committee to consider and report on the propriety of arranging with the Gas Committee for securing the whole or part of the ground lately occupied by the Townhead Gas-Works, for the purpose of forming a public square to be suitably laid out." In the course of the discussion which took place upon the motion, the Lord Provost said that, by the Gas Act, any profits derived from the sale of gas could be applied to corporation purposes, and that it would be a graceful thing on the part of the Gas Committee to make a gift of the ground. Bailie Collins who proposed the motion, said he thought that he would be able to show the committee that the proposed square could be made without almost any additional cost to the city, the idea being to feu the eastern portion of the eastern boundary fronting High Street. For this a considerable sum would be realized, and there would still remain behind a larger space than that comprised in George Square, which might be laid out at a moderate cost to the Corporation..

The Aberdeen Corporation Gas Commissioners, on the recommendation of their Gas Committee, have resolved to erect a new station-meter at the gas-works, at a cost of £448, which was the lowest offer. The contract has been secured by Messrs. James Milne and Son, gas-meter manufacturers, Edinburgh. According to the estimates of the Gas Committee, the cost of re-roofing the purifier-house of the gas-works will be £700—namely, £525 to Messrs. Blackie Brothers, for ironwork, and £175 to Mr. W. W. Milne, for slater-work.

Dundee has just been "exercised" regarding the question of lighting common stairs and private courts. The Police Commissioners had asked the Gas Commissioners to insert, in their Bill now before Parliament, a clause relating to that subject; but, notwithstanding that the first-named body had decided on taking the onus of the arrangements, the Gas Commissioners were not satisfied that it was in their province to take such action as had been suggested, and they told the Police Commissioners to go to Parliament themselves for the powers which they desired.

Rapid progress is being made with the new water-works for the town of Galashiels, both in the construction of reservoirs at Knowes Dean and Stantling Crag, and in the distributing arrangements.

The Elgin Police Commissioners have resolved to borrow £14,000 from the Public Works Loan Commissioners, to defray the expense of the local water-works.

Operations are to commence at once in connexion with the new water supply works for the town of Bathgate.

Messrs. J. and A. Leslie, C.E., have reported to the Dundee Water Commissioners that the Clatto reservoir is completed, and they recommend that the year of maintenance should reckon from the day when the water was admitted—namely, the 16th of December last.

The local authority of Newburgh, Fifeshire, have resolved to proceed with a new water supply scheme, from plans devised by Mr. Storrar, C.E., Cupar.

A hitch seems to have occurred in regard to commencing operations for the construction of the new water-works for Wemyss, Fifeshire. Labourers were expecting to be employed at the works before this time, but the ground still remains unbroken.

The villagers of Fowlis Wester have lately been endeavouring to raise funds to carry out a proposed water supply scheme. The lord of the manor (Mr. C. H. D. Moray, of Abercairny) has given instructions to proceed with the undertaking, and has intimated that he will pay the sum required to complete the works.

Plans are now prepared for proceeding with the construction of the store reservoir, required as part of the new water supply works for Dunfermline. There will be about 150,000 cubic yards of earthwork and clay puddle to execute.

On the 7th inst., Glasgow Corporation Water Annuities realized 10s. above the former quotation at 103½.

The pig iron warrant market suffered several falls in prices during the past week, which closed at 10d. lower than the closing price of the previous Friday. As low as 54s. 1½d. was taken on Friday afternoon. Several makers have reduced their quotations.

No change of any importance has taken place in the coal trade, and business is extremely dull. Local demand is quiet, and house descriptions are becoming increasingly slow of sale, the advance of the spring season evidently contracting the demand. Prices, however, remain steady.

DEATH OF A VETERAN.—Joseph Naylor, ex-foreman of the Cork Gas-Works, died at Cork last week, at the advanced age of 81. He was the first man who charged a retort in Cork 52 years ago. He was previously employed, as early as 1810, at the Peter Street works of the Chartered Gas Company at Westminster.

RIELEY GAS AND WATER WORKS COMPANY.—The statement of accounts presented at the annual meeting showed that during the past year there had been expended on capital account £436 3s. 7d., making a total outlay of £9976 8s. 11½d. The revenue for the year was £2445 15s. 2½d.; the payments, £1567 12s. 10½d. This admitted of a dividend of 9s. per share, and the directors recommended that dividend, which was accordingly declared.

SALES OF GAS AND WATER SHARES.—Twenty £10 shares, D Preference Stock, in the Sheffield Water-Works Company, were sold by auction on the 20th ult., and realized £11 2s. 6d. per share. At Longton, on the 2nd inst., £150 Consolidated Stock in the Stoke, Fenton, and Longton Gas Company, was sold by auction, and realized £313. At Norwich, on the 5th inst., 30 shares, at £20 each, in the British Gaslight Company, realized on an average £41 15s. 10s. per share.

QUALITY OF THE GLASGOW GAS.—The following is the report on the illuminating power of the gas supplied in Glasgow during the week ending March 3:—

	St. George's Cross.	Alston Street.	West Street.	Hillhead
Illuminating power, average .	24'93 .	26'89 .	26'14 .	26'25
" " maximum 26'46 .	29'12 .	27'98 .	26'74	
" " minimum 23'07 .	25'49 .	25'00 .	25'51	
Number of days below 25 candles, 3 .	— .	— .	— .	—

NEWCASTLE AND DISTRICT ASSOCIATION OF FOREMEN ENGINEERS AND MECHANICAL DRAUGHTSMEN.—We learn that at a general meeting of this association on the 3rd inst., Mr. W. J. Warner, the engineer of the South Shields Gas-Works, was unanimously elected as a life honorary member, as a token of the respect and esteem the members entertain toward him. We congratulate Mr. Warner on the distinction so spontaneously and cordially conferred upon him.

TENTERDEN GAS COMPANY.—At the annual meeting of shareholders the accounts showed a balance of profit of £523 3s. 8d., including stock in hand, and a dividend of £6 per cent., free of income-tax, was declared, leaving a sum of £270 1s. 8d. to be carried to the account. The sum of £100 was ordered to be paid off the loan borrowed some time back. The price of gas it was decided should be reduced from 6s. 8d. to 5s. 10d. The chairman pointed out that the company stood now in an improved position to that occupied when the great advance in coal took place two or three years ago, but the expenditure in the present year would be augmented in consequence of new retorts having to be fitted.

NARBOROUGH GAS COMPANY, LIMITED.—The annual meeting was held on the 20th ult.—Mr. J. Simpkin in the chair. The directors in their report congratulate the shareholders upon the continued prosperity of the company; sincerely regretted the deaths, during the year, of two of their colleagues—viz., the Rev. H. J. Hoskyns and Mr. John F. Johnson; referred to the concession made to consumers at Midsummer last, by allowing a discount for prompt payment and reducing the price of coke; stated with pleasure that they had added to the reserve-fund £113, though expenses had been very heavy; and recommended a dividend for the half year ended the 31st of December last, at the rate of 5 per cent. per annum, free of income-tax.

EUROPEAN GAS COMPANY, LIMITED.—An extraordinary meeting of the shareholders of this company was held on Wednesday, March 7, at the offices, 11, Austin Friars, London—Wm. White, Esq., in the chair. The object of the meeting was to elect a director in the place of the late Mr. Walter Thomas Fawcett, deceased. There were four candidates, but Mr. Backler announced that he was requested by Mr. E. T. E. Besley to withdraw his name on this occasion. A poll was taken in the interest of Messrs. G. Harrison, H. J. Baddeley, and E. Garey, and, after an animated conversation, the chairman declared Mr. H. J. Baddeley to have the largest number of votes recorded in his favour. Mr. H. J. Baddeley returned thanks for his election, and a vote of thanks to the chairman brought the proceedings to a close.

WIMBLEDON GAS SUPPLY.—There has been a good deal of grumbling in the neighbourhood of Mitcham, Merton, and Wimbledon of late in reference to the quality of the gas supplied in the district, and at a meeting of the Wimbledon Local Board on the 7th inst., the following resolution was adopted:—"That, while the members of this board would regret being compelled to take steps in any degree hostile to the Mitcham and Wimbledon Gas Company, they cannot but concur with the petition of influential ratepayers now before them, and they trust the directors will be induced to give effect to the wishes expressed in such petition—viz., the reduction in price and improvement in quality." It was further resolved that a copy of the resolution should be forwarded to the vestries of Merton and Mitcham, with a request for similar action on their part.

REDUCTIONS IN THE PRICE OF GAS.—The Hereford Town Council, on the recommendation of their Gas Management Committee, have agreed to reduce the price of gas to private consumers from 4s. to 3s. 9d. per 1000, and the public lamps 6d. per 1000. At Tenterden, the price to private consumers has been reduced from 6s. 8d. to 5s. 10d. At Bromley, the price will be reduced from 4s. 6d. to 4s. 2d. The Salford Town Council, at their meeting on the 7th inst., resolved—"That, after the quarter ending the 30th of June next, the price of gas shall be reduced to the following scale of charges:—Consumers of 250,000 cubic feet within the borough, 3s. 8d. per 1000 cubic feet; ordinary consumers within the borough, 3s. 9d. per 1000 cubic feet; consumers beyond the borough, and within a radius of five miles from the Regent Road Gas-Works, 4s. 3d. per 1000 cubic feet; and consumers beyond such radius, 4s. 8d. per 1000 cubic feet.

NEW GAS AND WATER COMPANIES.—During the month of February the following new companies were registered:—*South Hayling Gaslight and Coal*.—With a capital of £4000 in £5 shares, for purchasing certain gas-works in course of erection belonging to Mr. Henry Skoines, of 7, Argyle Street, St. Pancras, for supplying gas and gas products to the inhabitants of the Island of Hayling, Hampshire. *Hengoed Gas and Water*.—With a capital of £5000 in £5 shares, for carrying on the business of a gas company at Hengoed, Maesycwmmmer, Ystrad, Fleur-de-Lis, and Pengam, in the counties of Glamorgan and Monmouth; and also to carry on the business of a water company at Hengoed and Maesycwmmmer, and places adjacent thereto. *Colne Valley Gas, Drysaltery, and Manufacturing*.—With a capital of £40,000 in £5 shares, for taking over the business and property of the Colne Valley Gas Company, Limited; also to carry on the business of cutters, manufacturers, and dealers in longwood, chemicals, and chemical products; and also to spin and manufacture textile fabrics.

DEATH OF MR. WILLIAM FRASER, OF INVERKEITHING.—Our readers will learn with regret of the almost sudden death of this gentleman on the afternoon of Sunday, the 4th inst. The *Glasgow Herald* says that Mr. Fraser had been ailing slightly for several days previous, but was able to give the usual attention to business, and up till Saturday evening nothing of a serious nature was apprehended. About midnight, however, he was seized with inflammation of the heart, and became rapidly worse till he expired in the course of the following day. Mr. Fraser, who was in his 64th year, was the son of the late Rev. William Fraser, minister of the 2nd U.P. congregation, Alloa, and brother of the Rev. Erskine Fraser, Langside, Glasgow. He was bred to the legal profession in the office of Mr. James Peddie, W.S., Edinburgh, from whence he went to Cupar, but the situation of town-clerk at Inverkeithing having become vacant, he received the appointment, the duties of which he has fulfilled for a period of 38 years. He was instrumental in establishing the first banking office in Inverkeithing in connexion with the Eastern Bank of Dundee, which sometime afterwards became a branch of the Clydesdale Bank, and since then it has been the only bank in town. He held a number of important positions of trust and responsibility, and took an active interest in several neighbouring industries, being for many years one of the principal partners of the Halbeath Coal Company, and also the proprietor of an extensive brickwork on the north side of the town. He was a shrewd business man, possessing remarkable energy and industry, and he was readily consulted by people in the district, who highly estimated his sagacity and judgment in all matters pertaining to his profession.

WAKEFIELD WATER-WORKS COMPANY.—The ordinary half-yearly meeting was held on the 26th ult.—Alderman Connor presiding. The Chairman, in opening the proceedings, said the only business they had to transact was to affix the seal of the company to the register, and to pass the half-yearly accounts. The shareholders were aware that the company had no dividend to declare, as, instead of dividend, the corporation, who had decided to purchase the works, had to pay interest on the capital up to December last. It was thought the company would not have had occasion to meet again; but on reference to the Act it was found that, until the transfer actually took place, it would be necessary for them to hold half-yearly meetings for the same purpose as that for which they met that day. In all probability they might have another meeting like that to attend, or perhaps not. He believed every gentleman had been furnished with a copy of the accounts, and he did not think it would be necessary for him to go through the items, or for the accounts to be read. He thought they might take them as read, and if they were all of that opinion, he would

propose that the balance-sheet should be adopted. Mr. George Haldane, one of the directors, seconded the motion. Mr. G. V. Ellerton said he supposed the purchase of the company's works by the corporation would not be completed until the Improvement Bill had passed. The Chairman said that was so. He might also say that the detailed agreement which was entered into between the corporation and the company had been sealed and signed, and he believed there was no doubt as to the Act being passed, as there was practically no opposition to it.

THE GAS QUESTION AT BISHOP AUCKLAND.—On Monday, the 5th inst., at the Bishop Auckland Town-Hall, Mr. Harrison, one of the inspectors of the Local Government Board, sat to hear evidence in connexion with an application which had been made by the Urban Sanitary Authority, for a Provisional Order to enable the authority to supply gas to the district. Mr. Proud entered into a long history of the proceedings of the board in reference to the gas question, stating that power had been given by the board to the Gas Lighting Committee to enter into negotiations with the present gas company for the purchase of their works. The company, in the first instance, stated their willingness to sell, and when the Urban Authority notified their intention to apply to the Local Government Board for a Provisional Order, they then said they would not sell. Mr. Proud, as chairman of the Lighting Committee, Mr. Thornton, clerk, and Mr. Lindsay, the surveyor of the local board, gave evidence bearing out this statement. Mr. Hepworth, gas engineer to the Corporation of Carlisle, and Mr. W. Smith, engineer of the Darlington Gas-Works, were examined at considerable length as to the condition, efficiency, and value of the present gas-works. Their evidence was to the effect that the company's plant was of a very primitive description, the gas very imperfectly purified, and the works altogether inadequate to the supply of a town's population with gas. Messrs. J. Armstrong, R. Harborn, and William Allan, were also examined in regard to the dissatisfaction which had existed at various times with the gas company. At the close of the evidence, the commissioner said it was his own conviction that the gas-works should be in the hands of the Urban Authority, but that had nothing to do with the present inquiry, the facts of which he should simply lay before the Local Government Board.

SALFORD CORPORATION GAS SUPPLY.—At the meeting of the council on the 7th inst., it was stated that the Gas Committee, in order to afford every convenience for, and ensuring prompt and proper attention to, gas consumers in or near Eccles, had resolved that a workshop and house should be taken in Eccles, and a servant of the corporation placed therein, rent free, and furnished with tools, fittings, stock, and books requisite for the performance of the necessary work, under the superintendence of the engineer. The council resolved to accept the tender of Mr. William Healey for the erection of a new purifier-house for the sum of £6947 10s., and the tender of Messrs. Adam Woodward and Sons for the supply and fixing of the lifting machinery for the purifier-lids and oxide for the sum of £1590. Mr. Sharp, the chairman of the Gas Committee, moved the following resolution:—"That the price of gas be reduced to the following scale of charges after the quarter ending the 30th of June next—viz., to consumers of 250,000 cubic feet within the borough, 3s. 8d. per 1000 cubic feet; to ordinary consumers within the borough, 3s. 9d. per 1000 cubic feet; to ordinary consumers beyond the borough, and within a radius of five miles from Regent Road Gas-Works, 4s. 3d. per 1000 cubic feet; to ordinary consumers beyond such radius, 4s. 8d. per 1000 cubic feet." Alderman Dewhurst seconded the resolution, and Mr. James Johnson remarked that he hoped the small concession in price now made was only the forerunner of larger concessions. Mr. Mather trusted that those who desired a reduction in price would keep in view the large expenditure required to put the works in order. They were sadly out of order now, and every endeavour was being made to get them in proper trim, after which the price of gas might probably be gradually reduced. The motion was carried unanimously.

LONGTON GAS COMPANY.—The half-yearly general meeting of shareholders was held on the 26th ult.—Mr. W. Webberley in the chair. The company's engineer and manager, Mr. J. M. Darwin, presented the report of the directors, which was as follows:—"The directors have to report that during the past half year it has been found necessary to expend a larger sum than usual in the maintenance of plant, and that having undertaken a systematic examination and testing of the company's mains and meters, a larger amount will be found to have been expended under these heads of account. The sewerage operations of the corporation have interfered very materially with the smaller mains of the company, and considerably increased the leakage account. Most of these mains, although sufficient for the supply of the districts in which they were laid, yet after being disturbed it has been found necessary to take them up, and larger and stronger pipes have been laid to prevent breakage or other damage. A new valuation of the company's undertaking has been made for parish purposes, and the new assessment is nearly treble the amount of the former valuation. After the last half-yearly general meeting an extraordinary meeting of the shareholders was held, in accordance with the notice duly given, to consider the propriety of extending the time for the completion of the sale of the works, and also to consider the terms on which such extension should be granted. It was resolved at this meeting, and has since been agreed to by the corporation, that the purchase-money of the share capital should be increased from £66,000 to £70,000, the corporation, as before, taking also the mortgage debt of £3150. The last issue of £5000 share capital will now rank with the ordinary 7 per cent. capital, and the dividend of 5 per cent. paid on this capital is increased to 7 per cent. The directors recommend that the following dividends be declared at the half-yearly general meeting—viz.: 10 per cent. on the original, and 7 per cent. on the ordinary 7 per cent. and ordinary shares; and also that the difference of dividends from 5 to 7 per cent. be paid for the half years ending Dec. 31, 1875, and June 30, 1876, on the amounts then called up. The balance brought forward from the half year ending June 30 last was £957 7s. 7d., the profit of the past half year being £1935 15s. 4d. After payment of interest on mortgages and dividends, amounting to £1761 15s. 8d., there will remain a balance of £1053 5s. 4d. to be carried forward to the next half year's account. The corporation, finding they could not succeed in obtaining satisfactory powers from the Local Government Board for the purchase of the whole of the undertaking of the company, are now promoting a Bill in Parliament in accordance with the new terms of purchase agreed to by both parties." The report was adopted, and the usual dividends declared.

MAIDSTONE WATER-WORKS COMPANY.—The report of the directors presented to the annual meeting of shareholders, on the 26th ult., was as follows:—"For the quarter ended on the 31st day of March last, the company received for water-rent, £1077 2s. 7d.; for the quarter ended the 30th of June last, £1103 0s. 5d.; and for that which ended on the 30th of September last, £1140 9s. 2d. The rents for the quarter which ended on the 31st of December, 1876, are estimated to realize about £1150. The amount of water-rents for the year which ended on the 31st of December, 1876, will, therefore, be about £4470. Taking into account the amount of water-rents due for the quarter which ended on the 31st of December last, the amount due from customers on the trade account, and the value of the stock of coals and materials in hand, the directors estimate that there was

a profit for the year of about £1366, this being a clear income of more than 6½ per cent. upon the ordinary share capital of the company—a result upon which the directors think the shareholders may fairly be congratulated. The directors propose to recommend to the shareholders at the present meeting that a dividend of £4 10s. per cent. per annum, free from income-tax, upon the ordinary share capital of the company, should be declared, such dividend to be payable on the 1st of May next. This will absorb £900 of the profits of the year, and the directors propose that the balance of £466 12s. 11d. be carried to the reserve-fund, which will then amount to £656 10s., out of which the directors propose to pay the cost of supplying three new pumps, and repairing and strengthening three old pumps at the company's works. During the year 1876 the directors have received £250 further capital by the issue of twenty-five £10 preference shares, at an interest of £5 per cent. During the past year, besides extension of mains in a few new streets, the following works have been performed:—1. The taking up of about 540 yards of 6-inch pipes along the line of the South-Eastern Railway, and replacing them by 9-inch pipes. This work was found to be necessary in consequence of the 6-inch pipes having been found of insufficient size to convey the water from Tutsham, in addition to the small supply for which the 6-inch pipes were originally laid down. The cost of this work was about £370, against which may be set off the value of the 6-inch pipes removed, estimated at about £70, and which pipes may at some time be useful on the company's works. 2. At a very small cost to the company, the mode of supplying with water the County Lunatic Asylum has been very greatly improved by the Asylum Committee supplying a new pipe of larger bore from the company's works to an enlarged reservoir at the asylum. These works were done by the committee, and the consequence of this has been that the cost of pumping the water from the company's works to the asylum has been considerably reduced. 3. It having been found by the directors that the company's pumps, which had been in use for fifteen years, were out of repair, and in consequence of which there was a great loss of water in pumping, the directors resolved that they would effect a complete restoration of the pumps. This work has been recently finished. By operating upon the pumps connected with each of the two engines separately, the work, though longer in hand, has been done without accident, and without interfering in any way with the supply of water to the town. Three new pumps have been put in, and the remaining three have been repaired and strengthened. These repairs and restorations have been found to decrease the time employed in pumping, and thereby to effect a saving in the consumption of coals. The cost of these works has been £482 9s. 10d., which sum the directors, as before stated, propose to pay out of the reserve-fund.

Register of New Patents.

1071.—MILLER, A., Glasgow, "*A new or improved construction of pump or fluid drawing and forcing apparatus.*" Provisional protection only obtained. Dated March 11, 1876.

This invention consists in a reciprocating cylinder or barrel pump, with stationary outer radial pistons or plungers on the inner end of their stems, made hollow for the fluid to be drawn in and forced out through them as the barrels are reciprocated on the pistons. The back or outer ends of the stems or pipes are attached to an outer pipe common to, and opening into, all the hollow pistons and their barrels.

1074.—SAVILLE, G. E., Sowerby Bridge, "*An improved gas scrubber or washer.*" Patent dated March 11, 1876.

This invention was described and illustrated in the JOURNAL for Jan. 9, page 58.

1108.—BOULTON, M. P. W., Tew Park, Oxford, "*Improvements in apparatus for producing heat by the combustion of inflammable gases or vapours, and for generating the latter.*" Patent dated March 15, 1876.

This invention relates to apparatus for the mixing and burning of gas or inflammable vapour with air, or with any gas or elastic fluid capable of supporting combustion, and also to apparatus for generating inflammable vapour.

Where gas is burnt with common air, the gas issues in a jet from a tube or nozzle of ordinary form, into a conical passage converging in the direction of the movement of the gas. A stream of air enters through the passage into the space around the gas-jet, and in virtue of the conical form of the passage is directed against the jet so as to impinge upon it. The stream of gas and air partially mixed passes through a throat beyond which the passage first expands and afterwards contracts, or successive expansions and contractions may be provided. The mixed stream issuing from this passage may undergo combustion in the open air, like the stream issuing from the tube of an ordinary Bunsen burner; but for many purposes it is preferred to cause the stream to enter another conical passage, similar to that previously mentioned, where a further quantity of air is caused to join it and impinge upon it, and the mixed stream passes through a throat into a chamber of refractory material, in which the mixture undergoes combustion. In order to mix thoroughly the air and gas, this second chamber may also vary in area alternately enlarging and contracting. The products of combustion issuing from it are used for any heating purpose required, as for instance to heat a boiler.

In order to be able to regulate at pleasure the quantities of air admitted at both places of admission, each of the conical passages is connected with a separate chamber communicating with the atmosphere by means of a passage furnished with a stop-cock, valve, or slide. More chambers might be employed if desired, the air being admitted in more than two places; but generally the two chambers, as above described, are sufficient.

To enable this apparatus to be employed for the different purposes for which it is applicable, various modifications are specified.

1117.—KÖRTING, E., Hanover, "*Improvements in the mode of and apparatus for forcing and raising liquids, and for other useful purposes.*" Patent dated March 15, 1876.

The object of this invention is the construction of steam-jet apparatus, for forcing liquids, to work in a more economical and reliable manner than heretofore, and to render their application more fit for some purposes in practice. For this purpose two or more steam nozzles of different or graduated diameters or sectional areas are employed instead of one only, all of which are fitted centrally one into the other, the inner one always projecting some distance beyond the nozzle into which it is fitted. The liquid to be forced meets the steam in the usual condensing nozzle or chamber, into which it may flow either through one annular space centrally surrounding the steam nozzle, or through several consecutive annular spaces or slits, or through a number of openings in the condensing nozzle. Through the steam not meeting the liquid in only one place, but working on it in as many places as steam nozzles are provided for, the whirling and collapsing of the liquid at the place of condensation of the steam, which is very prejudicial to a good and reliable effect if the condensation of the whole mass of steam takes place at once, is to a great extent avoided.

1123.—CLARK, A. M., Chancery Lane, London, "*Improvements in screw wrenches.*" A communication. Patent dated March 15, 1876.

This invention relates to certain improvements in screw wrenches, whereby

the moveable jaw may be quickly and readily adjusted to different sized nuts or bolt-heads with a very slight application of power, and it consists in a moveable jaw formed without a female screw thread, and sliding freely on the operating screw. It is provided with a spring of just sufficient stiffness to hold it in position when no resistance is brought to bear upon it, combined with an independent nut or carriage travelling upon the screw, and bearing against the moveable jaw for the purpose of holding it in position when pressure is brought to bear upon it, this carriage being in lieu of the female thread in the moveable jaw.

The invention also consists in a bar having an angular back and a concave front edge, and a moveable jaw having a tubular portion adapted to the concave front edge of the bar, and an angular keeper adapted to the angular back edge of the bar, whereby the jaw is provided with a firm and steady bearing on the bar.

1128.—LOWNE, R. M., Finchley, Middlesex, "*Improvements in anemometers or instruments for measuring the velocity of currents of air or gas.*" Provisional protection only obtained. Dated March 16, 1876. In this invention the blades of the fan are made of vulcanite instead of metal or mica, and the gearing communicating with the counting apparatus is arranged so that it shall be practically sealed off or protected from the entrance of dust, gases, and impure air. For this purpose instead of mounting a worm or screw on the axis of the fan of larger diameter than such axis, as heretofore, which necessitates the leaving of an open hole in the case of the counting apparatus, the worm or screw is formed as small as, or smaller than, the axis; or, preferably, the worm or screw is dispensed with, and in lieu thereof there is fixed on the axis of the fan a toothed wheel or a pinion, which communicates motion to the counting gear, thereby enabling the axis of the fan to be passed through a hole in the case of the counting gear closely fitting such axis.

1130.—SPOUR, W., Walker-upon-Tyne, "*Improvements in ratchet braces.*" Provisional protection only obtained. Dated March 16, 1876. This invention consists chiefly in an arrangement of ratchet brace that will cause the ratchet tool to go twice the number of revolutions in a given time that the ordinary brace will drive it, and in a brace that will travel both during the forward and the backward stroke of the handle.

On the barrel or body of the ratchet brace, in which the main screw works at one end, and into which the tool is struck at the other end, there are two mitre wheels facing each other. The upper one of these (nearest the screw) is free to revolve, the other is fast. Gearing into these there is placed a preferably equal and similar mitre wheel made to run on an axis at right angles to the body of the brace. This axis consists of a bar, usually cylindrical in shape, and having an eye at one end encircling the body of the ratchet brace. The other end projects out so that it can rest against a stationary support, usually the drill stand, while a collar on the bar keeps the mitre wheel in position. The handle is also attached to the body by an eye or eyes, or usually one on each side of the eye of the stop-bar. On the handle are catches or pawls working on the ratchet mitre wheels, one in one direction, the other in the other. There can, if desired, be four pawls, two to each wheel, so arranged that only one can be in action at a time on each wheel. The operator can then arrange to make the tool turn either way. If desirable only one pawl, and that on the upper wheel, can be put in action. The ratchet brace will now be changed into a single-acting one, with this great advantage, however, that the drill goes through the double angular distance that the handle passes through in the same time, instead of through an equal distance, as in ordinary machines. When a hole is drilled, it can be tapped by putting the tap in the brace and driving it down by the brace screw. This brace has this advantage that by putting the back pawl or pawls into action instead of the ordinary one, the drill can be withdrawn by the brace.

1179.—DAVIES, P. J., King's Cross Road, London, "*Improvements in closet and other valves, and apparatus for cleansing, watering, controlling, regulating, and arresting the flow or discharge of water, and preventing waste thereof.*" Patent dated March 18, 1876.

This invention consists partially in certain arrangements and combinations of apparatus so contrived and adapted as to act as water-waste preventers for fixing in cisterns under water or otherwise, whereby simplicity, economy, and freedom from derangement are more effectually attained than heretofore. This is partially effected by employing one or more diaphragms of suitable material or materials (such as leather or india-rubber) to act with or without a plate, disc, cup, or other apparatus, which will form a sucker that may act either directly or indirectly; or with a valve which will also at times form a sucker for the purpose of actuating a valve or valves. This sucker can be applied to the top or other parts of a valve, either fixed in a cistern or to pipes or otherwise, and when pulled up with a screw, cam, lever, wire, rod, chain, or otherwise, will allow the valve to fall or go back to its seat after a given time, which may be regulated by a small tap, screw, or valve, so that it is impossible to keep the valve open beyond a certain length of time, thereby preventing waste.

Another part of the invention consists in a valve seating, which is also applicable to the "Hornsey" and other valves. Instead of having the main inlet water-way through the sides or parallel with the bottom of the cistern, the main inlet water-way is formed underneath or vertically with regard to the bottom of the cistern, which simplifies the valve seatings, and prevents the valve being propped open by any small pieces of solid substance that may be swimming in or on the water, or by persons tampering with the valve by placing anything between the valve and seating, thereby preventing wilful waste.

Another part of the invention relates to what is known as the "two gallon London closet-valve waste-preventing cistern," working with moveable and fixed valve seatings and syphons with service-box arrangements described in patent No. 1579, of 1873, and consists in forming the division or plate between the top and bottom of the cistern much lower, and supporting the same on a ledge. By making the hollow spindle work through this partition, the bottom box or lower division of the cistern to be supplied slowly (when the outlet valve is closed) with water through any of the hollow spindles and valve boxes described in the above patent. When the inlet-valve is shut and the outlet-valve opened, a syphon communication is established between the top and lower boxes. This can be easily accomplished by placing a tube closed at one end over the present air-pipe, but it is preferred to construct it in the angles of the cistern, or by forming the syphon of zinc, copper, lead, or other materials (easily soldered), and fixing the same over or into a socket cast to the middle partition. This will syphon or take the necessary portion of the water from the top or large division (which must be of certain dimensions on account of the room for the ball-valve working) to supply the lower, but only when the outlet-valve is full open, and only then for a given time, by reason of a small air-hole made in the syphon or top tube, so that the lower box or division need only be made proportionately larger to set the syphon or syphons in action thereby. This part of the invention enables a starting compartment to be made in this small cistern, which, instead of being made to hold $1\frac{1}{2}$ or 2 gallons, as heretofore, may be made less than one quarter that size, which will better answer the purpose. It is intended to continue the use of the present syphon when required for the purpose of converting this same cistern into an "after-flush" cistern; and the syphon

is improved by forming a ventilating hole, which can be adjusted by a screw-tap or small valve near the top of the syphon.

The invention also relates to certain improvements in what are known as water-frugals (or water-waste preventers) for which letters patent were granted to the present inventor on July 3, 1871, No. 1716, and consists in making the locomotive clack and carrier therein described work within the retarding valve, and in some cases this valve or locomotive clack is made to work without the carrier.

APPLICATIONS FOR LETTERS PATENT.

- 635.—CLAYTON, L. and L., Hunslet, Leeds, "An improved mode of and apparatus for punching metal plates to be used as gasholder top sheets." Feb. 15, 1877.
 640.—HADDAN, H. J., Strand, Westminster, "Improvements in apparatus for cutting pipes, columns, shafts, and such like." A communication. Feb. 16, 1877.
 641.—RIGNALL, R., Hull, "An improved adjusting pipe-tongs." Feb. 16, 1877.
 642.—WALKER, W., Scholes, York, "Improvements in rings for joints, for steam, water, gas, or air." Feb. 16, 1877.
 657.—GREEN, C. H., Old Broad Street, London, "Improvements in the arrangement and construction of gas-stoves and utensils to be used therewith, and for other purposes." A communication. Feb. 17, 1877.
 663.—NEWMAN, J., and DUESBURY, W., Derby, "Improvements in apparatus for transmitting gas from the retorts to the 'hydraulic main.'" (Complete specification.) Feb. 17, 1877.
 687.—RUSSELL, W. J., and WILSON, R., Croydon, Surrey, "Improvements in locks or fastenings for securing the lids to the bodies of gas syphon boxes and other similar cases or coverings." Feb. 20, 1877.
 688.—HUNT, C., Birmingham, "Improvements in gas-meters." Feb. 20, 1877.
 705.—LIVESEY, G. T., Old Kent Road, London, "Improvements in apparatus used in the purification of gas." Feb. 21, 1877.
 706.—JACKSON, W. M., Rhode Island, U.S.A., "Improvements in gas-stoves." (Complete specification.) Feb. 21, 1877.
 726.—JOHNSON, S., Wood Green, and BURTON, R., Clerkenwell, London, "Improvements in gas-meters." (Complete specification.) Feb. 22, 1877.
 727.—BUCHHOLZ, J. A. A., Hammersmith, London, "Improvements in the manufacture of gas for lighting purposes, and in machinery or apparatus connected therewith." Feb. 22, 1877.
 748.—STOVE, A. S., Lerwick, Shetland, "Improvements in the manufacture of gas, and in the apparatus or means employed therefor." Feb. 23, 1877.
 765.—BOULTON, M. P. W., Tew Park, Oxford, "Improvements in apparatus for producing heat by the combustion of inflammable gases or vapours." Feb. 24, 1877.
 766.—BOULTON, M. P. W., Tew Park, Oxford, "Improvements in engines worked by products of combustion either alone or in conjunction with other elastic fluid." Feb. 24, 1877.
 770.—SMITH, J., jun., and DOWKER, W., Barrow-in-Furness, Lancs, "Improvements in apparatus for feeding fuel to furnaces, gas producers, and other combustion chambers." Feb. 24, 1877.
 795.—DENNIS, T. H. P., Chelmsford, Essex, "Certain improvements in water-waste preventers." Feb. 27, 1877.
 796.—MILNES, J., Milnesbridge, York, "Improvements in taps for steam and water." Feb. 27, 1877.
 819.—HALLWELL, R., Blackburn, Lancs, "Improvements in gas motor engines and in the valves of such engines." Feb. 28, 1877.
 824.—TURNBULL, R., Glasgow, "Improvements in collecting and purifying sewage, and in the apparatus or means employed therefor." March 1, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3319.—DUCKETT, J. D., Rotherham, York, "An improved cistern and self-acting water-waste preventer (superseding the ball-float)." Aug. 24, 1876.
 3365.—FROST, J., Huddersfield, York, "Improvements in purifying sewage and foul water, and in treating water for boiler purposes." Aug. 26, 1876.
 3443.—MORGAN-BROWN, W., Southampton Buildings, London, "A new or an improved hydro-piro-pneumatic pump." A communication. Sept. 1, 1876.
 3485.—CLARK, A. M., Chancery Lane, London, "Improvements in the purification of gas." A communication. Sept. 4, 1876.
 3493.—GIDNEY, J. W., West Ham, Essex, "Improvements in apparatus for carburetting air or gas for illuminating or heating purposes." Sept. 5, 1876.
 3528.—ROBINSON, C. S., Leicester, "Improvements in burners for burning a mixture of gas and atmospheric air." Sept. 8, 1876.
 3547.—WEBBER, C. E., Knightsbridge, London, "Improvements in the manufacture and mode of utilizing gas for heating or other purposes, and in the apparatus or means employed therein." Sept. 9, 1876.
 3551.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in the treatment of the iron residues obtained in the purification of coal gas, and in the obtaining of products therefrom." A communication. Sept. 9, 1876.
 3571.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in closets or receptacles for sewage matters, and in the means of or apparatus for disinfecting or deodorizing such matters." A communication. Sept. 12, 1876.
 3756.—WIRTH, F., Frankfurt-on-the-Maine, Germany, "An improved method of treating spent materials from the gas-works by recovery of sulphur." A communication. Sept. 26, 1876.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

- 467.—CAFFALL, R. M., and THOMAS, A., "Improved means of and appliances for effecting the automatic sealing of hydraulic gas-mains, and for removing the pressure of gas on retorts at pleasure." Feb. 5, 1874.
 499.—UNDERHAY, F. G., "Improvements in bib-cocks or cocks for drawing off water." Feb. 7, 1874.
 531.—JOHNSTON, W., "Improvements in machinery or apparatus for compressing air or gases." Feb. 11, 1874.
 565.—HAZELDINE, F., "An improved valve or tap for liquids and other purposes." Feb. 14, 1874.
 566.—BOX, W. W., "Improvements in apparatus used in the manufacture of gas." Feb. 14, 1874.
 567.—RICHARDS, W., "Improvements in regulating the supply of fluids and liquids for the manufacture of illuminating gas, and for the apparatus employed therein." Feb. 14, 1874.
 601.—M'BEATH, C., "Improvements in retorts and apparatus connected therewith for the purpose of distillation and calcination of minerals, parts of which are applicable to other purposes." Feb. 18, 1874.
 641.—HOLLAND, H., "Improvements in the manufacture of gas for illuminating and heating purposes." Feb. 19, 1874.

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TO CORRESPONDENTS.

CANTOR LECTURES.—Mr. A. Vernon Harcourt's Lectures on the "Chemistry of Gas-Making," now in course of delivery at the Society of Arts, will be reported in the JOURNAL. The first lecture is in type, but its publication is unavoidably postponed.

N. S.—Your letter received. We are obliged by the suggestion.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 20, 1877.

Circular to Gas Companies.

THE Committees of the House of Commons who have Gas Bills under their consideration, are proceeding with some alacrity. The Longton Corporation Bill has already been passed. It is, as our readers have been informed, a Purchase Bill, the terms of purchase having been arranged between the Company and the Corporation. Thus one more Gas Company disappears. The consideration is to be the payment of a gross sum of £73,150 in cash. The paid-up capital of the Company is £40,000, one-half of which is entitled to ten per cent., and the other half to seven per cent. At this rate the undertaking must be considered as decidedly cheap, and the Corporation may be congratulated on its acquisition. The prospects are exceedingly good, for the district is improving, and the demand for gas increasing.

The Bill by which the Ramsgate Local Board seek to make a compulsory purchase of the Isle of Thanet Gas Company occupied the attention of a Committee three days last week, but we are compelled to defer a report of the evidence. When the Committee rose on Friday, the Chairman expressed a hope that before they met again (yesterday) the contending parties would have come to some agreement. At the time we are writing, we have no knowledge that an agreement has been arrived at, and, frankly speaking, we do not see how one could be come to, unless the Company surrender at discretion. We shall, perhaps, learn more before we go to press. It may be said, however, that the terms of purchase offered by the Local Board are by no means bad, taking everything into consideration, still, no company in a good position like to be snuffed out, as it were. There is, we rather think, no other Gas Company situated exactly as the Isle of Thanet Company, but there are some non-statutory Companies growing into a like case, and if these will take our advice, they will lose no time in clothing themselves with the most recent parliamentary powers, and subjecting themselves to the most recent statutory regulations. We shall say no more of Ramsgate until the fate of the Company is decided. The Committee, while refusing to express any opinion on the merits of the several Bills before them, evidently think that an arrangement may be made. There can be but one, and that will be come to or declined before these lines see the light.

[We learn that, on the meeting of the Committee yesterday morning, it was stated that the Local Board had offered the Company £110,000 for their undertaking. The Company, however, declined to sell at this price, and the proceedings before the Committee, therefore, continued.]

When attending the Committee on this Bill on Thursday last, we noticed one circumstance which really calls for remark. The Gas Company are supposed to be represented by three counsel, and, as a matter of course, pay their fees. But, on the day we have named, the learned gentleman who was cross-examining the principal witness for the Local Board was stopped in the middle of a question, and called to another committee-room, and thereafter, during the re-examination of the witness, and for some time after, the Company were absolutely unrepresented by counsel, not one of the three being in the room. It might not have been a matter of very much consequence, and we have to admit that the Local Board were but little better represented. They have four counsel engaged, but only one was present at the time we speak of.

The Committees of the Lords were to commence yesterday with the Blackburn Bill, which aims at confiscating the undertaking of the Blackburn Gaslight Company. In this case, we believe, no terms have been proposed, and the Bill, if successful, will leave them to be settled by arbitration, under the provisions of the Railway Clauses Consolidation Act, 1847.

In another column our readers will see that an agreement has been come to between the Corporation of Clitheroe and the Clitheroe Gas Company, by virtue of which the undertaking of the latter will be transferred to the former. The terms cannot be considered illiberal. The Corporation agree to pay £437 10s. in satisfaction of arrears of dividends, and a bonus of £2887 to ordinary shareholders, in consideration of uncalled-up capital, and annuities equal to maximum dividends on all classes of shares; the Corporation, of course, assuming all the mortgage debt from the date of the transfer. Regretting, as we always do, the extinction of a Gas Company, we feel bound to say that the Directors of this Company would have made a mistake if they had not agreed to the terms now settled.

Mr. Chamberlain, now M.P., not content with buying up the Gas and Water Companies supplying Birmingham, has sought authority to purchase all the public-houses in the borough. His really philanthropic purpose has unfortunately received a check, and the Gottenburg system will remain peculiar to Sweden, the population of which are, perhaps, the hardest spirit-drinkers in the world. We have nothing, however, to say to that. We refer to the matter simply to quote the opinion expressed by a daily metropolitan newspaper, supporting Liberal politics, to the following effect:—"It is ever odious to the spirit of true Liberalism to vest trading rights in incorporated monopolies. Indeed, nothing but the clearest demonstration of imperative public necessity would justify an acceptance of any scheme that so flagrantly violated the first principles of a sound commercial policy." Now a Gas Company, with statutory powers, is, of course, an incorporated monopoly up to a certain point; but a corporate gas undertaking is a real and absolute monopoly. The public inconveniences of competition in the supply of gas are very great, but the first principles of a sound commercial policy are as flagrantly violated when the monopoly is conferred on a Corporation as when it is granted to a Company.

The Bristol United Gas Company had, we are happy to say,

a very pleasant half-yearly meeting last Thursday. The directors were able, while proposing maximum dividends, to announce a reduction of threepence per 1000 feet in the price of gas, making it now 3s. 3d. per 1000 feet. No doubt the continued prosperity of the Company will soon attract the cupidity of the Corporation, who will endeavour to absorb the undertaking as they are now absorbing the Water Company. For the present, however, the Gas Company are not harassed. We notice with satisfaction that the salary of the Secretary has been raised from £600 to £800 per annum. This "princely" remuneration has been earned by forty years of faithful service. When Mr. Townsend entered on his duties, the two Gas Companies supplying Bristol made daily, on the average, 60,000 feet of gas; to-day an average of three and a half millions are supplied. The price at the same distant time ranged from 7s. to 12s. per 1000 feet; it is now, as stated above, 3s. 3d. per 1000 feet. What a record of progress is contained in these few simple figures!

When noticing, a fortnight ago, the sales of shares by auction by the Dover Gas Company, we overlooked the fact which had, indeed, escaped our memory, that by section 22 of that Company's Act, 1860, the sale of new shares by auction is made compulsory. Curiously enough, this provision of the Act reverses the ordinary course of practice, for the 25th section provides that any shares not purchased at the public auction shall be allotted *pro rata* among existing shareholders. At the present day, shareholders have small chance of an allotment, unless they go into the open market.

Where there is nothing of general public interest going on in Swansea, and the reporters of a local print accordingly have leisure, they are, we believe, usually set to write letters attacking the Gas Company. There is nothing novel in this fictitious correspondence, and, perhaps, the JOURNAL OF GAS LIGHTING may be the only paper in existence that can boast that no anonymous correspondence was ever concocted in the office. Be that as it may, the Swansea print has succeeded in goading that gentleman of many J's, Alderman John Jones Jenkins, into once more trying to persuade the Corporation of Swansea to start competing gas-works, or to purchase the undertaking of the Swansea Gas Company. It is only fair to say that the majority of the Town Council, while assenting to the resolution proposed by J. J. J., are not at all disposed to harass the Gas Company. They recognize the fact, that the Council have enough on their hands already. They have sewage-works in progress, which will cost £80,000. They have water-works also in progress, which have already cost £160,000, and now a gap in an embankment has been discovered, which it will probably cost £60,000 to fill up. Under such circumstances, we candidly recommend the Gas Company to follow their own course, to keep up the quality of the gas, to reduce the price to the lowest possible limit, and to pay no regard to anonymous correspondence or threatening resolutions in the Town Council.

A terrible explosion at Brighton, happily unattended with loss of life or personal injury, makes a brief allusion to steam-rollers necessary. The effect of these on gas-mains has been disastrous. We rather think the Liverpool United Company first suffered; but we forget whether any explosions followed from the fracture of the mains. In London we have had one explosion lately, attended with fatal effects, which clearly resulted from the fracture of a main caused by a steam-roller. If these ponderous engines are to come into general use, all gas-pipes must be laid much lower beneath the surface than they are at present. It is out of place in our "Circular;" but we feel bound to protest against the use of these fifteen-ton rollers. That they make smooth the rugged way, caused when a Local Authority spread, three and four inches deep, fragments of granite from two-and-a-half to three inches cube, and to pass over which, in a loose state, is calculated to give pain to horses, is indubitable. But at what expense is the smoothness gained? The granite is simply ground to powder, and we believe that an enormous loss is incurred by the use of the steam-roller. Regent Street has just been relaid and rolled in, for the benefit of the horses of the aristocratic spring and summer frequenters; but if we have, as we had last year, a day or two's heavy rain, Regent Street will be ankle-deep in mud, and half the new material will be carted away by the mud contractors. It would, we believe, be much cheaper if the granite were broken smaller, and the roads smoothed by the ordinary narrow-wheeled traffic. Our attention has, we may say, been called more particularly to this matter by the experience of the Corporation of Swansea, who have indulged in the luxury of a steam-roller, and now pay £2000 a year more for the repair of the streets than they did before they bought and used the roller.

If Mr. Yeomans, the Town-Clerk of Sheffield, has a fault, it evidently consists in his being over-zealous. In 1870, or

rather in November, 1869, he, without any authority from the Town Council, issued the necessary notices preliminary to the promotion of a Bill, by which power was sought to effect a compulsory purchase of the Sheffield Gas and Water Companies. Steps were soon taken by the Water Company to restrain the Town Council from expending corporate funds in the promotion of a Bill in Parliament. In the end the question came before the Court of Queen's Bench, and the judges unanimously decided, that as the law then stood, a Corporation had no power to expend public funds on a parliamentary contest. The Town Council, however, having adopted Mr. Yeomans's proceedings, persevered with their Bill, but suddenly withdrew it, when it came before a Committee of the House of Commons. In the meantime heavy costs had been incurred, and the payment of such as could not be deferred, was made by the Town-Clerk out of his own pocket. In this way it would appear that he disbursed £7600 of his own money. The question had previously arisen, who was to bear the expenses, and three Town Councillors had become guarantors for the repayment of the money advanced by the clerk. When, however, that unlucky functionary sought to realize his guarantee, the guarantors repudiated. The injustice of this proceeding was recognized by the Town Council, who agreed to levy a "voluntary" rate to raise the money. Being "voluntary," however, most of the ratepayers declined to pay it, and in the end it produced only £2500, leaving the unfortunate clerk still over £5000 out of pocket. In the meantime he has been sued at law, driven into the Bankruptcy Court, and is now practically a ruined man. That is the story which Mr. Yeomans told with "much emotion" to the Town Council of Sheffield at their last meeting. It is a caution to all Town-Clerks; but the like can never happen again. Our readers will remember that the Municipal Corporations (Borough Funds) Act, as originally drawn, was designed to meet this very case, for it provided that the ratepayers money might be expended in the payment of costs incurred within three years anterior to the passing of the Act. The House of Commons, however, refused to pass the Bill with this provision, and hence Mr. Yeomans's tears. We may mention that the story was brought out by a proposal to raise the clerk's salary, so as to give him five per cent. interest on the debt owing to him; and that it is further proposed to insure his life, so that his family may not in the end suffer from his unselfish determination to support the credit of his borough. It is hardly necessary to say that the Gas and Water Companies were freely abused in the course of the discussion; but they are used to this in Sheffield.

Mr. J. Glaisher, F.R.S., the eminent meteorologist, and chairman of the Harrow Gas Company, is a decidedly practical man. We commend his remarks, reported in another column, to the notice of Gas Managers, who, with a little trouble, and at small expense, may often remove the cause of the complaints made. It happened to us once to walk about a town with an inspector who carried a stock of nipples, and in the course of the evening several complainants were satisfied that the fault was not in the gas.

We may briefly call the attention of Gas Examiners and Managers to a paper which we publish to-day "On the Volumetric Estimation of Sulphur and Ammonia in Illuminating Gas." The name of one of the authors, Dr. B. Silliman, is sufficient to stamp it as of value. Volumetric processes possess many advantages when followed by competent experimenters, but offer many sources of error to inexperienced and careless operators. We have no doubt that Dr. Silliman's plan may be followed with advantage.

Water and Sanitary Notes.

ALONG with the gas-works, the Corporation of Clitheroe are about to acquire the undertaking of the Clitheroe Water Company. The consideration in this case must also be considered liberal. Annuities of ten per cent. will be paid on both old and new shares, together with a cash bonus of £4000 in satisfaction of back dividends on original shares. We have nothing to say against such terms, which are, however, no more than just. The Clitheroe Corporation acquire two excellent properties, which we hope they will work to the profit of the town, not in the ordinary pecuniary sense of the word, but to the advantage of the inhabitants in many respects.

The Corporation of Reading, under compulsion to keep their unpurified sewage out of the Thames, have acquired lands, on which they intended to establish sewage farms. Unfortunately, however, it has turned out that the greater part of the land is liable to be flooded, and since water irrigation by overflows from the Kennet, and irrigation with sewage from the town, are

incompatible, the Town Council are placed in a difficulty. The recent floods have been exceptionally high—the highest, it is said, known for fifty-seven years; still, the liability of the land to submergence obviously renders it an unfit site for a sewage farm. It seems strange that this danger was not known before the land was acquired. Floods in the Thames Valley have been frequent enough of late years. We fear this will add one more disastrous failure to the number of bad speculations made by Corporations to rid themselves of the sewage difficulty.

We publish to-day Dr. E. J. Mills's annual report on the chemical quality of the Loch Katrine water supplied to Glasgow. It will be seen that, from a washerwoman's point of view, the water is excellent; but, to our taste, it is singularly rapid, and we are not at all surprised that the Glasgow artisan gives a flavour to it by the addition of "wusky." We do not know why a report on the quality of the Gorbals supply is not given, especially as we may assume that it will soon be extended.

We hear rumours, to which, however, we give but little credence, that the question of a lake supply for the Metropolis will soon be brought forward again. Undoubtedly, before many years are over, it will be necessary to add to our present sources of supply. Parliament, we may take it for certain, will not give permission to pump more than is now allowed from the Thames. We have, however, in the chalk districts around London sufficient resources for long years to come, even if the Metropolis continue to grow at its present rate, and grand as the ruins of that mighty aqueduct, which brought water from Windermere to London, might be to the expected New Zealander, we believe that common sense will prefer to draw from humble wells rather than to expend some millions to immortalize an engineer.

We see that Dr. Frankland has added the supply of the Colne Valley Company to the list of waters he examines. At present they soften their water by Clark's process, but as their business increases—and they have a splendid prospect before them—they will get tired of this practice, and none but laundresses and the lovers of filthy tea will regret the discontinuance.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MARCH 12, 1877.

LOCAL GOVERNMENT OF THE METROPOLIS.

EARL DE LA WARR moved for a return of sums expended by vestries and district boards within the metropolitan district, exclusive of the City of London, upon paving, lighting, drainage, water supply, sanitary arrangements, and other works not under the jurisdiction of the Metropolitan Board, during the years 1874, 1875, and 1876. After referring to the recent debate on the question raised by Earl Camperdown, on a reform in the constitution of the Metropolitan Board, the noble earl said the subject to which he wished to call attention involved many interests, and could not be approached without awaking a certain amount of prejudice, as touching upon what might be considered ancient customs and long-existing practice. Previous to the passing of the Act of 1855, under which the Metropolitan Board of Works were created, the Metropolis had been mainly under the government of vestries, with the exception of the comparatively small area which, as now, was under the jurisdiction of the Corporation of the City of London, and, as might be expected, there were hardly two parishes which were governed alike. The object of this Act was to produce greater uniformity of local government, and no doubt a great deal had been achieved, but the evil had only been partially cured. Before the appointment of the Metropolitan Board, the subject had been for many years under the consideration of the ablest and most practical men. Parliamentary Committees and Royal Commissions had sat and reported upon it. Bills were introduced by the Governments of the day, and by private members of the Legislature, which were afterwards withdrawn, and the question seemed to be beset with difficulties, one of which, and he thought not the least, was the attempt to amalgamate the City of London with the surrounding boroughs and parishes. It was, therefore, wise in the Metropolitan Act of 1855 to exclude almost entirely from its operation the City of London. For, while the rights and privileges of that ancient Corporation had happily been respected by Parliament, they had adapted their practice to the wants of the present time, and had set an example of local government which was worthy of being followed. The area and population included within the City boundary was comparatively small, and was numbered by thousands, while outside they came to millions. Excluding, then, as he proposed to do in this discussion, the City of London, what was found existing under the Metropolitan Act? There was a divided jurisdiction in many important matters affecting public interests and public convenience. If they looked outside the City boundaries, there was a population approaching four millions, with an area extending into four counties, and enclosing nine parliamentary boroughs. Under the Act of 1855, this immense district, covered with houses, was placed under the joint government of 38 select vestries or district boards and the Metropolitan Board of Works. The smaller parishes were grouped together and formed district boards, the larger ones being divided into wards, having members according to their sizes. These vestries or district boards had under their management branch drainage, buildings, to some extent streets, water supply, lighting, and sanitary arrangements. The Metropolitan Board had entrusted to them the main drainage and large works, which were carried on by committees. Now he was at a loss to see how it could be for the advantage of the ratepayers or the public that there should be this divided jurisdiction, and these numerous centres of management. He would mention an instance—that of drainage. Could it be a good, or convenient, or economical arrangement that the main drainage should be under the Metropolitan Board, and the smaller drainage under parochial or district boards? Or to take the water and lighting, was it desirable to leave important matters like these, which required unity of action, in the hands of different boards, with perhaps

more or less different interests. It was argued, "You will distrust the parochial system if you take away the jurisdiction of vestries;" but was not that done already? They had districts boards formed by the union of parishes instead of vestries, and it was but a small step further to unite these in one central board, to be elected by the ratepayers, who would thus be directly represented, and would exercise more the rights which they were intended to have, than was done under the present system. He came now to the practical results of this divided authority, as existing in the Metropolitan Board of Works and the 38 vestries or district boards; and here he wished distinctly to state that in the remarks which he might offer he desired in no way to attribute maladministration either to the Metropolitan Board or to the different vestries and local boards. He regarded the defects in practice, to which he asked their lordships' notice, as the natural and, in many instances, unavoidable consequences of the existing divided authority and jurisdiction. The Metropolitan Board of Works had no control over many of those matters which materially affected public interests and public convenience. Streets were continually disturbed and broken up in different districts, for gas or drainage pipes or other reasons, at inconvenient seasons of the year; new pavement was sometimes laid down in one street and not in another which equally required it; the paving of one street was often of a totally different kind from that in the other adjoining, so that horses suddenly passed from a macadamized street to a slippery wood or asphalt pavement; large masses of broken granite were laid down in some streets at a time when the carriage traffic most required an even road. Steam-rollers were worked at all hours of the day. Streets in the summer were frequently imperfectly watered; and he had heard of an instance where one parish insisted upon watering their side of the street in the morning, while the other watered it in the evening, thereby having dust all the day. These, he believed, were the words of the Act giving power to the vestries to water the streets—"As often as they think fit." This, of course, admitted of a very wide interpretation. So also as regarded crossing-sweepers, to be distinguished by their dress as public servants, the Act allowed them to be appointed, but did not make it compulsory, consequently it was never done. And with reference to clearing the streets of dust or snow, the Act required it to be done at "such hours as fixed by the vestry." It was too well known how imperfectly this was carried out, and in cleaning the streets it was frequently done by aged and infirm persons instead of by improved machinery. And he could not omit to notice the subject of the gas and water supply of the Metropolis. These were, as their lordships knew, in the hands of companies, and, consequently, vestries and district boards were dependent upon those companies, both with regard to the quantity and quality of that supply. The gas of London, as was well known, was inferior to what was used in many other large towns; and there were instances of successful management of gas supply by corporations—as in Manchester, where the gas was made a source of income to the town. In like manner, the quality of a considerable portion of the water as now supplied was not what it ought to be, and what it might be in such a city as London. Then, what an unfavourable contrast did London and other large towns of England afford when compared with towns on the Continent with regard to markets? Where were our meat markets, our fish markets, our general markets? The few which existed were not accessible to a large portion of the population, and the poor as well as the rich had often no choice but dealing with tradesmen at a disadvantage. These were some of the inconveniences, and others might be enumerated, which arose from the divided jurisdiction of so many vestries and district boards; and he could not but think that what he had ventured to suggest would, in a great measure, afford a remedy—i.e., if the management of the Metropolis were placed under the control of a Central Board, such as, or similar to, the existing Metropolitan Board, and to be elected in a direct manner by the ratepayers. He believed it would be more economical, that the work would be better done, and that it would be greatly to the advantage of the public. He had to thank their lordships for listening to what he felt was but an imperfect statement of a large question, and which he trusted might be supplemented by other remarks, in the hope that Her Majesty's Government might be induced to give their consideration and attention to this important subject. As he proposed to move for a return of the sums expended by vestries and district boards of the Metropolis during the past three years, he might mention that there was, he believed, a return of the period between 1856 and 1870, showing a total expenditure of upwards of seven millions.

EARL BEAUCHAMP said that on the part of Her Majesty's Government there was no objection to the production of the papers for which his noble friend had moved. No one could contend that there were not imperfections in the present system of managing metropolitan affairs; but he thought that if regard was had to what had been accomplished since the passing of the Metropolis Local Management Act, it must, in candour, be admitted that the vestries had not laboured without success, and that on the whole the management of the Metropolis would compare favourably with that of continental towns. The Metropolis Local Management Act contained the provisions in accordance with which the vestries were elected and transacted their business. In 1870 a number of questions were addressed to the various vestries of the Metropolis; and the answers to those questions showed that, between the date of the passage of the Metropolis Local Management Act, in 1855, and that year, the sanitary condition of the Metropolis had changed very considerably for the better. Rome was not built in a day, but, considering the vastness of the work they had to do, the Metropolitan Board of Works and the vestries might congratulate themselves on having taken most effective and successful steps in embellishing the Metropolis of this great empire. He was far from denying that much remained to be done; and those who had done so much would be far from denying it. The death-rate of the Metropolis had been considerably diminished, but there was no reason why it should not be diminished still more. As to what his noble friend had said with regard to the pulling up of streets for the purpose of laying and repairing gas and water pipes, all that was disagreeable, but the vestries had no jurisdiction to enable them to prevent it. Then his noble friend had complained that there were different descriptions of paving in adjoining streets, but in reply to that it was to be said that as yet no one kind of pavement was acknowledged to be the best, and it must be remembered that the sort of pavement which answered very well in one street might not be suitable to another, in which perhaps there was much more traffic. As to markets, it would be very hard to hold the vestries accountable in that matter, seeing that after the immense expense to which Lady Burdett Coutts had gone to erect a market at Shoreditch, the splendid market established by her ladyship had not commanded the approval of the people of the locality. Mr. Haywood had shown by statistics that to make provision for the immediate removal of the snow after a heavy fall of snow in the Metropolis would involve an expenditure out of all proportion to the object to be achieved. In short, while some of the complaints made by the noble earl were not without foundation, others were such as it was rather unreasonable to urge against the local authorities, seeing what they had already accomplished.

THE DUKE OF SOMERSET could not agree with the commendations bestowed by the noble earl upon the municipal government of the Metropolis. He

thought that if he took his "intelligent foreigner" through the West-end of London that personage would be very much astonished at the way the public thoroughfares were interfered with by vestries and by gas and water companies. In dealing with streets the vestries ought to act under the control of a central authority, such as the Metropolitan Board of Works.

Earl FORTESCUE thought the system a most defective one, under which not only vestries but gas and water companies had power to take up streets. These companies acted independently of the vestries. Two companies might be pulling up different portions of a street at the same time, and he had known instances in which no sooner had one company taken up a street and put it down again, than another company entered and performed the same operation over again. He was glad to find that the noble earl who had spoken on behalf of the Government did not speak of the management of the Metropolis as being absolute perfection, but he regretted that the admissions which he had were so very qualified. He could not agree with Earl Beauchamp that things had been done so well. On the contrary, he held that at the present moment the state of the Metropolis was far from creditable to the greatest capital in the world. He was of opinion that as the duties of the vestries were administrative, the members of those bodies were too numerous. He must solemnly enter his protest against regarding the present state of administration in the Metropolis as being either satisfactory, efficient, or economical.

The motion was then agreed to.

TUESDAY, MARCH 13.

The Blackburn Borough Gas, Water, and Extension Bill was referred to a select committee, consisting of Lord Strathford (chairman), Lord Auckland, Lord Hylton, Lord Hammond, and Lord Harlech; to meet on Monday, March 19.

FRIDAY, MARCH 16.

The Sittingbourne Gas Bill, brought from the Commons, was read the first time and referred to the Examiners.

HOUSE OF COMMONS.

MONDAY, MARCH 12, 1877.

The Epsom and Ewell Gas Bill was read a second time and committed. The Sittingbourne Gas Bill, as amended, was considered.

A petition for additional provision in the Leeds Improvement Bill was referred to the Examiners.

The *locus standi* of the Corporation of Doncaster, as petitioners against the Rotherham Corporation Bill, was disallowed.

The select committee on the Longton Corporation and Rotherham Corporation Bills was further altered by the replacement of Mr. Monk as chairman, in place of Sir Dudley Majoribanks.

Mr. Alexander Brown's motion in reference to the Water Supply of Villages and Rural Districts was deferred from Friday, March 16, till Friday, April 6.

TUESDAY, MARCH 13.

The Crystal Palace District Gas and the Bristol United Gas Bills were read a second time and committed.

On the motion of Sir Charles Forster, it was ordered that the minutes of the evidence taken before the committee on the Ramsgate Local Board Bill, in session 1876, be referred to the committee on the Ramsgate Local Board, Ramsgate Water, and Thanet Gas Bills.

The Examiners reported that the further Standing Order applicable to The Gaslight and Coke Company's Bill has been complied with.

A petition against the Thanet Gas Bill, and in favour of the Ramsgate Local Board Bill, was presented from Ratepayers and gas consumers of Margate.

The petitions were withdrawn of the Corporation of Dublin against the Alliance and Dublin Consumers Gas (Bray Supply) Bill; of the London, Chatham, and Dover Railway Company against the Kent Water Bill; and of Property owners and ratepayers of Warrington against the Warrington Corporation Gas Bill.

The constitution of the committee on the Longton Corporation and Rotherham Corporation Bills, was again changed, by the appointment of Mr. Hibbert as chairman, in place of Mr. Monk.

WEDNESDAY, MARCH 14.

The petition of the Metropolitan Board of Works against the Woolwich, Plumstead, and Charlton Consumers Gas Bill was withdrawn.

THURSDAY, MARCH 15.

The Sittingbourne Gas Bill was read the third time, and passed.

The Examiners reported that the further Standing Order applicable to the North Cheshire Water Bill has been complied with.

FRIDAY, MARCH 16.

The Examiners reported that the further Standing Order applicable to the Heywood Water Bill has been complied with.

The following Bills were reported:—Dundee Gas; Edinburgh and District Water; Falmouth Water; London Corporation; Longton Corporation; West Surrey Water.

The petitions were withdrawn of the South-Eastern Railway Company against the Kent Water Bill; and of the London and North-Western Railway Company against the Warrington Corporation Gas Bill.

CHELMSFORD GAS COMPANY.—The annual meeting of shareholders was held on the 24th ult., when a dividend of 10 per cent. was declared upon the whole of the paid-up capital of the company. Much satisfaction was expressed at the recent addition to the works, carried out by the engineer, Mr. Mead, A.I.C.E., and also at the general good condition of the whole concern.

EVESHAM GAS SUPPLY.—At the meeting of the Evesham Town Council on the 10th inst., the town-clerk read a letter from the Local Government Board, stating that they were willing to issue a Provisional Order for extending the borrowing powers of the Town Council, in order to enable them to acquire and maintain the gas-works for the town, on the understanding that the council will pay off their present debt of £4000 within a period of 50 years, in accordance with the principle now generally adopted for the repayment of such debts. It was resolved that, in the matter of the transfer of the gas-works, it was desirable to appoint a committee of members of the council, in lieu of the committee of the whole of the council, and that they be authorized and instructed to make the necessary arrangements for the transfer of the gas-works to the council under the contract, and to employ such professional and other assistance as they may deem necessary, and to report the result for the approval of the council. It was resolved that the sum of £15,000 be fixed as the sum to be authorized to be borrowed under the extended powers, and that the council consent to the order being made upon the terms contained in the above letter.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

FRIDAY, MARCH 16.

(Before Vice-Chancellor MALINS.)

In re THE NATIVE GUANO COMPANY.

This was a shareholder's petition to compulsorily wind up the company. On the matter coming before his lordship this morning,

Mr. HIGGINS, Q.C. (with him Mr. EVERITT), for the petitioner, Mr. Anthony Blackburn, asked leave to withdraw the petition on his agreeing to pay the costs of the company up to the day of withdrawal.

Mr. PEARSON, Q.C. (with him Mr. CROSSLEY), appearing for the company, said he thought he should ill perform his duty if he did not draw his lordship's attention to the circumstances under which the petition, now sought to be withdrawn, had been presented, because serious injury resulted to companies from such petitions. No doubt it was right in many cases that a company should be wound up, but to present a petition which was so utterly hopeless, so utterly improper, as this, as was proved by the fact that before it came on to be heard, the petitioner's solicitor advised its withdrawal, was a monstrous abuse of the rules of the Court. The petitioner was the holder of 20 shares out of 29,000 shares, he had been present at a variety of meetings of the company, and had asked questions of the chairman—in fact, had done all he could to injure the company, probably with a view to affect operations on the Stock Exchange. The company being unanimous against him, as a last effort he filed the present petition, and advertised it with the greatest possible haste.

The VICE-CHANCELLOR: He did more than that; he moved to commit the directors.

Mr. PEARSON said he was coming to that point. The next step the petitioner took was to come before his lordship, and ask to have the directors committed for contempt, because the solicitor of the company, the moment he was served with the petition, knowing all the facts, exerted his utmost diligence, summoned all the directors by telegram, and they ordered a circular to be sent round to the shareholders, informing them that a petition was presented, that it was an improper petition, and that it should be opposed. It was plain the petition must have been dismissed, simply upon the ground that the shareholders, not listening to the advice of Mr. Blackburn, were convinced they had a good and lucrative concern, that they were sure to succeed, that they were succeeding, and were determined to carry out the business of the company. Under those circumstances, if Mr. Blackburn had any case at all, instead of coming to the Court, he should have gone to a meeting of shareholders, explained his views, and asked them to agree with him in refusing to spend any more money. But instead of doing that, and knowing he had no case in Court, he, with a view perhaps to effect some change in the price of shares on the Stock Exchange, presented his petition.

The VICE-CHANCELLOR inquired whether it had had any effect upon the price of the shares.

Mr. PEARSON replied that it had done a deal of harm. For instance, the petitioner's solicitor had been down to Aylesbury, where the company had a contract, and told the town-clerk that the company were going to be wound up.

The VICE-CHANCELLOR said it was a most unjustifiable speculation to present a petition to injure a company when the person presenting the petition knew that no ground was alleged in the petition on which a winding-up order could be made.

Mr. PEARSON said he had to ask, although he was afraid it was not in his lordship's power, to give the company their costs as between solicitor and client.

Mr. HIGGINS said he had purposely abstained from interrupting his friend, but after the statements which had been made he felt it his duty to make a few observations.

Mr. PEARSON said the company were bound to meet what was stated in the petition, and, among other things, they were charged with packing the meetings of shareholders. They had been put to considerable expense in preparing affidavits answering such charges, though of course, after the receipt of the notice that the petition would be withdrawn, the affidavits had not been filed, and he should ask for the costs of preparing such affidavits.

The VICE-CHANCELLOR: When did you receive notice that the petition was to be withdrawn?

Mr. PEARSON: On March 12.

The VICE-CHANCELLOR said the company would have the costs up to that date, and also the costs of appearing on the petition.

Mr. PEARSON said that as they had been threatened with a speech from Mr. Higgins, he begged to say that he was not entitled to be heard. The Master of the Rolls had decided that where a petition was withdrawn the Court would not look at it, nor allow it to be opened. He had not dealt with the petition, but simply the question of costs, and had, therefore, a right to be heard.

Mr. RIGBY (with him Mr. GLASSE, Q.C.) said he appeared for a large majority of the shareholders, and must ask for his costs. He did not receive notice that the petition would be withdrawn until the 14th of March.

The VICE-CHANCELLOR said they must have their costs up to the time of receiving notice, including the costs of the present appearance.

Mr. HIGGINS: On behalf of the petitioner—

Mr. PEARSON said he objected to Mr. Higgins being heard.

The VICE-CHANCELLOR said he did not think he could hear Mr. Higgins.

Mr. HIGGINS said that Mr. Pearson had been heard on the question of costs, and also as *amicus curie*; and he had just as much right to be heard as his friend. Mr. Pearson had made a violent attack upon the petitioner, under the impression that his counsel would not be allowed to be heard in defence.

The VICE-CHANCELLOR said that Mr. Pearson was quite entitled to address the Court upon the question of costs, but upon the merits of the case he was not strictly entitled to be heard.

Mr. HIGGINS said the attack had been extremely unfair. The petitioner had proved, on oath, that he had been a victim of the company.

Mr. PEARSON again objected to Mr. Higgins being heard.

The VICE-CHANCELLOR said the better way would be to let Mr. Higgins make his statement.

Mr. PEARSON said that if the company had put in their evidence it would have displaced the statement about the petitioner being a victim of the company.

Mr. HIGGINS said as the petitioner had been held up to public indignation, under the impression that his counsel could not be heard, he thought he was entitled to say that a gentleman who paid £29 for £5 shares, in the public market, had great reason to be dissatisfied with the company.

The VICE-CHANCELLOR: If he gave £29 for £5 shares, he must have been a very sanguine man.

Mr. HIGGINS, continuing, said the company was an abortion, and kept up only for Stock Exchange purposes. After the petitioner bought his shares, they receded to 40s. per share, and had still further decreased. At the

time he presented the petition, he was fully under the impression that he would be able to maintain it, and were it not for the enormous weight which the Courts gave to the majority of votes, he would have succeeded. One-half of the shares were held by members of the Stock Exchange, and therefore the petitioner, having such a majority against him, thought it right not to proceed with the petition. The petitioner was a *bona fide* shareholder; he considered the company was entirely gone, and was a mere creature of the Stock Exchange, kept up for Stock Exchange purposes. But finding that other branches of the Court had lately held that a winding-up order could not be made when the majority were in favour of continuing, he withdrew his petition. He did hope that his lordship would not give costs to the shareholders appearing, because the company represented the shareholders.

The VICE-CHANCELLOR said he did not see the reason for shareholders appearing to oppose, as the company represented them.

Mr. PEARSON maintained that the shareholders had a right to their costs.

Mr. HIGGINS objected to Mr. Pearson—who appeared for the company—arguing the case of the shareholders, when they were otherwise represented.

Mr. RIGBY understood that his lordship had already given him his costs.

The VICE-CHANCELLOR was not sure that he should have given them. He should be glad to have some authority for giving the shareholders costs when the company represented them.

Mr. RIGBY quoted the case of the *Marlborough Hotel Company*, decided by Vice-Chancellor Kindersley. Shareholders in their individual capacity were invited by advertisement to appear and be heard.

The VICE-CHANCELLOR inquired whether, after the petition was presented, the directors held a meeting at which they came to the conclusion to oppose.

Mr. HIGGINS: Yes; and they sent out a circular stating that the company would oppose.

The VICE-CHANCELLOR: Then I do not see why the shareholders appeared.

Mr. RIGBY said it was the common practice, where the company and shareholders opposed separately, and no order was made, for the shareholders to receive one set of costs. That point had been decided over and over again.

The VICE-CHANCELLOR said the petition was presented for the purpose of having the company, a going concern, wound up. The company had not been very successful, but the great majority of shareholders were of opinion that it would be successful hereafter. The rules of the Court required a petitioner to show that the company had either not commenced business within a year from incorporation, or had suspended business for a year, that the members were reduced in number to less than seven, or that the company could not pay their debts. Those were the only grounds on which a winding-up order could be made. If a company were losing money, and there was every prospect of their continuing to do so, it was not a reason for winding them up, if the majority were in favour of going on. There not being any ground stated in the petition on which a winding-up order could be made, he was bound to say that the presentation of the petition was a very unwise, and, he was inclined to think, an unjustifiable act, it being calculated to do the company great injury. Without at all saying that the petitioner was actuated by improper motives, he must say that the petition ought not to have been presented. But it having been presented, the petitioner had exercised a sound discretion and withdrawn it, as he was entitled to do upon paying the costs. The company would have their costs properly incurred up to the time of notice of withdrawal, including the costs of appearance; and, as it had been decided by other learned judges that shareholders opposing were entitled to their costs, he was bound by those decisions, and should therefore give them the costs up to the time of receiving notice. Had the matter been *res integra*, he should probably not have given them any costs.

SATURDAY, MARCH 17.

In re THE EUPION GAS COMPANY.

Mr. HIGGINS, Q.C. (with whom was Mr. MILLAR), moved on behalf of twelve, out of seventeen, alleged contributories of the company, that so much of the order made by his lordship in chambers on the 3rd of August as affected the applicants, for the payment of the amount alleged to be due from them for calls, be rescinded or discharged, and that all further proceedings against the applicants be stayed.

The VICE-CHANCELLOR: What do you say regarding them?

Mr. HIGGINS: I say they are not contributories, and ought not to pay calls. The facts, shortly stated, were these: Mr. Joseph Aspinall was called upon to pay a call of 2s. 6d. per share in respect of 2200 shares—

The VICE-CHANCELLOR asked whether that would be sufficient to pay all the debts.

Mr. HIGGINS replied that the legitimate debts were very small.

The VICE-CHANCELLOR inquired the amount of the debts.

Mr. COOPER (the liquidator) said the debts amounted to £3000, the assets in hand were £150, and there was nothing further to come in except the present call.

Mr. HIGGINS said the questions raised were simply questions of law. He would first of all take the case of Henry Kelsall Aspinall, because the decision in his case would cover four or five other cases. He was an original allottee. The application for 1000 shares was on the 20th of March, 1874, and on that day Joseph Aspinall paid into the bankers of the company, the National Provincial Bank, the sum of £500 for Henry. On the 30th of March the directors allotted the 1000 shares, and the allotment was duly signified to Henry by the usual allotment letter. On the same day Henry signed a blank transfer of the shares, and forwarded the same to Joseph. On the 7th of April the balance of £500 remaining due upon the shares was paid by Joseph into the bank. On the 18th of December, 1874, an order to compulsorily wind up the company was made by his lordship. The shares being £1 shares, they were consequently paid up in full by the payments made.

Mr. GLASSE, Q.C. (for the liquidator), said that would be so, and the point would be very simple, if the money paid belonged to Henry.

Mr. HIGGINS supposed the defence would be that Joseph had made an arrangement by which the moneys paid to the credit of the company were to be returned.

The VICE-CHANCELLOR asked whether the moneys were returned.

Mr. HIGGINS replied in the negative. Henry had filed an affidavit, in which he stated that he applied for shares at the request of his brother, that it was understood he was not to have any beneficial interest in them, and that he signed and returned the application at his brother's request.

The VICE-CHANCELLOR said he was, in fact, the brother's cat's-paw.

Mr. HIGGINS said that appeared to be so. He also stated in his affidavit that he only consented to take the shares on the condition that the £1000 paid into the bank was accepted as payment, and that he was in no way a party or privy to any arrangement by which the moneys paid into the bank were withdrawn. Therefore he submitted, upon that evidence, Henry could not be called upon to make any contribution to the company, he being a holder of fully paid-up shares.

The VICE-CHANCELLOR said he understood the real point to be determined was, whether or not the shares had been paid up.

Mr. HIGGINS said that was not the question. The way he put it was simply this: either Henry was a shareholder, or he was not; if he was, it was only by virtue of the application and allotment, and the application was upon the footing of the £1000 being accepted in payment. It came precisely within the decision of Carling's case decided by the Lords Justices. In that case there was a contract to accept shares upon certain terms, and a direct allotment of five shares to a director. But in the present case the allotment was to a perfect stranger of the company. Henry was not a director, his conduct was not impeached; he applied for shares upon the conditions before stated, and upon the decision of the Lords Justices he (Mr. Higgins) submitted that he could not be called upon to pay any call in respect of the shares.

Mr. GLASSE, Q.C. (with him Mr. MONTAGUE COOKSON, Q.C.), appeared for the official liquidator. He submitted that the authorities cited by his learned friend did not apply to the present case, for the simple reason that in those cases there was no application for shares, and, therefore, no contract with the company to take the shares. The short history was as follows:—The directors, for the purpose of the fraud for which they were convicted, borrowed the money one day from the Midland Bank, paid it, in the names of supposed allottees—mere nominees of Joseph Aspinall—at the company's bankers, and the next day the money was withdrawn, so that it never reached the hands of the Eupion Company at all; and his lordship so decided on the 1st of July, 1875, when the case was before him. By the order of the 3rd of August, Henry Aspinall was placed on the list of contributories, as a holder of unpaid shares, and that order was not appealed from.

Mr. HIGGINS denied that the shares were not fully paid up.

The VICE-CHANCELLOR said the only question before him was whether the calls had been paid.

Mr. GLASSE assented. Henry Aspinall, in his affidavit, did not swear that the £1000 was paid by his brother Joseph out of his own moneys.

The VICE-CHANCELLOR said, if the shares were paid for, the company got £1000, and the shareholder ought not to be asked to pay again.

Mr. GLASSE said the only way in which it could be shown strictly, was by going through the evidence, which had satisfied his lordship on a previous occasion, that the money was not paid. Instead of reading the evidence in full, to save time he would put it all in, so that it might be used by the parties if the case should go to another Court.

Mr. HIGGINS said among the evidence to be put in was the affidavit of Charles Knocker, and upon that he wished to ask a few questions. [Mr. Knocker was present, having been brought up on *habeas corpus*.]

Mr. Charles Knocker, cross-examined by Mr. HIGGINS.

I made an affidavit in the claim of the Midland Bank against the Eupion Company. The securities referred to in that affidavit were deposited by Joseph Aspinall for a loan to be made by the bank. The securities consisted of shares in an iron company and a gold company. The nominal value of the securities deposited was £32,000. I caused inquiry to be made respecting the genuineness of the securities, and I satisfied myself that they were sufficient to cover any amount the bank would be out of pocket by these transactions. Messrs. Hardwick and Holmes acted as the advisers of the bank in the matter. They were not the ordinary solicitors of the bank; they were the solicitors of Mr. Richardson, the chairman. Sometimes they acted for the bank. They reported that the securities were sufficient. The advances made by the bank were made, to some extent, upon those securities.

Re-examined by Mr. GLASSE: The transactions first commenced on the 19th of March. The security was not first given in the month of May. I received the letter produced, dated the 14th of May, from Mr. Aspinall. I had a security from Mr. Aspinall before that date. The £10,000 mentioned in that letter had nothing to do with the Eupion Company; it was a subsequent loan entirely. Aspinall gave security previous to February. The £2000 mentioned in the letter of February had nothing to do with the money advanced to the Eupion Company. The bank had no further securities than those mentioned in the letters of February and May.

Further cross-examined by Mr. HIGGINS: Having looked at the two letters, I adhere to the statement that the securities represented by the shares were given to the Midland Bank by Mr. Aspinall in respect to the advance made to the Eupion Company.

Mr. HIGGINS was then heard in reply upon the whole case.

The VICE-CHANCELLOR, in giving judgment, said the application made by Mr. Henry Kelsall Aspinall was to rescind the order, so far as it related to him, for the payment of the call of 2s. 6d. per share. He would shortly state the facts. The company was formed by Joseph Aspinall and others for the purpose of working certain gas patents. It had been shown, in the course of the proceedings before the Courts, that the company was, from the beginning to the end, a mere fraudulent, sham scheme, formed simply for the purpose of issuing shares, which, by various fraudulent devices, were to be the means of producing money to the directors, and those associated in the formation of the company. Mr. Joseph Aspinall, Mr. Knocker, and several other directors, having been brought before the Lord Mayor for their fraudulent conduct in the management of the company, were by him committed for trial. They were tried before the Lord Chief Justice and convicted of fraud in the concoction, creation, and management of the affairs of the company. The jury having convicted them, various objections were taken to the form of the indictment, and those objections came before the Court of Queen's Bench, and afterwards the Court of Appeal. The result was they were finally convicted. Mr. Knocker was still undergoing his imprisonment, and Mr. Joseph Aspinall, in consequence of ill-health, had received the Queen's pardon. The matter had been before him in various forms—first, to wind the company up, then to allow the prosecution of the directors to be at the expense of the company, and afterwards with reference to a sum of £35,000, borrowed from the Midland Bank. The Bank parted with that sum through the gross conduct of Knocker, who had, in his examination that morning, aggravated his offence by attempting to impose upon the Court by saying that he took security from Joseph Aspinall for the money lent by the bank. When the matter was before him in July, 1875, he came to the conclusion—as also did the jury afterwards—that the whole thing was a deliberate concocted fraud, that the money was obtained from the Midland Bank for the purpose of fraud, and that the thing was a fiction from the beginning to the end. Now, how did that affect Henry Aspinall, the present applicant? It having been the object of Joseph Aspinall to give shares the appearance of being taken, when in reality they were not, he got his brother, who seemed to have had unlimited confidence in him, to apply for 1000 shares. The applicant, in his affidavit, stated that in March, 1874, he received from his brother a form of application for 1000 shares in the company, and a blank form of transfer for his signature, with a letter asking him to sign and return the documents, that he (Joseph) would pay at once the full amount of capital due upon the shares, and that no personal liability or risk would be incurred by the applicant. He signed and returned the documents, relying, as he said, on such statement, and 1000 shares were allotted to him. Not only was he an allottee, but he had also stood on the list of contributories without objection.

Mr. HIGGINS said he objected when the list was settled.

The VICE-CHANCELLOR: But not in a form which the Court could recognize. If he thought himself wrongly on the list he should have brought the matter before the Court and had the question settled. No such step was taken, and being on the list of contributories, on the list he must remain, and pay the £1000, if it were required, if he had not already paid it. It was not pretended that he had paid it himself; he said his brother Joseph paid it. Had Joseph paid? If he had, the company must have had the money. Had the company had the £1000. The company never had the money—that, like everything else, was a fraud. The evidence satisfied him he did not in fact pay, because directly after he paid the money in he took it out again. It was also quite clear that Joseph was the agent of Henry, and therefore by Joseph's transactions Henry was bound. Henry having made himself the tool of his brother, must suffer the consequence of so doing—viz., be held liable to pay the call of 2s. 6d. per share, and any future call which might be made, as well as the costs. The other cases would stand over until next week.

Mr. GLASSE said he thought they might dispose of Turpin's case, as he did not intend to argue it. He would merely state the case, and leave it in his lordship's hands. Mr. Turpin bought 100 shares upon the Stock Exchange, for which he paid £150. He bought the shares as fully paid up, although, in fact, they were not. He could not be treated as having notice, and therefore he would not press the case against him.

Mr. METHOLD, for Mr. Turpin, cited the case of *Waterhouse v. Jamieson*, in which it was held that a person in the position of the applicant was not liable.

The VICE-CHANCELLOR said every company was at liberty to issue shares with the usual certificate stating the sum paid, and if they issued a certificate stating that A.B. was the holder of "paid-up shares," by that statement they must be bound. As Mr. Turpin bought his shares under the belief that they were paid up, he was not liable; his name must be taken off the list of contributories, and he would have his costs out of the estate.

(Before the MASTER of the ROLLS.)

In re THE BARKWAY (HERTFORDSHIRE) GAS COMPANY, LIMITED.

This petition, praying for a compulsory order to wind-up the company, was in the paper of his lordship on Saturday last, and when it was called on,

Mr. CHITTY, Q.C., said: The petitioner is a creditor, and there seems to be a case for winding up. I am not even sure that there is any opposition.

The MASTER of the ROLLS: If the company do not appear, you may take an order.

Mr. CHITTY: My lord, there is this upon the affidavit of service. The affidavit is not in the common form. It says, "I did, on Saturday, March 3, 1877, personally serve Baker, the secretary of the company, with a true copy," &c.; and "I say that I served the same upon Baker, at his residence in Barkway, which I am informed and believe is the registered office of the company."

The MASTER of the ROLLS: That will do, if you get a certificate that it is the registered office.

Mr. CHITTY: It is a country service; but we can produce a more formal one if it is thought necessary.

The MASTER of the ROLLS: A certificate that that is the registered office will do.

Mr. CHITTY: Your lordship sees that it is only "I am informed and believe" it is the registered office.

The MASTER of the ROLLS: The certificate will make it regular. You can take the order.

BRADFORD BOROUGH COURT.—WEDNESDAY, MARCH 14.
(Before the Mayor, Mr. W. SUTCLIFFE, Mr. R. KELL, and Mr. S. SCOTT.)

ILLEGAL USE OF GAS.

Edward Purcell, plasterer, Jury Street, was charged, at the instance of the town-clerk, with illegally burning gas, the property of the corporation.

The TOWN-CLERK stated that they might have preferred a charge of theft against the defendant, but they had brought the case forward in the milder form. The Bench might inflict a penalty of £5, and 40s. for each day during which the nuisance was continued, and he wished that they would deal with the defendant in such a way as would tend to suppress this kind of procedure.

John Firth, gas-meter inspector, deposed to having visited the defendant's house on the 1st of March. He then found that the connexion between the meter and the burner had been severed, and the gas was conveyed to the burner by the aid of a flexible tube, direct from the main, consequently it was not registered by the meter. On the 5th of March he repeated the visit, and found the gas in the same condition.

Another inspector gave corroborative evidence.

Defendant said that what he had done had been done in ignorance. He went to live in the house about a month ago, and finding there was no gas, he spoke to the landlady, and acting upon her advice, he attached the pipes, but without the slightest intention to defraud.

The TOWN-CLERK said he was only getting himself out of one difficulty into another. He had no right to connect the gas without giving notice.

Defendant was fined £2, and 12s. costs, or in default to be committed to Wakefield House of Correction for two months.

BIRMINGHAM GAS ARBITRATIONS.—The arbitrators appointed by the Birmingham Corporation and the Local Boards of Smethwick, West Bromwich, Oldbury, and Tipton, met for the first time on Saturday last. Mr. Hawksley, C.E., appeared on behalf of the Birmingham Corporation, and Mr. Bramwell, C.E., for the Local Boards. The clerks of the respective Local Boards and members of the Gas Committee of the Corporation were also present. The proceedings were of a purely formal character, and although the next meeting has not yet been agreed upon, we understand that it will probably be held in the month of July next.—*Birmingham Daily Gazette*.

GAS EXPLOSION AT LIVERPOOL.—On Saturday morning, an explosion of gas occurred in Phythian Street, at the house of Mr. Griffiths. It appears that a workman was engaged in effecting some job in the corner of a small front room used for storage purposes, and that he detected a strong smell of gas on entering the apartment. He then went in order to turn it off at the meter, and on returning lighted a match to enable him to see under a sink-stone (the room was formerly used as a kitchen). Immediately the match was struck, an explosion took place which shook the whole house, knocked the window almost completely out, sash and glass; shattered the windows of other rooms, and the flame passing through the open door and along the hall, smashed the panes in the back part of the premises. The workman and Mrs. Griffiths were both scorched, the former on his hands, and the latter on the side of the face and head, but the injuries are not of a serious nature. It is thought that the man did not effectually turn off the gas at the meter, or that the accumulation of gas, consequent on a leakage in the chandelier in the room, was greater than he imagined before he struck the match.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

WOOLWICH CONSUMERS GAS COMPANY.—At the meeting of the Metropolitan Board of Works on Friday, the Parliamentary Committee reported that it was not desirable the Board should petition, as it had previously been resolved to do, against the Bill of this company, with the view of obtaining the insertion in it of clauses corresponding to those of the Chartered and South Metropolitan Acts of last session.

Dr. Stevenson's report on the gas supplied by The Gaslight and Coke Company to the vestry of St. Pancras, during the month of February:—Maximum light, estimated by sperm candles, according to the Act—17.3. Minimum light, sperm candles—15.5. Average light, sperm candles—16.5. Traces of ammonia, indicated by turmeric test-paper—Traces only, on all occasions. Traces of sulphuretted hydrogen, indicated by lead test-paper—none. Sulphur, 17 grains per 100 cubic feet.

METROPOLIS WATER SUPPLY.

The Registrar-General publishes the following return of the average daily quantity of water supplied by the London Water Companies during February. According to this, 110,670,113 gallons, or 502,825 cubic metres of water (equal to about as many *tuns* by measure, *tons* by weight), were supplied daily; or 209 gallons (95.0 decalitres) rather less than a *ton* by weight, to each house, and 29.4 gallons (13.4 decalitres) to each person, against 29.7 gallons during February, 1876.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	Feb., 1876.	Feb., 1877.	Feb., 1876.	Feb., 1877.
Total supply	523,801	530,656	110,394,788	110,670,113
From Thames	246,016	248,196	57,055,749	55,996,723
„ Lea and other Sources	277,785	282,460	53,339,039	54,673,390
THAMES.				
Chelsea	28,600	28,737	6,980,600	6,955,400
West Middlesex	47,506	48,810	9,226,178	9,313,279
Southwark and Vauxhall	80,346	77,850	18,600,000	17,230,000
Grand Junction	36,036	37,055	10,078,371	10,578,944
Lambeth	53,528	55,744	12,170,600	11,919,100
LEA AND OTHER SOURCES.				
New River	124,051	125,061	24,672,000	24,299,000
East London	109,375	111,967	22,079,500	23,838,000
Kent	44,359	45,432	6,587,539	6,536,390

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for February, 1877, as compared with that for the corresponding month of 1876, shows an increase of 6855 houses, and an increase of 275,325 gallons of water supplied daily.

Dr. Frankland, F.R.S., reports, as the results of his analysis of the waters supplied to the inner, and portions of the outer, circle of the Metropolis during the month of February, that, taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the last nine years as unity, the proportional amount in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was—Tottenham 0.5, Kent 0.8, Colne Valley 1.0, New River 3.1, Chelsea 3.6, East London 3.6, West Middlesex 3.7, Lambeth 3.8, Southwark 3.9, Grand Junction 4.3. The water taken from the Thames and Lea, and delivered by the Chelsea, West Middlesex, Southwark and Vauxhall, Grand Junction, Lambeth, New River, and East London Companies had undergone great improvement since January, and it was all efficiently filtered except that supplied by the Southwark Company, which was slightly turbid and contained moving organisms. The water supplied from artesian wells to the inner circle by the Kent Company, and to the outer circle by the Colne Valley Water Company, and the Tottenham Local Board of Health, was wholesome, bright, and palatable, and of most excellent quality for dietetic purposes. The water delivered by the Kent Company and by the Tottenham Local Board was hard, and therefore unsuitable for washing, but that supplied by the Colne Valley Company was softened by Clark's process before delivery, whereby its hardness was reduced to less than one-fifth of the original amount, and the total solid matters from 38 to 12 parts in 100,000 parts of water. In this way the water was rendered suitable for washing. Seen through a stratum two feet deep, the Kent and Colne Valley waters were clear and colourless. The Tottenham water was also colourless, but not quite clear. The remaining samples presented the following appearances—Chelsea, clear, very pale yellow; West Middlesex, clear, very slightly brown; Southwark, turbid, brownish; Grand Junction, brownish yellow, and not quite clear; Lambeth, clear, very pale brown; New River, clear, very pale brownish yellow; and East London, clear, very pale yellow.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Mat- ters.	Or- ganic Car- bon.	Or- ganic Nitro- gen.	Ammonia.	Nitrogen, as Ni- trates and Nitrites.	Total combined Ni- tro- gen.	Chlo- rine.	Total Hard- ness.
Inner Circle.								
Thames—								
Chelsea	30.14	.182	.032	0	.312	.344	1.52	20.0
West Middlesex	29.10	.186	.031	0	.290	.321	1.50	20.3
Southwark and Vauxhall	30.70	.190	.042	0	.297	.339	1.52	21.5
Grand Junction	31.00	.205	.048	0	.281	.329	1.47	21.2
Lambeth	33.06	.192	.033	0	.409	.442	1.78	22.1
Other Sources—								
New River	32.00	.156	.029	0	.328	.357	1.52	22.4
East London	34.40	.188	.026	0	.302	.328	1.70	22.7
Kent	44.74	.041	.007	0	.615	.622	2.45	28.1
Outer Circle.								
Colne Valley	12.10	.046	.011	0	.296	.307	1.32	5.1
Tottenham Board of Health	47.30	.0.8	.012	.003	.498	.517	3.30	24.2
Corporation of Birming- ham*	23.56	.499	.089	.002	.209	.299	1.40	15.5
Corporation of Glasgow†	3.68	.158	.011	.002	0	.013	.70	.7

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.

† Analyzed by Dr. E. J. Mills, F.R.S., of the Andersonian University, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

HARROW DISTRICT GAS COMPANY.

The Ordinary Half-Yearly Meeting of Shareholders was held at the Guildhall Tavern, London, on Wednesday, the 14th inst.—JAMES GLAISHER, Esq., F.R.S., in the chair.
Mr. BAYNES, in the absence of the secretary (Mr. J. L. Chapman) through indisposition, read the notice convening the meeting.
The following report was presented:—

The directors, in submitting the accompanying statement of accounts to the proprietors, are glad to be in a position to report that the business of the company continues to increase.

The illuminating power and quality of the gas have been tested by the gas examiner of the Harrow Local Board of Health and found to be perfectly satisfactory.

Notwithstanding the unusual mildness of the weather, affecting so prejudicially the demand, the gas-rental of the company for the half year shows an increase of £197 11s. 3d., compared with the corresponding period of the year before, and the residual products have also improved.

The balance of profit and loss account shows a total of £1129 10s. 10d. for disposal, which the directors recommend be appropriated to the payment of a dividend at the rate of 5½ per cent. per annum, and to the extinguishment of the preliminary expenses amounting to £237 12s. 5d., leaving a balance of £66 18s. 5d. to be carried forward to the credit of the next account.

One of the directors, Mr. Alfred Henry Baynes, F.R.A.S., and one auditor, Mr. James Randall, retire by rotation, who, being eligible, offer themselves for re-election.

Dr. Revenue Account, for the Half Year ended Dec. 31, 1876.			Cr.		
Manufacture of gas—			Sale of gas—		
Coals, including all expenses	£1,253	13 9	Michaelmas quarter—		
Purifying materials, water, oil, &c.	33	9 6	Private rental—		
Salary of engineer	100	0 0	2,114,100 cubic feet at 6s.	£334	4 9
Wages	170	7 0	191,700 cubic feet at 6s. 3d.	59	18 5
Works, machines, and apparatus—maintenance of, repairs, and labour	180	2 6	Public rental and under contracts	94	4 6
Distribution of gas—			Christmas quarter—		
Mains and service-pipes, repairs, maintenance, renewal, and labour	31	1 3	Private rental—		
Meters, renewing, repairing, and refixing	20	12 0	5,657,800 cubic feet at 6s.	1,697	6 7
Public lamps—			541,300 cubic feet at 6s. 3d.	169	3 6
Lighting	20	17 0	Public rental and under contracts	171	3 6
Rents, rates, and taxes—			Meter-rental, half year.	69	12 0
Rents	19	10 0	Residual products—		
Rates and taxes	125	11 3	Coke, less labour and cartage	409	0 0
Management—			Tar	81	19 11
Directors and auditors allowances	110	10 0			
Salary of secretary	25	0 0			
Collector's commission	25	0 0			
Stationery and printing	20	3 5			
General establishment charges	57	6 10			
Sundries—					
Bad debts and allowances	17	4 10			
Total expenditure	£2,210	9 5			
Balance carried to profit and loss account	1,176	3 9			
	£3,386	13 2		£3,386	13 2

The CHAIRMAN, in moving the adoption of the report, said it was always a gratification to the directors to meet the shareholders, and especially when they had to render so satisfactory an account of their proceedings as they were able to do on the present occasion. The first paragraph of the report spoke of continued prosperity, and he thought that, if the shareholders would compare the present with any past report, they would see that the company had made a perhaps not very rapid, but certainly a steady progress, and that each half year they had taken a step in the right direction. With reference to the illuminating power and quality of their gas, which was mentioned in the second paragraph, he was happy to corroborate the statement that, upon examination, it had always been found perfectly satisfactory, and he might add that on no occasion had it been below the parliamentary standard. Still, at Harrow, as elsewhere, they were not entirely free from complaints, owing to the defective state of consumers fittings. His own experience in burning gas made him always prompt to see that the fittings were in proper order. Some of his early lessons in the use of gas were taken at the Royal Observatory, Greenwich. The gas supplied there was manufactured by the Phoenix Company, and in his department underground, there were always, night and day, ten or twelve lights in action, photometrically registering the most delicate operations. If one of those lights was bad, and all the others burnt well, it would have been of no use for him to go to the company and complain that the quality of their gas was at fault in the one instance; it was evident that something was wrong with the burner. He, therefore, always had a stock of nipples on hand, and thus effected a ready remedy. Probably, if he had only had one burner in use instead of a dozen, he would, in his ignorance of the cause of defect, have made hundreds of complaints to the company. He remembered at Blackheath, on one occasion, a document was brought to him by a solicitor, signed by a considerable number of persons, many of them in good positions, who ought to have known better, which document was in the nature of a remonstrance to the Phoenix Company about the badness of the gas they supplied. He (Mr. Glaisher) at once said he could not think of signing the paper, as the gas in his house, supplied by the same company, was extremely good, and, as he tested it himself, he knew that it was above the parliamentary standard of illuminating power. His friend suggested that, perhaps he improved his gas by using some hydrocarbons to increase its illuminating power; but he assured him he did nothing of the sort, he only carefully looked to the state of his burners, under the advice of his friend, Mr. Ohren. To inform himself of the nature of his friend's complaint, he visited his house, and found that it arose from the way in which the gas was consumed, and, by simply using a needle to clear the burners, he effected at once such a change in the lights as to quite surprise and convince his friend. The result was that the petition was torn to pieces, and the Phoenix Company never knew of the existence of the document. Thus was it at Harrow. Complaints were occasionally made which were always courteously acknowledged, and the consumers recommended to look after their fittings, which, when set right, always satisfied the complainants. In the next paragraph in the report, the directors spoke of the effect of the unusual mildness of the weather on the sale of coke. In this they did not stand alone; every company had suffered from this cause more or less severely. They had battled with the difficulty as well as they could, and the accounts showed the result. Although they had made 200 chaldrons of coke less, they had received £26 more in cash on that item than before. The next paragraph in the report referred to the profit of the last half year, and stated that the directors proposed to pay a dividend at the rate of 5½ per cent. At the same time, the profits enabled them to extinguish the item for preliminary expenses (£237), and they carried forward a balance of £66. The latter was as small a balance as they could venture to leave, because the difficulties which attended them in the early winter had continued to follow them to the present time. Still the directors had confidence that they would be able to continue the same dividend in the second half of the year, and before long they hoped that

the promise held out in the original prospectus of the company would be fully realized. Their business was steadily increasing, not only half year by half year, but month by month, and if fortune should smile on the district, and the long projected railway into the town be constructed, so as to give the inhabitants another road into London, there was no question it would lead to a considerable increase in the number of houses and inhabitants, which would be of great advantage to the company.

Mr. JOHN CHAPMAN seconded the motion, and said that he believed everything in connexion with the company was in a sound and encouraging condition.

The motion having been adopted, it was resolved, on the motion of the CHAIRMAN, seconded by Mr. MAGNUS OHREN, that a dividend at the rate of 5½ per cent. per annum, free of income-tax, be now declared and paid.

The CHAIRMAN moved, and Mr. CUTLER seconded, the re-election of Mr. Baynes, the retiring director, which was agreed to. Mr. James Randall was also re-elected an auditor of the company.

On the motion of Mr. CUTLER, seconded by Mr. OHREN, thanks were voted to the chairman and directors, and speeches in acknowledgment of the re-elections and thanks, terminated the proceedings.

UNITED GENERAL GAS COMPANY.

The Half-Yearly General Meeting of Proprietors was held at the Company's Offices, in London, on Tuesday, the 13th inst.—ROBERT HUDSON, Esq., in the chair.

The SECRETARY (Mr. D. W. Ogg) having read the advertisement convening the meeting, the following report of the directors was submitted:—

The directors submit to the proprietors the following report and audited statement of the company's accounts, for the year ending Dec. 31, 1876.

Considering the competition which has now been going on for nearly two years, by the active opposition of the Limerick Corporation, it is satisfactory to observe that the company's rental has not been materially affected.

The sale of residuals has improved, and had the winter season not been of such an unprecedentedly mild character, the coke would have been more in demand, and the amount sold have added still further to the company's revenue.

The directors have made several additions to the manufacturing plant and apparatus, and a contract has been entered into for telescoping the 70-feet gasholder, which work will be commenced in the spring and completed in time for next winter's requirements.

Since the meeting of proprietors in September last, the directors have made application to Parliament for an Act, conferring certain necessary powers upon the company.

The profits of the year, after deducting £224 for depreciation of plant, being at the rate of 1 per cent. per annum on the investment, amounts to £1730 17s. 8d.; balance of undivided profit, £165 6s. 2d.; making a total of £1896 3s. 10d., from which the directors recommend the proprietors to declare a dividend of 3s. per share (free of income-tax), £1350; leaving a balance to be carried to the next account of £546 3s. 10d.

Dr. Abstract of the Limerick Working Account, for the Year ending Dec. 31, 1876.			Cr.		
Coals			Gas-rental, one year		
Wages	£3896	18 0		£6642	15 10
Salaries	719	19 1	Residual products		2705 15 3
Rents and taxes	355	19 0			
Charges	384	14 7			
Allowances and bad debts	546	7 5			
Wear and tear	426	11 3			
Gas-meter repairs	702	3 8			
Depreciation of plant	186	9 5			
Balance, working profit	224	1 9			
	1905	6 11			
	£9348	11 1		£9348	11 1

On the motion of the CHAIRMAN, the report and accounts were adopted, and the dividend recommended by the directors declared.
The usual votes of thanks terminated the proceedings.

OTTOMAN GAS COMPANY, LIMITED.

The Ordinary Meeting of Shareholders was held at the Company's Offices, 85, Cheapside, London, on Thursday, March 15—S. A. BECK, Esq., in the chair.

The SECRETARY (Mr. A. J. King) read the notice convening the meeting, and the following report and statement of accounts were presented:—

The directors herewith present the audited statement of accounts for the year ending Dec. 31, 1876.

The gas-rental for that period amounts to £7324 11s. 3d., and the net profit (after paying interest on debentures) to £2497 14s. 2d., which, added to the balance brought forward, make the sum of £2932 11s. 1d., which the directors propose to deal with as follows:—

A dividend of 7 per cent. on the preference shares	£498	15 0
A dividend of 3 per cent on the ordinary shares	1500	0 0
To write off from the preliminary expenses account	500	0 0
Leaving a balance to carry forward of	433	16 1

£2932 11 1

And resolutions will be proposed at the general meeting accordingly.
The directors retiring by rotation are Henry Deffell, Esq., and Dr. Fraser, who being eligible, offer themselves for re-election. The auditors, E. P. Rowsell, Esq., and George Allin, Esq., also offer themselves for re-election.

Dr. Balance-Sheet, Dec. 31, 1876.			Cr.		
Capital			Plant		
£50,000	0 0			£43,508	0 0
Do., preference shares, viz.—			Concession and preliminary expenses	13,500	0 0
1025 shares, £5 paid	5,125	0 0	Amount owing for public lights	2,270	12 5
1000 shares, £2 paid	2,000	0 0	Sundry debtors	3,280	0 1
Debentures	5,200	0 0	Stocks	5,715	5 2
Sundry creditors	4,884	6 7	Office furniture	60	0 0
Profit and loss account—			Cash	1,607	19 7
Amount brought forward	434	16 11			
Add for 1876	2,497	14 2			
	£70,141	17 8		£70,141	17 8

Dr. Profit and Loss Account for the Year ending Dec. 31, 1876.			Cr.		
Cost of coals			Gas rental		
Wages and materials	£2,465	9 10		£7,324	11 3
Salaries and office expenses, Smyrna	1,003	7 4	Products		799 16 2
Bad debts and allowances	995	17 3	Net profit on chandeliers, fittings, meter-rents, &c.	564	5 8
Exchange	91	5 0	Transfer fees		1 12 6
Repairs and renewals	479	6 11			
Debenture interest	207	8 5			
Directors fees	321	0 0			
Rent, salaries, interest, and discount, and office expenses, London	360	0 0			
Income-tax	308	6 4			
Balance (profit)	20	10 4			
	2,497	14 2			
	£8,690	5 7		£8,690	5 7

The CHAIRMAN, in moving the adoption of the report, said they had, unfortunately, rather less rental last year, but this was partly compensated for in the reduced cost of coals. The other items in the accounts were very similar to those presented at their last meeting. The directors might have divided 3½ per cent., as before, but seeing how bad trade was throughout Turkey, in Smyrna particularly, they had deemed it prudent not to go beyond 3 per cent., and he hoped the shareholders would approve of that course. They had paid £500 off preliminary expenses, as before, and had reduced their debentures about £5000 since 1872, so that, upon the whole, he thought they might congratulate themselves upon the position of the company.

Mr. HORNER seconded the motion, which was put and carried. The CHAIRMAN then moved that a dividend at the rate of 7 per cent. upon the preference shares, and 8 per cent. upon the ordinary shares, free of income-tax, be declared.

Mr. HORNER seconded the motion, which was put and carried. The retiring directors were re-elected, and Mr. DEFFELL returned thanks for himself and colleague. The retiring auditors were also re-elected.

A vote of thanks having been passed to the directors, The CHAIRMAN acknowledged the compliment. The company was a small undertaking, but the directors all took a deep interest in its prosperity, and had worked together assiduously to secure its success. He felt bound to say that they had been most fortunate in having a good manager at Smyrna, and a most able secretary in London, and this had been of the utmost service to them.

Mr. HORNER remarked, as a proof of the excellent condition of the company's plant, that the leakage at Smyrna was only 5½ per cent. He thought few foreign gas companies could say that.

The CHAIRMAN: Or English either.

A vote of thanks to the secretary, acknowledged by Mr. King, closed the proceedings.

BRISTOL UNITED GAS COMPANY.

The Half-Yearly General Meeting was held on Thursday, March 15—F. TERRELL, Esq., in the chair.

The SECRETARY (Mr. H. H. Townsend) read the report of the directors, which was as follows:—

In accordance with the practice now adopted by the company, a printed copy of the accounts for the half year ended the 31st of December last has been sent to each proprietor in the company. The profits for the half year will be found sufficient to meet the usual dividend which has for some years been paid by the company.

At the last half-yearly meeting of proprietors the directors announced an intended reduction in the price of gas, from 3s. 6d. to 3s. 3d. per 1000 feet, from and after Jan. 1, 1877. That reduction has now been carried into effect, and, of course, will be perceptible in the current half year's revenue, when made up to the 30th of June next.

The Bill in Parliament, to which the proprietors gave their assent at the special meeting convened under Lord Wharnclyffe's Act, and held on the 28th ult., has been read a second time in the House of Commons, and will no doubt be carried through both Houses without any material obstruction.

Possession has been obtained of the greater portion of the land lately purchased at Stapleton, and the whole purchase will very shortly be completed. Your engineer is engaged in preparing his plans for its occupation by the new works which have become necessary to meet the annually increasing demand for gas.

The directors, desiring to recognize the long and efficient service of the secretary, and the greater responsibilities of his office in connexion with the extension of the works, recommend that from and after the 29th of September last his salary be increased from £600 to £800 per annum.

The directors recommend that a dividend at the rate of 10 per cent. per annum on the capital of the company entitled to dividend be declared, and made payable at the bank of Messrs. Cave, Bailie, and Co., Bristol, on and after Monday, the 26th day of March inst., subject to the deduction of income-tax.

The CHAIRMAN said there was nothing in the accounts calling for any special remark. The directors were quite satisfied with them, and he hoped the proprietors also would be satisfied with them. In the report the price of gas was dwelt upon, the 3d. per 1000 being a reduction to the general consumer. This would make a difference in the revenue of between £4000 and £5000, but they trusted that the increased consumption would make up the deficiency, and that the revenue would reach the usual amount. A gratifying fact was that no one now complained of the quality of the gas. There used to be a great deal of grumbling, especially by the Sanitary Authority, but within the last six months even the grumblers at that board had ceased to grumble. The Bill which was being promoted by the company in Parliament was progressing very satisfactorily, and he did not think they would meet with any opposition of consequence. As the report stated, they had purchased the land at Stapleton for new works, and he hoped that gas would be made in that district within three years from that time. With respect to the increase of salary to the secretary, he thought he might say that Mr. Townsend's qualities as secretary could not be equalled. When he came to the company he had a natural aptitude for the work, which had been increased by 40 years service; and he (the chairman) thought they would allow that 40 years service entitled him to great consideration. Alluding to the growth of the operations of the company during those 40 years, the chairman said that 40 years ago the production of gas (with two companies) was about 60,000 cubic feet per 24 hours; now the production was 3,500,000 cubic feet per 24 hours. Forty years ago the price of gas ranged from 7s. to 12s. per 1000 cubic feet; now it was 3s. 3d. per 1000, and no doubt there would yet be a further reduction in price. He moved the adoption of the report and accounts.

Mr. T. T. TAYLOR seconded the motion, and said he thought the board had done right in purchasing the ground at Stapleton for the development of the works. He considered there was a large increase of business in store for the company, and that at present there was no prospect of their resting and being thankful.

Mr. GILES inquired what steps were being taken to counteract the influence of naphthaline in the manufacture of their gas. He approved of the extension of their works, as a company which enjoyed a monopoly should always keep ahead of the demand.

Mr. FINDES, the engineer, explained the expedients adopted to counteract the naphthaline, which had so far been successful that retorts which were formerly required to be cleaned out every month had now been in use nearly three years without requiring to undergo that operation.

The motion was then adopted, as was also a resolution declaring a dividend at the rate of 10 per cent. payable on the 26th inst.

The SECRETARY acknowledged the adoption of that part of the report referring to himself and their kind recognition of his services. He had simply endeavoured to do his duty, and did not wish to take credit for anything that did not fairly belong to him. As in the past, so in the future, as long as he had health and strength he would endeavour to deserve their confidence, and his best energies would be exerted in promoting the interests of the company.

The meeting was then made special, and a series of resolutions were passed adopting a special report, and authorizing the directors of the company to issue from time to time new shares or stock of a nominal value not exceeding the sum of £50,000, and to exercise the borrowing powers of the company in respect of the said sum of £50,000, either by the issue of debenture stock or on mortgage, at their discretion. Also, to authorize the directors from time to time to issue debenture stock in substitution for, and to pay off existing loans, and up to the extent of their borrowing powers. It was explained in the report that the additional capital was required to meet the expenditure rendered necessary for the increasing demand for gas.

A vote of thanks to the chairman and directors (proposed by Mr. GILES, and seconded by Mr. G. WILLS) terminated the business of the meeting.

WATTON GAS COMPANY.—The annual meeting was held on the 6th inst.—Mr. T. Barton in the chair. The increasing demand for gas had led to the erection of a new gasholder since the last meeting, at a cost of £260. A dividend as usual, at the rate of 5 per cent., was declared.

ROCKHAMPTON (COUNTY LIVINGSTONE, QUEENSLAND) GAS AND COKE COMPANY, LIMITED.

The Half-Yearly Meeting of Shareholders was held in the Municipal Council Chambers, Rockhampton, on Thursday, Dec. 21, 1876—Mr. HENRY JONES, chairman of the board of directors, occupying the chair.

The SECRETARY (Mr. H. Mills) having read the advertisement convening the meeting, the reports of the directors and engineer were read as follows:—

Directors' Report.

Your directors have the pleasure to report that the business of the company has steadily progressed during the present half year, and the result, as shown by the balance-sheet, enables them to recommend payment of a dividend at the rate of 10 per cent. per annum on all shares paid up.

For ordinary wear and tear and renewals, the sum of £140 has been written off, and is shown in the balance as "depreciation on fixed investment."

It is necessary to create a reserve-fund for contingencies and the equalization of future dividends, and the directors therefore propose to appropriate the balance, after payment of dividend, for this purpose.

The system of discounts for prompt payment is found to work favourably, and enables all who avail themselves of it to obtain their gas at a considerable reduction.

After the last general meeting, all preference shares were eagerly sought after, and sold. The company still hold 103 original forfeited shares, for which there are inquiries.

The subject of extensions has been carefully considered, and your directors have ordered from England 100 tons of mains and services, which they hope to receive in March or April next, and a portion of these will be ready for profitable employment during the winter months.

Managing Engineer's Report.

I have the pleasure to lay before you for your information report of the general condition and progress of your works, the quantity of coal carbonized, and the amount of gas sold for the half year ending Nov. 30.

During the half year I have taken down one bench of retorts and replaced them with new ones, doing the whole of the work, including brickwork, with the help of the ordinary hands employed on the works. This ensured good solid work, and the result is a considerable saving in the fuel, and increase in the amount of gas produced per ton of coal carbonized.

The whole of the building, carbonizing, purifying, storage, and distributing plant, street-mains, and services, have been maintained in good order and condition, the most careful attention being directed to detect any defects, and remedy them at once. The leakage averages from 1½ to 8 per cent.

During the half year a number of extensions have been decided upon, both in the carbonizing power and in the street-mains, the pipes and other materials for which may be expected to arrive shortly, when the works will be proceeded with.

The quantity of coals carbonized for the half year has been 247 tons 10 cwt., and the amount of gas sold, 1,893,260 cubic feet, of a quality equal to 15 candles. The demands for coke and tar show a satisfactory increase.

(Signed)

W. SMITH, Managing Engineer.

Dr.	Profit and Loss Account for the Half Year ended Nov. 30, 1876.	Cr.
Manufacture, distribution of gas, and management	£975 13 3	Balance, May 31 £952 15 7
Interest account	13 1 8	Sales of gas, coke, and tar 1,740 14 9
Discount on gas-rents	35 15 10	Scrip and transfers 1 2 0
Depreciation written off fixed investments	140 0 0	Rent of dwelling-house 22 10 0
Dividend Aug. 1	948 18 9	
Profit balance from last half year	3 16 10	
This half year's profit	599 16 0	
	£2,717 2 4	£2,717 2 4

Liabilities and Assets.

A. J. S. Bank	£102 6 10	Fixed investment—Land, buildings, machinery, mains, meters, &c.	£11,638 12 7
Original capital, 2000 shares at £5	£10,000 0 0	Floating investment—Coal, coke, and tar	655 3 9
Preference capital, 1000 shares at £5	5,000 0 0	Sundry debtors	463 2 11
	£15,000 0 0	Cash in hand	12 7 7
Less due from shareholders, and preference shares not called up	£2559 6 11		
103 forfeited shares	480 5 11		
	3,039 12 10		
Unclaimed dividends	11,960 7 2		
Profit and loss	43 0 0		
	603 12 10		
	£12,709 6 10		£12,709 6 10

A proposition was made by Mr. J. BOYCE, and seconded by Mr. J. JOYCE, that the dividend of 10 per cent. be paid on and after the 28th of December.

An amendment was proposed by Mr. W. PATTISON, and seconded by Mr. A. BELL, that the payment be made on the 3rd of January.

A further amendment was proposed by Mr. E. P. LIVERMORE, and seconded by Mr. J. FORREST, that the dividend be paid on and after ten a.m. on the 23rd of December.

The latter amendment was ultimately carried.

A vote of thanks was then passed to the directors for their services during the past half year, and the meeting terminated.

PURCHASE OF THE CLITHEROE GAS AND WATER COMPANIES.

A Meeting of the Clitheroe Town Council, as the Urban Sanitary Authority of the District, was held on Thursday, March 8—the Mayor (Mr. J. Mitchell) presiding—the first business being to consider agreements entered into on behalf of the Authority with the Clitheroe Water-Works Company and the Clitheroe Gas Company for the purchase of the works of the respective companies, and, if so determined, to approve of and confirm the same, and to order the common seal to be affixed thereto.

The MAYOR said that in this matter he would take up little of the time of the council. The question, however, they had to deliberate upon that morning was of far greater importance than any question that had hitherto come before the corporation. He congratulated not only the two companies, but the council, in having by mutual concession succeeded in coming to a conclusion which, in his opinion, would not only be satisfactory to the sellers, but also to the ratepayers. These companies took the businesses in hand when the ratepayers refused to do anything of the kind. They had nursed and cultivated them, and made them both admirable properties. They were entitled, as they insisted, to the full value of their works, and the corporation had given, he believed, a price that would be satisfactory to all. He proposed, without further comment, that the agreement entered into between the sub-committee and the water-works company be affirmed.

The following is a memorandum of the agreement:—

The said company, in consideration of the annuities and of the sum of £4000 herein-after agreed to be paid by the said authority, agree to sell, and the said authority to purchase, all the water-works property, lands, rights, powers, privileges, easements, plant, stock, and effects of the said company, whether vested in or held in trust for the said company, with the incidents and appurtenances thereto respectively belonging in as full, ample, and beneficial a manner as the said company now can, or ought to hold, possess, exercise, and enjoy the same, subject to all rents payable from or by the said company, and the covenants and agreements affecting the same, except in respect of loans and debts, such sale to take effect as from March 25, 1877, and on the terms and conditions following:—The said authority to pay to the said company the sum of £4000 by way of bonus in satisfaction of back dividends for the holders of the original shares in

the said company on the completion of the transfer of the said undertaking; and also to legally and effectually secure to the persons who shall be shareholders in the said company, on the said 25th of March, their executors, administrators, and assigns, perpetual annuities of 10 per cent. per annum on the amount of the share capital of the said company respectively held by them, both old and new shares, such annuities to be secured with all usual powers, in case of being in arrear, on the works, property, and privileges of the said company, and also on the general district rates made by the said authority within their district, and to be payable in equal portions half yearly on every 25th day of March and the 25th day of September in every year, or within 21 days thereafter respectively, the first payment to be made on Sept. 25, 1877, and to be free from all deductions except property-tax. The said company to pay all its loans and debts, and all rents, rates, and taxes, and working expenses up to the said 25th of March, and to retain for its own benefit all water-rents and arrears thereof up to that time, as well as its reserve-fund. The stock of pipes and other loose materials which may be on hand on the said 25th of March, as per book produced, and appearing in the last balance-sheet at £139 0s. 1d., to be handed over to the said authority gratis. All expenses of the transfer to be paid by the said authority. No abstract of title to be required by the said authority; but on the completion of the transfer, all deeds, books, and documents to be delivered to the said authority. Until the completion of the said transfer, all water-rents accruing from the said 25th of March to be paid to a joint account at the Craven Bank, Clitheroe, of the said company and the said authority, and all payments made therefrom to be by cheque signed by the chairman of the said company and the water committee of the said authority; but the works to be managed by the said authority from the said 25th of March. In the event of non-payment of the £4000 on the 25th of March, the same shall bear interest at the rate of $\frac{4}{2}$ per cent. until payment.

Councillor GRIME seconded the motion, and he did so because he felt that the time had come when these properties ought to become the property of the corporation. The feeling outside was the same, and the people would be glad when the matter was settled.

The motion was put to the meeting, and carried unanimously.

The MAYOR said that he would at once proceed to make the same resolution with reference to the gas-works, and, without any remarks, moved that the following agreement between the Clitheroe Gas Company and the Corporation be confirmed:—

The said company, in consideration of the annuities, and of the sum of £3325, hereinafter agreed to be paid by the said authority, agree to sell, and the said authority to purchase, all the gas-works, property, lands, rights, powers, privileges, easements, plant, and effects of the said company, whether vested in, or held in trust for the said company, with the incidents and appurtenances thereto belonging, in as full, ample, and beneficial a manner as the said company now can, or might hold, possess, exercise, and enjoy the same, subject to all rents payable from or by the said company, and the covenants and agreements affecting the same, except in respect of loans and debts, such sale to take effect as from July 1, 1877, and on the terms and conditions following, viz.:—The said authority to pay to the said company for the ordinary shareholders the sum of £2887 10s., by way of bonus for the uncalled amount of such shares, and £437 10s. in satisfaction of back dividends, on the completion of the transfer of the undertaking, and also to legally and effectually secure to the several persons who shall be shareholders in the said company, on the said 1st of July, their executors, administrators, and assigns, perpetual annuities as follows, that is to say:—To the holders of class A and B shares, 5 per cent. per annum; to the holders of class C and D shares, 10 per cent. per annum; to the holders of the ordinary shares, on £6 the amount paid up thereon, £7 10s. per cent. per annum. Such annuities to be secured with all usual powers in case of non-payment, on the works, property, and privileges of the said company; and also on the general district-rates made by the said authority within their district, and to be payable in equal portions on the 1st of January and the 1st of July in every year, or within 21 days thereafter respectively, free from all deductions, except income or property tax. The said company to pay all its loans and debts, and all rates, taxes, and working expenses, and outgoings of every description, up to the said 1st day of July next, and to retain for its own benefit all accounts, gas-rents, rents, and arrears thereof, up to that time, as well as its reserve-fund. The stock of coal, coke, lime, and gas, which may be on hand on the said 1st of July, to be taken at its original cost. All expenses of the transfer to be paid by the said authority. No abstract of title to be required by the said authority, but, on the completion of the transfer, all deeds, books, and documents to be delivered to the said authority. Until the completion of the said transfer, all gas-rents and other moneys accruing from the said 1st of July next to be paid to a joint account at the Craven Bank, Clitheroe, of the said authority and the said company, and all payments made therefrom to be by cheques, signed by the chairman of the said company and the gas committee of the said authority; but the works to be managed by the said authority from the said 1st of July. If the said sum of £3325 is not paid on the said 1st of July, it is to bear interest from that date until payment, at the rate of $\frac{4}{2}$ per cent.

Councillor GRIME seconded the motion, which was also carried unanimously.

It was then resolved to apply to the Local Government Board for powers to borrow sufficient money to complete the purchases, on the mortgage of the corporation property.

GAS EXPLOSION AT BRIGHTON.

On Wednesday morning last, an explosion of gas of a very alarming character occurred in the King's Road, Brighton, at the corner of Market Street. The result was an immense damage to property; but, fortunately, the accident was unattended with loss of life or serious personal injury. The primary cause of the mischief appears to have been a broken water-main belonging to the corporation, underlying the 6-inch gas-main of the Brighton Company, which runs along the road at some 12 inches below the surface of the ground. The leakage from the water-pipe had softened the earth in all directions, and made it incapable of sustaining the weight of a heavy steam-roller, which had been at work on the spot that morning. The passage of the roller snapped the company's main, and the gas escaping in large quantities into the lower part of the adjoining premises, where it became ignited, a tremendous explosion took place. Several houses were more or less damaged, some of them almost completely wrecked, while the furniture and the valuable stocks of jewellery, silk, and other goods contained in them were scattered in all directions. Within an hour after the explosion the gas-mains at a lower level were logged, more than 200 gallons of water having flowed in through the crack from the water-main. The gas-main itself was found to be as perfect a casting as when delivered from the foundry, and the fracture itself was as bright as it could be.

THE THEORY OF THE BUNSEN LAMP.

The *Chemical News* publishes the following report of the proceedings of the Chemical Society on the 1st inst., when Professor THORPE read a paper "On the Theory of the Bunsen Lamp":—

Professor THORPE, after some preliminary remarks as to the great value of this lamp, both to the scientific chemist and in the arts, pointed out the origin of it at the time when Bunsen introduced coal gas into his laboratory. He considered the contrivances which had been used in this country as unworthy of the fuel they had to burn, and, bringing his own inventive powers to bear on the subject, the Bunsen lamp was the result; the original apparatus differing but little from that now generally in use. After a short description of the lamp, the mode by which the air is drawn in at the holes at the bottom, and caused to mix with the gas, was considered. This is due to the well-known fact that when a gas issues from an orifice under pressure, it carries with it more or less of the circum-jacent air, partly as the result of the expansion, and partly as the result of its viscosity. This was experimentally illustrated by an ingenious adaptation of List's multiplying manometer, which, when connected with one of the holes at the base of a Bunsen lamp, distinctly showed the rarefaction produced by the gas as it issued from the jet, despite its low pressure. The intermixture of the gas and air in the tube is greatly facilitated by the spreading out of the gas stream after leaving the jet, and the amount of air carried in varies, of course, with the size of the air-holes, being in an ordinary burner from two to two-and-a-half times that of the gas. An

average lamp, giving a flame 120 millimètres high, burns about 80 litres of gas per hour, so that as much as 250 litres of mixed gases pass through the tube of the lamp in that period of time. In some modifications of the lamp, such as Wallace's, the proportion of air is very largely increased, but then it is necessary to resort to some such contrivance as a perforated cap to prevent the flame retreating down the tube and burning below; for from Mallard's observations on the maximum rapidity of the propagation of combustion, it is evident that the velocity of the current of mixed gases in the tube of the Bunsen lamp would have to exceed that of the velocity of the propagation of combustion, in order that the flame should not retreat down the tube. Having traced the progress of the mixture of air and gas up the tube, attention was directed to the flame itself, which is hollow, and contains a large internal area of the unflamed mixture, as it has been found that a mixture of gas with less than three-and-a-half times its volume of air will not burn; it is only, therefore, when it meets with an additional supply of oxygen from the surrounding air that combustion occurs. The composition of the gas in the unflamed interior cone is not the same in every part, however, as has been shown by Blackmann; the amount of hydrogen, of the hydrocarbons, and of oxygen diminishing, and that of the carbonic oxide, carbonic acid, and especially the aqueous vapour and nitrogen, being largely increased, the latter being derived from the surrounding air. This was still more clearly shown in a table giving the amount of air mixed with 100 volumes of gas, both in the tube and at various distances above it. The cause of the rapid diminution in the proportion of hydrogen, and the corresponding increase in aqueous vapour, is to be sought for in the greater diffusive power of the gas, and the lower ignition point of a mixture of hydrogen with air. If the supply of air be cut off from the air-holes at the bottom of the Bunsen lamp, the flame becomes luminous, so that the non-luminosity of the flame is due to the air, and at first sight it would be imagined that it was due chiefly, if not entirely, to the oxygen in the air, since it is known that an admixture of air with coal gas greatly decreases its luminosity. The nitrogen, however, is concerned in the matter, for if, instead of supplying air at the holes at the bottom of the lamp, we supply nitrogen, or even steam, the flame at once ceases to be luminous, showing that the oxygen of the air is not necessarily the true cause. Knapp has shown that any indifferent gas, as carbon dioxide or hydrochloric acid, will produce the same result. Frankland proved many years ago that a mixture of marsh gas and air, which was almost destitute of illuminating power, might be made to give a luminous flame by heating the gas to redness; and Wibel has recently shown that the ordinary Bunsen flame is luminous when the gas is previously heated. This fact was experimentally illustrated by means of a Bunsen lamp with a platinum tube. When the latter was heated to redness by means of a blowpipe, the flame became luminous, as when the air supply is cut off from the holes at the base. The feeble luminosity of the Bunsen flame would appear to be due to a variety of causes, such as the oxidation of luminiferous material, the action of the nitrogen and other diluting gases, and the withdrawal of heat by the indifferent gases, such as nitrogen, carbon dioxide, and water vapour; for, although the temperature of a flame of coal gas mixed with air is higher than that of one of unmixed coal gas, it requires a still higher temperature in order to become luminous. When the gas is lowered in the Bunsen lamp, and the flame becomes very small, it will be seen that it does not rest immediately upon the end of the tube—a fact due to two causes, namely, the cooling action of the tube, and to the velocity of ignition of the mixed gases being less than the rate at which they issue. When the flame is very small, we all know that the least current of air causes the flame to retreat down the tube and ignite the gas at the jet below. This is due to an admixture of air causing the velocity of ignition of the mixed gases to become greater than the rate at which it passes upwards in the tube. When the flame burns at the bottom, a very much smaller quantity of air passes into the tube, and the gas which issues at the top is entirely deprived of oxygen, and has, moreover, a disagreeable odour, arising in part from the presence of acetylene formed by the imperfect combustion of some of the hydrocarbons present; the amount of carbon monoxide also is very largely increased. The pernicious effect of this partially burned gas is due to the acetylene and carbon monoxide thus formed.

The PRESIDENT (Professor Abel, F.R.S.) in thanking the lecturer, remarked that it would have been difficult to select a subject having a more special interest for working chemists; he had brought before them facts with which many were only generally or very partially acquainted, and made them familiar by his explanations and admirable experimental illustrations. Of those points of interest in the theory of the Bunsen lamp which had been mentioned, perhaps those bearing on the luminosity of flames were of the greatest interest at the present time, when so much attention was being directed to the subject.

Dr. FRANKLAND said that, although he had not paid any special attention to the luminosity of the Bunsen flame, it had been a point of special interest to him to ascertain the cause of the greater or less luminosity of flames under certain conditions. With regard to the effect of dilution on the luminosity of the Bunsen flame, it had been advanced that when gases containing oxygen had been employed, such as carbonic anhydride, they had given up their oxygen; but there could be no doubt that this was not the case when nitrogen was used. From his own experiments it was evident that a comparatively slight elevation of temperature has a great effect on the luminosity of a flame which was just on the point of becoming luminous. He had resumed his researches on the luminosity of flames, and might say that he had repeated the very important experiments of Heumann, whose details of results he had found to be most accurate. He might mention that the exceedingly luminous flame of phosphoretted hydrogen did not give the faintest shadow in bright sunlight, showing that no solid matter was present in it; but as to whether the luminosity of carbonaceous flames was due merely to the great density of the hydrocarbon vapours, or to solid particles of carbon, was a matter which must still be considered as *sub judice*. The two important points to be determined were the presence or absence of polarized light in carbonaceous flames, and as to whether a flame whose luminosity was undoubtedly due to the presence of solid particles would behave in the same way under diminished pressure as hydrocarbon flames, such as that of a candle, &c.

Mr. VERNON HARCOURT wished to ask the lecturer whether the luminosity of the Bunsen flame, when the tube was heated to redness, might not be due, in part, to the formation of tarry matters or of hydrocarbons containing a large proportion of carbon, as it was not possible that the mixture of gas and air could be passed through the red-hot tube without undergoing considerable change.

Dr. WRIGHT suggested that the effect of heating the tube was comparable with that produced by lighting the jet below.

Professor THORPE replied that Heumann had very carefully examined into the matter, and had found that when the experiment was properly performed there was no deposit of tarry or carbonaceous matter in the tube. If a much longer platinum tube to the Bunsen were employed, and only the lower part heated, so that the gases became cooled again before being burnt, the lamp gave a non-luminous flame, showing that the luminosity was chiefly due to the heating. In reply to a question put by Professor Foster, he said that when a cold body was introduced into the luminous flame soot was deposited on it.

SOLVAY'S DISTILLING APPARATUS FOR THE CONCENTRATION OF GAS LIQUOR FROM GAS-WORKS.

By Dr. G. TH. GERLACH, of Kalk.

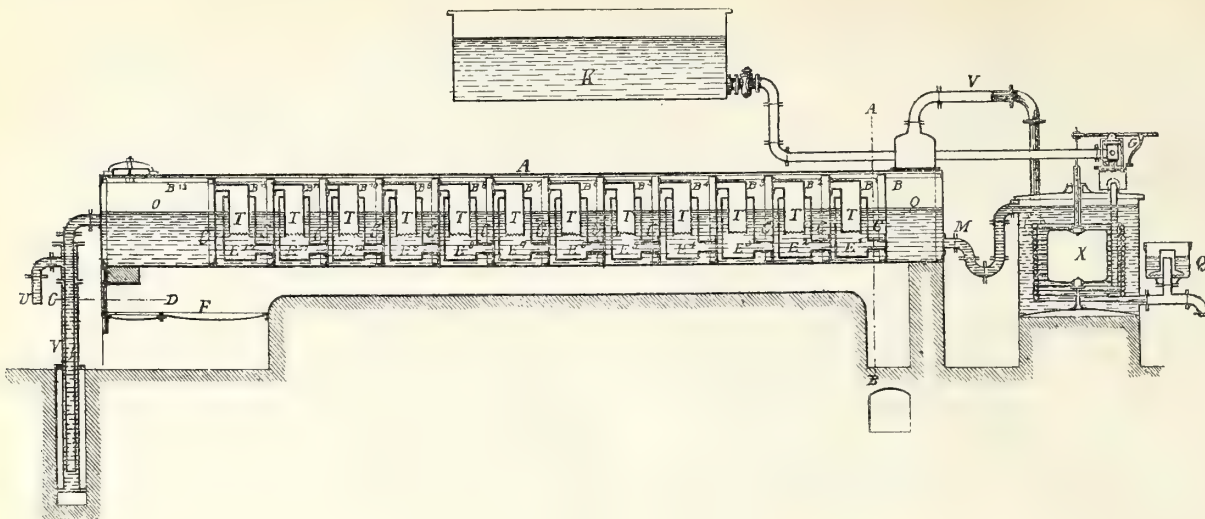


FIG. 1.—LONGITUDINAL SECTION.

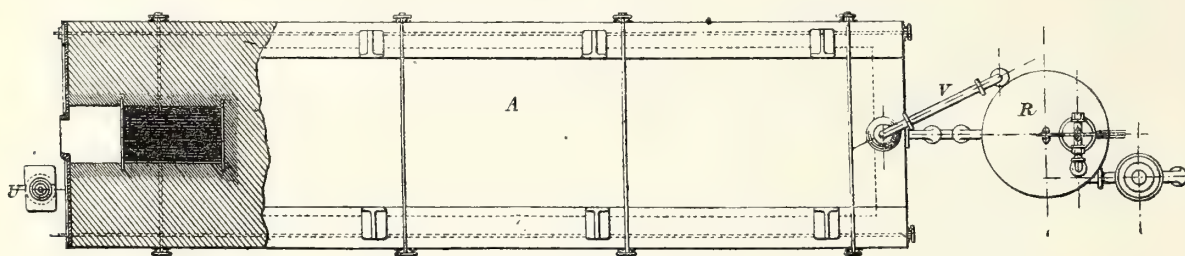


FIG. 2.—PLAN ON LINE C D (FIG. 1).

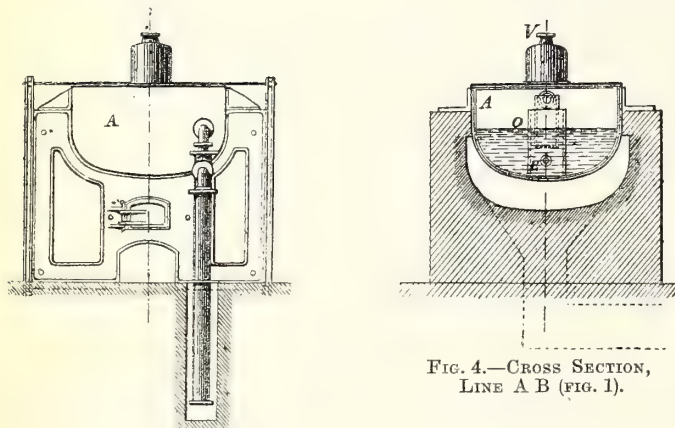


FIG. 3.—END ELEVATION.

FIG. 4.—CROSS SECTION,
LINE A B (FIG. 1).

I have several of Solvay's new distilling apparatus in use myself, and have also erected two at Rome and one at Utrecht. I cannot sufficiently praise this apparatus, which is equally ingenious and practical, and as it is scarcely known in Germany, I trust that a description based upon a drawing in the "*Revue Universelle*" for 1875, may draw attention to it.

With a view to systematic arrangement and continuous action in distilling apparatus, several boilers were contrived vertically above each other, so that the descending liquid and ascending vapours would move in opposite directions—a necessary condition in such works.

The disadvantages of this vertical arrangement of the boilers are—

1. Direct fire heat cannot be applied. It becomes necessary to introduce high-pressure steam into the liquid, causing a mixture of this steam with the vapour distilled.

2. The liquid to be distilled must be pumped to a certain height before it can flow into the apparatus.

3. The apparatus is difficult to get at to examine its condition internally. The exclusion of direct fire heat is often exceedingly inconvenient; besides rendering a steam-boiler necessary in places where it is probably of no further use, the employment of steam in this case is less economical.

The apparatus of E. Solvay offers very special advantages for distilling ammoniacal gas liquor. It is constructed to work horizontally, and is heated directly. It also has the advantage of producing a constant motion of the whole fluid mass, by the vapours of distillation being themselves forced through the fluid. It is convenient and not expensive in its arrangement, can be economically worked, is perfectly regular in its operation, and is independent of any special skill in the workmen employed.

The apparatus is particularly remarkable for the principle on which it is constructed, by which the vapours of distillation themselves force on the liquid to be distilled, in a horizontal direction opposite to that of the vapour.

If a gas or vapour rises in a narrow vertical tube, it will raise with itself a certain portion of the liquid, and if the volume of the gas is sufficiently great in proportion to the liquid, and rises with sufficient velocity, the liquid may be raised to a considerable height—greater than it would be by the mere pressure of the gas or vapour, even if this pressure is not perceptibly diminished. This latter circumstance is of especial importance if the apparatus is used for washing or absorbing gas, when loss of pressure is to be avoided.

The apparatus is represented in figs. 1 to 4.

It consists of a boiler, A, divided by the partitions, C, into a certain number of divisions, B₁ to B₁₃. Each division contains a jar-shaped cast-iron

vessel, E, connected with the succeeding division, so that the liquid can flow into the latter by the lateral aperture, while the vapour from the preceding division enters the same vessel, E, through the bent tube, T. The fire is applied at F.

The apparatus, therefore, works as follows:—The level of the liquid being the same throughout the whole apparatus as far as O, the liquid to be distilled is warmed in the vessel R (which will be explained presently). The warmed liquid passes from R, through the pipe M, into the apparatus A—namely, into the division B, and from thence into the vessel E₁; the vapour produced in the division B, also passes through the bent tube, T, into E₁. But this vapour forces a portion of the liquid over the edge of the vessel E₁ into the division B₁, from whence it can pass into E₂. In the same way the vapour from B₁, entering E₂, forces the liquid into B₂, and thence into E₃, and so on till it reaches the division B₁₃, from which the exhausted liquor runs off through the pipe U, while the products of the distillation escape through the tube V.

If it is required to wash or absorb gas, the gas must be admitted into B₁₃, while the purifying or absorbing liquid flows in through B.

The progress of the liquid in the apparatus depends upon the relative diameters of the bent tubes, T, and the vessels, E. The circular space between the bent tube and the edge of the jar, E, must be duly proportioned to the quantities of liquid and of gas which are required to pass.

R is a condenser for the vapours distilled. Passing through the worm, J, they are cooled and condensed by the liquid to be distilled, and which enters cold from the reservoir, K, into a small apparatus, G, whence its admission into R is regulated by a valve, S, which is closed or opened by the float, X. According as the liquid is more or less warmed the float falls or rises, and allows more or less of the liquid to pass, so that the more heat is applied, and the more vapour is produced, the more liquid can flow in through the valve S. This float will also act if the products of the liquid to be distilled are variable.

Q is a small washing apparatus for cleansing incondensable gas before it escapes.

It is to be noted that the float prevents the entrance of any more liquid when the fire is put out, for there is then no product of distillation, the liquid in the condenser remains cold, the float rises and the valve closes, while as the condenser is warmed by distillation the float sinks, and the valve is opened.

The apparatus, as shown in the drawing, is also applicable to the distillation of gas liquor. The product is a concentrated gas liquor of uniform strength, the quantity of ammonia being equal to about 15 per cent. of caustic ammonia. The apparatus employed will distil, in 24 hours, 12, 24, and 48 cubic metres of gas liquor of 2° to 3° Beaumé. A concentrated product is obtained containing 15 per cent. of ammonia. The consumption of fuel varies from 25 to 30 kilogrammes of coal for each cubic metre of raw gas liquor.

With very weak gas liquor, the steam of the portion distilled is utilized to warm the gas liquor as much as possible before entering the apparatus. As gas liquor always contains a variable quantity of solid ammoniacal salts in solution, a special lime apparatus, to be connected with the still, is requisite to recover the ammonia of these salts. In the distillation, carbonic acid and sulphuretted hydrogen first pass off with ammonia, the water in the still then containing only a small quantity of caustic ammonia. When this is distilled, the water is mixed with the requisite quantity of lime in the lime apparatus, and immediately redistilled, without in the slightest degree interfering with its continuous working.

To produce ammonia, sulphate or chloride, it is only necessary to pass the vapour, or the concentrated gas liquor, into sulphuric or hydrochloric acid. The vessel, R, is then made to warm the liquor to be distilled, by conveying the heated residual liquor from the division B₁₃ through the worm.

If the apparatus is used for absorbing gas or vapour, the float must be arranged to work reversely in R, as a larger supply of liquid will be required the more rapidly the gas is absorbed, only care should be taken that the liquid never reaches too high a level.

There is no doubt that Solvay's ingenious apparatus is capable of varied application, and that it forms a real step in advance.

ON THE VOLUMETRIC DETERMINATION OF SULPHUR AND AMMONIA IN ILLUMINATING GAS, WITH A DESCRIPTION OF THE APPARATUS EMPLOYED.*

By H. E. SADLER and B. SILLIMAN, of New Haven, Conn.

The research here recorded was undertaken early in the present year and has been prosecuted steadily for about eight months. While the work has been under my constant supervision and advice, the labour has all been performed by Mr. Sadler, to whom is chiefly due the development of the successive steps which have led to the final result. The process is better than I dared to hope, and we are able to place at the command of chemists and engineers interested in the matter an apparatus of continuous and uninterrupted action, and methods of analysis by which the daily averages of the two variable and inconstant factors of illuminating gas, ammonia and sulphur, may be determined with all needful accuracy, even by those little skilled in chemical manipulation, and with very little loss of time.

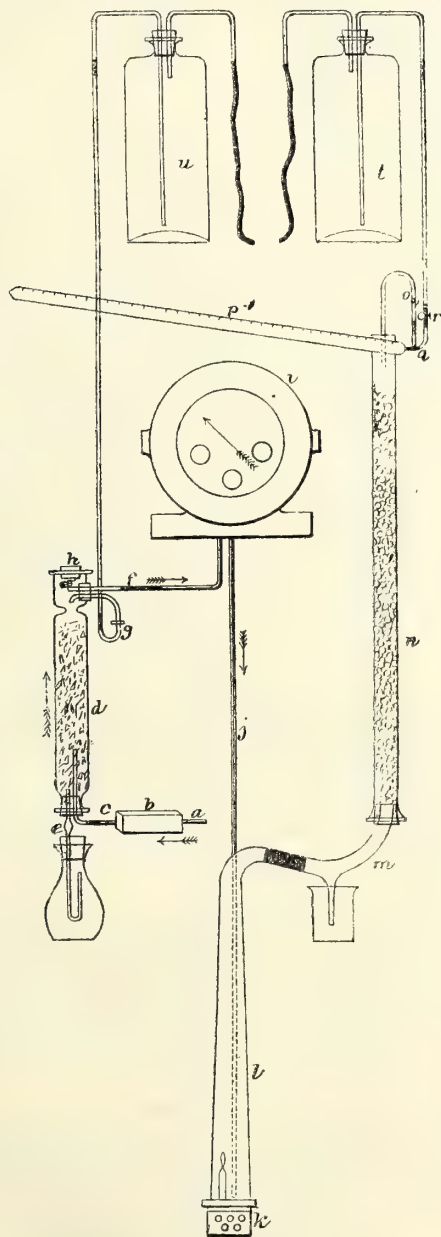
This research has been carried out in the laboratory of the New Haven Gaslight Company.
Oct. 17, 1876.

B. SILLIMAN.

Introduction.

In making some determinations of the sulphur in coal gas by the Letheby apparatus, the importance of some simpler process was forcibly suggested by the experience, skill, expense, and time required to obtain trustworthy results. The chances of error were numerous. Insufficient washing of the apparatus, with the liability of breakage in daily handling, the care required in the concentration and in the expulsion of the ammonia, the varying solubility of barium sulphate in presence of indefinite quantities of ammonium nitrate and free acid, the tendency of that precipitate to run through the filter, the opportunities for loss in the incineration and ignition, the expense of the analytical balance, with the delicacy of manipulation which it requires, and, above all, the time involved—from four to eight hours after the gas is burned—all these seemed to place the Letheby test beyond the possible for the practical gas manager.

To escape these numerous drawbacks, without the sacrifice of accuracy, was the end proposed. The result attained is a simple process for the volumetric estimation of the sulphur, dispensing with the balance, and requiring but ten minutes for a determination. The apparatus at the same time affords the working engineer a continued and ready check upon all his purifying processes except the removal of the tar.



Description of the Apparatus.

The apparatus represented in the accompanying drawing is of glass, except the governor, *b*, the meter, *i*, with its connexions, and the burner, with its case, *k*, which are of metal: *d* performs the office of a scrubber. It is an inverted calcium chloride or bubbling tube, of about 600 cubic centi-

mètres capacity, with a third hole drilled for the admission of the stopper, *h*, which carries a wire to support ammonia, acid, and hydrogen sulphide test papers. The larger cylinder is filled with broken glass, and supplied with standardized acid from the bottle, *u*, by means of the syphon-tube, *g*, which is fitted with a stopcock. The gas is admitted by the tube, *c*, extending 5 centimètres into the cylinder, and the acid escapes into a flask below by the tube *e*, which is bent to form a seal. The meter and burner are substantially those used by the Referees.* The adapter or eductor, *l*, is 50 to 60 centimètres high, the diameter at the base about 7 centimètres, and the smallest internal diameter at least 1½ centimètres: *m* has a diameter of 2 centimètres, with an opening drawn out at the bottom for the escape of the drip from *n*: *n* is a strong tube 3½ centimètres in diameter by 80 centimètres long, filled with glass marbles 1½ centimètre in diameter. This tube serves as a condenser, and also to break up the ascending current from the burner, and bring it into intimate contact with a standard alkali, dripping upon the marbles through the tube and stopcock, *o*, from the pipette, *p*. This measures 200 cubic centimètres by halves, and is 60 centimètres long. At the beginning of an experiment it is filled by the three-way pipe, *q*, from the bottle, *t*, by opening the pinch-cock, *r*.

The apparatus is most conveniently mounted against the wall; the meter and bottles standing upon shelves, and the burner and beakers upon swinging brackets. The remaining parts are then secured by clamps driven or screwed into the wall.

Mode of Manipulation.

Solutions of caustic soda or potash and an acid, sulphuric or oxalic, are provided of such strength that one cubic centimètre has a saturating power exactly equal to 1-10th of a grain of sulphur in the form of sulphurous or sulphuric acid.† The containing-bottles and the pipette being filled, the gas is lighted and regulated by the governor, as near as may be to the rate of 10 feet in 24 hours. The stopcocks in *o* and *g* are then opened, so that 10 cubic centimètres will pass each for one foot of gas burned.‡ After half an hour or an hour, when the apparatus has attained its normal working, a clean flask is placed under each drip, while the meter and the quantity of alkali solution in the pipette are accurately noted.

When, thereafter, 10 feet have passed the meter, which will be in about 24 hours, the quantity of alkali which has flowed from the pipette is determined, and the flasks are removed, others being substituted if a test is desired for the following day.

The free and carbonated alkali present in the drip is then to be saturated with the standard acid; but since with litmus, and even with cochineal,§ the carbon dioxide obscures the point of neutralization, it is best to add a quantity of acid equal to the total alkali used, and after removing the carbon dioxide by boiling the liquid for a brief interval, to titrate back with the standard alkali. The number of cubic centimètres so used expresses the number of grains of sulphur in 100 feet of gas. For the alkali received in the drip being just saturated by the standard acid, the free acid there will be the quantity caught from the gas. Now, since one cubic centimètre of the alkali finally added is saturated by 1-10th of a grain of sulphur, 1-10th of the cubic centimètres added indicates the number of grains caught from the 10 feet burned, and ten times this, the quantity of sulphur in 100 feet.

The acid solution used in the scrubber is also measured, and the acid remaining free determined by the standard alkali. The difference expresses, as in the case of the sulphur test, the number of grains of sulphur which can be neutralized by the ammonia in 100 feet of gas. Since one grain of sulphur neutralizes 1 1-16th grain of ammonia, if the number of cubic centimètres of acid neutralized by the ammonia be increased by 1-16th, the sum will express the grains of ammonia in 100 feet. This may be accomplished mechanically by having the ammonia measuring-glasses graduated so that 17 divisions shall be equal to 16 cubic centimètres.

The conditions indicated are the most convenient for continuous daily determinations. They are not essential to successful working. On the contrary, 2 feet of gas are sufficient to give reasonably accurate results, and the apparatus has not proved unequal to a rate of one foot per hour. Moreover, much less acid run through the scrubber would be usually sufficient. The quantity of ammonia to be arrested during the period of these experiments was abnormally large, pending a rearrangement of the scrubbers at the works.

Efficiency of the Apparatus.

The following results were obtained from an apparatus which differed from that figured only in that the eductor, *l*, and the condensing-tube, *n*, were each one-third shorter than described. It was worked first in comparison with the Letheby test, taking the gas from the same supply-pipe, and burning it during the same interval, at nearly the same rate—about two-thirds of a foot per hour. From 2 to 4 feet, according to convenience, were taken for each experiment. || The Letheby was supplied with about 100 cubic centimètres concentrated liquor ammonia. However, this rule was not invariable, and, with three or four of the experiments, which cannot now be specified, a weaker solution was used. No result, however, is reported, or was worked out, in which at the end of the burning an exposure of three seconds at the escape failed to turn turmeric paper deep brown. The condensations and washings were evaporated in the water-bath to about one-half, acidified with bromine, heated to expel any great excess, precipitated while boiling with barium chloride, allowed to settle, the supernatant liquid, and finally the powder, decanted on to a filter, washed with hot water so long as the washings showed the presence of

* First Report of the Gas Referees upon the Sulphur Question, July 13, 1870. Reported in the LONDON JOURNAL OF GAS LIGHTING, &c., Aug. 16, 1870.

† The standard solutions can be purchased of chemical dealers, and no balance will then be needed. They may conveniently be made of ten times the strength indicated, and portions withdrawn and diluted to this strength as required.

‡ Great difficulty was experienced in securing an uninterrupted and uniform flow of the solutions. The purest distilled water seemed to carry down impurities sufficient to choke the capillary opening of the stopcocks, which at the proper rate pass but four drops per minute. Filters of Swedish paper, of cotton batting, of fine linen cloth, and of sand, were tried in vain. The simple device of passing the solution through the stopcocks in ascending instead of descending currents, which placed the force of gravity in opposition to, instead of in accord with, the slow suction of the streams, afforded instant and complete relief.

§ Hamatoxylin was first chosen as an indicator, both because it is the most sensitive to minute quantities of free acid and alkali, and because the change of colour, yellow to port wine, is the most conspicuous. But in this solution the reaction was very unsatisfactory. The colour changed gradually from yellow to reddish-brown. The absence of metallic salts, at least of the heavy metals, was well demonstrated, and there seemed no explanation of the phenomenon, except that the colouring matter was oxidized by the nitrous acid present and rapidly destroyed. Cochineal was therefore substituted, and proved very satisfactory.

|| It may be remarked that in the Letheby test, as described in Sugg's "Gas Manipulation," the gas is burned in an atmosphere strongly ammoniacal. The products of combustion are carried into a large glass cylinder, where the resulting ammonium sulphite and sulphate fall with the condensing vapour of water, passing into solution. The sulphur is then converted into the form of barium sulphate, and weighed. In the apparatus used, a second condensing cylinder was added, and a trial with a further addition of ten feet of tubing, as a condenser, showed that less than one-half of 1 per cent. of the liquid escaped.

* A paper read before the American Institute of Mining Engineers at the Philadelphia Meeting, Oct., 1876.

barium, dried, ignited, and weighed, the filtrate being always tested for sulphuric acid.

The other apparatus was supplied with from 9 to 12 cubic centimètres of the standard soda solution for each foot burned. The gas was taken direct from the governor to the meter, without the interposition of the ammonia test, and the drip having been slightly acidified with hydrochloric acid, and further with bromium water, was boiled, and the contained sulphates precipitated hot with barium chloride, and treated thereafter as in the Letheby determinations.

The following table gives the results:—

TABLE A.				
Date	Sulphur Caught. Grs. per 100 Ft.	Sulphur Caught by Letheby. Grs. per 100 Ft.	Excess over Letheby. Grs. per 100 Ft.	
May 15	18.64	12.44	6.20	
" 16	19.62	13.70	5.92	
" 17	18.54	14.01	4.53	
" 22	19.33	12.88	6.95	
" 23	18.15	12.11	6.04	
" 24	17.64	11.64	6.00	
" 25	16.58	13.04	3.54	
" 26	14.25	10.21	4.04	
" 27	18.43	10.47	8.43	
Total	161.65	110.00	51.65	
Average gain over Letheby			46.95 per cent.	

The only means at hand for comparing the new apparatus with the Referees is through the Letheby. In their description of their test, before referred to, a table is given in which the following determinations only are strictly comparative:—

TABLE B.			
Referees. Grs. of Sulphur per 100 Ft.	Letheby. Grs. of Sulphur per 100 Ft.	Excess. Grs. of Sulphur per 100 Ft.	
33.4	25.1	8.3	
35.5	24.4	11.10	
32.6	22.2	10.4	
31.8	23.8	8.00	
29.2	23.9	5.3	
29.6	24.9	4.7	
31.17	24.9	6.27	
31.4	25.4	6.0	
32.27	25.8	7.47	
32.8	25.24	6.56	
31.6	24.32	6.28	
32.96	23.96	9.0	
34.41	23.35	11.06	
35.0	21.86	13.14	
34.73	24.92	9.81	
34.98	25.82	9.16	
34.8	25.24	8.56	
35.5	25.4	10.1	
36.26	25.12	11.14	
27.4	18.4	9.0	
28.0	19.2	8.8	
27.7	23.3	4.4	
26.6	20.6	6.0	
28.03	20.4	7.63	
379.85	577.53	197.68	
Average gain over Letheby		34.2 per cent.	

And in the place cited, Dr. Odling reports the following comparative workings:—

TABLE C.			
Referees. Grs. of Sulphur per 100 Ft.	Letheby. Grs. of Sulphur per 100 Ft.	Excess. Grs. of Sulphur per 100 Ft.	
26.41	21.04	5.37	
25.60	19.32	6.28	
21.33	19.76	1.57	
21.04	17.48	3.56	
94.38	77.60	16.78	
Average gain over Letheby		21.6 per cent.	

A comparison of these workings seems to indicate that in efficiency this apparatus does not differ materially from that of the Referees; for while the per centage of gain over Letheby's is considerably larger, it will be noticed that the quantity of sulphur to be caught was less, and the actual number of grains caught in excess of the Letheby is in favour of the Referees test. Perhaps no apparatus arrests absolutely all of the sulphur, and the real usefulness of sulphur tests consists in indicating the relative amounts of sulphur in the gas from day to day. A consideration of these tables forces upon one a conviction of the entire worthlessness of the Letheby test for even this purpose, a defect which the experience and carefulness of Dr. Odling himself has not overcome. A third sulphur test is that of Mr. F. J. Evans, who drew the products of combustion through an alkaline solution contained in Woolfe bottles. It is to be regretted, in this connexion, that no figures could be obtained showing the result of his workings and affording a comparison of the new test with his, and that no opportunity has been offered to compare its simplicity or accuracy with the test devised by Mr. Vernon Harcourt, and described at the last meeting of the British Association of Gas Managers.

Volumetric Estimation of the Sulphur.

Having so far demonstrated the efficacy of the new apparatus, the Letheby test was discarded, and the determinations of the sulphur hereafter given were made by precipitating the sulphur in the drip from the new apparatus by barium chloride, in the manner already described. The apparatus was not changed, except to introduce the tube *d*, to arrest the ammonia which, previously passing through the flame in undetermined quantities, had vitiated the volumetric estimations of the sulphur acids by standard alkali solution. The alkali used was caustic soda. For the scrubber, standard sulphuric acid was chosen on account of its slight volatility, and in order that the absorption of acid vapours by the gas, then deemed possible, might not complicate the results by introducing a new acid into the products. To saturate the alkali in the drip, standard hydrochloric acid was chosen, as it permitted a gravimetric estimation of the sulphur in the portion taken after it was titrated, avoiding alternate sources of error, either the estimation of the total sulphur introduced with the sulphuric acid, or obtaining two separate portions of the drip, having in solution exactly equal quantities of acid and of sulphur. Moreover, though free hydrochloric acid is somewhat volatile in boiling solution, experiment demonstrated that, with the degree of dilution and heat employed in these determinations, the loss was unappreciable. A 100 cubic

centimètre pipette, and a burette measuring 100 cubic centimètres by tenths, were used for supersaturating the alkali with acid, and a 25 cubic centimètre burette graduated to tenths for titrating back with the soda. For each determination a portion of the drip resulting from the combustion of from 6 to 10 feet of gas was taken, divided into two measurably equal portions, and duplicate experiments carried through, as shown in the following table, the results being calculated to grains in the hundred feet:—

TABLE D.

I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.		
No.	Date.	* Acid caught per 100 Feet, ex- pressed in Grains, Sulphur.	Grains of Sulphur caught per 100 Feet.	Ex- cess of Acid.	Ex- cess of Sul- phur.	Excess of Acid Cor- rected.	Soda, Cubic Centimètres. per Foot of Gas burned.	Rate. Feet Burned, 100 Min.		
	Aug.									
1	22-3	{ 38.55 38.65	38.60	39.34	3.31	0.74	-0.74	7.90	1.064	
2	23	{ 46.91 46.58	46.74	{ 41.33 41.42	41.37	5.37*	..	(-0.10)	9.75	1.026
3	23-4	{ 35.99 35.93	35.96	{ 35.28 34.76	35.02	0.94	..	+0.94	12.28	1.023
4	24	{ 30.55 31.25	30.90	{ 33.95 32.46	33.20	..	2.30	-1.21	13.67	1.056
5	24-5	{ 35.28 36.01	35.64	{ 34.48 32.60	33.54	2.10	..	+0.60	10.65	1.041
6	25	{ 36.61 35.95	36.28	{ 34.55 34.23	34.59	1.89	..	+1.89	12.80	1.026
7	28	{ 34.20 34.29	34.20	{ 35.50 35.37	35.43	..	1.23	-1.23	9.44	1.035
8	29	{ 38.98 38.98	38.98	{ 39.53 39.62	39.58	..	0.60	-0.60	11.70	0.986
9	30	{ 36.01 35.68	35.84	{ 35.80 35.22	35.51	0.33	..	+0.33	13.33	0.984
10	30-1	{ 33.27 32.91	33.09	{ 32.25 31.96	32.11	0.98	..	+0.98	9.90	10.22
	Sept.									
11	31-1	{ 33.63 33.79	33.71	{ 34.38 33.86	34.12	..	0.41	-0.41	10.87	0.987
12	1-2	{ 35.84 35.54	35.69	{ 33.91 33.74	33.82	1.87	..	+1.87	9.95	0.988
13	2-3	{ 34.87 35.00	34.93	{ 33.06 33.06	33.06	1.87	..	+1.87	10.99	0.966
14	3-4	{ 31.92 32.58	32.25	{ 31.40 31.44	31.42	0.83	..	+0.83	10.79	0.944
15	4-5	{ 31.90 32.07	31.98	{ 30.09 30.30	30.20	1.78	..	+1.78	10.20	0.957
16	5-6	{ 26.03 26.51	26.27	{ 26.46 26.91	26.68	..	0.41	-0.41	9.65	0.940
17	6-7	{ 24.81 24.81	24.81	{ 24.36 24.33	24.35	0.46	..	+0.46	10.47	0.943
18	7-8	{ 22.36 22.36	22.36	{ 20.12 20.27	20.20	2.16	..	+2.16	13.19	0.897
19	8-9	{ 18.43 18.44	18.43	{ 18.92 18.93	18.92	..	0.49	-0.49	10.75	0.960
Average errors				1.29	0.75	..	..	..
Average total error				0.27	..	..	..	..

* An error of 2 c.cms., in determining the quantity of alkali used, would have made this result -0.10. An exactly similar error in experiment No. 15 was discovered in time to be corrected. At all events, this result is so abnormal that it seems proper to disregard it. It will be noticed that, throughout, the duplicate experiments accord fairly with each other. In two instances, however, they differ by more than 1 grain per 100 feet—viz., in experiments Nos. 4 and 5. It is probable, since they cannot both be nearly right, that one is entirely wrong, and therefore, in computing column VII., only that result is taken which is most in accord with the other experiments.

It will be seen by comparing columns III. and IV. that the acid caught indicates the quantity of sulphur in the gas with tolerable accuracy, sufficient for all manufacturing purposes. Columns V. and VI. give the excess of acid and sulphur in terms of grains of sulphur to the hundred feet. The average error in favour of the acid is 1.29 grain, and in favour of the sulphur, 0.75 grain, making the average total error 0.27 grain in favour of the acid. Assuming this as a constant quantity, which, being deducted from the acidity found, gives the sulphur, we have as a limit of error in favour of the sulphur (No. 4) 2.03 grains, in favour of the acid (No. 18) 1.89 grain. We may say, then, that one grain to the hundred feet is the average error, and two grains the limit of error for the volumetric determination of the sulphur in gas by this apparatus.

(To be continued.)

SWINDON NEW GAS COMPANY, LIMITED.—The half-yearly meeting of shareholders was held on the 24th ult. The revenue account showed that the receipts had been £1225, and the expenses £978, leaving a profit of £247, out of which a dividend at the rate of 9 per cent. was declared. The company was started about 14 years ago, with a capital of £2500, but the marvellous growth of New Swindon has required many extensions of plant, so that the amount of capital issued to the present time is £5575. A new gasholder, 60 feet by 40 feet, has just been completed, and the prospects of the company are very encouraging. A reduction of 5d. per 1000 was made in the price of gas last June.

PROPOSED PURCHASE OF THE ILKESTON GAS-WORKS.—At a meeting of the Ilkeston Local Board, on March 8, the clerk read a letter from Mr. B. Wilson, secretary to the directors of the Ilkeston Gas Company, stating that a meeting of shareholders had been held to consider the offer of the board to give £12 per share for each registered share for the company's plant, &c., and that they declined to sell their works at the price named. It was stated that at the shareholders meeting it was proposed and seconded that the plant, &c., of the company be sold to the board at £12 per share, that price being considerably more than the original cost of the shares. On being put to the vote there were 31 votes in favour of the sale and 99 against it.

DERBY WATER-WORKS COMPANY.—The half-yearly meeting was held on the 27th ult.—Mr. Gascoyne in the chair. The report of the directors stated that the gross receipts from revenue amounted to £6171 11s. 2d., being £440 more than in the corresponding half year of 1875. The revenue expenditure amounted to £3417 13s. 4d., being £599 18s. 8d. more than that of the corresponding half year. The net profit realized was £2753 17s. 10d. available for dividend. The directors recommended the usual dividends of 10 and 7 per cent. respectively, amounting to £4739 8s. 1d., as against £3767 11s. 3d. in the corresponding half year, leaving a deficiency of £1985 10s. 3d., which would be supplied from the contingent and suspense funds. These funds, after supplying this deficiency, would still amount to £4956 19s. 2d. The cause of the deficiency arose partly from the increased dividends on further capital expended in the past year, the extra cost of coals, wages, and repairs to works and buildings. The engines, boilers, and the whole of the property generally were in good working order and condition, and quite satisfactory to the company's engineers.

GAS AFFAIRS IN AMERICA.

REPORT OF THE GAS COMMISSIONERS IN RELATION TO THE SUPPLY OF GAS TO THE CITY OF BOSTON.

(Continued from p. 386.)

Now, to compare results under the same method of getting at the supposed cost of the product of the Boston Gas Company:—

10 per cent. dividends on capital, 2,500,000 dols.	Dols. 250,000
6 per cent. interest on bonds, 500,000 dols.	30,000
Taxes on 4,426,000 dols. say	66,400
With delivery of 631 million cubic feet	346,400
Gives for each 1000 cubic feet, say	0 55
Average price of gas for 1875	2 50
Less for street lights and discounts	0 10
	2 40

Per 1000 cubic feet 1 85

And we find the supposed cost exceeding that of the New York Mutual by 34 cents per 1000 cubic feet.

This difference of cost of manufacture would seem too large to be passed over, without explanation by the Boston Gas Company, and we find the same upon comparing the four items of cost of coal, labour, distribution, and receipts for residuals, all of which items are in favour of the New York Mutual Company.

The Boston Gaslight Company do not, and probably cannot, for the reasons stated above, so long as they use coal alone, make gas as cheaply as the New York Mutual Company; but with an increase of 1000 cubic feet in the yield of coal per ton, which they have shown themselves capable of making—so that instead of 9572 cubic feet in 1875, about 10,500 were obtained in three months of 1876—a diminution in the cost amounting to about 8 cents per 1000 cubic feet is gained. With this increase in the yield, the illuminating power has been about 17½ candles. This diminution in the cost of the gas, arising from the increased yield, would naturally be accompanied by a corresponding diminution in the labour, and wear and tear of works and apparatus; so that we are firmly of the opinion that, with due consideration of the cost of the plant, and with proper economy in the manufacture of gas, even with the prices of coal for 1875, a superior article of gas can be made and delivered in Boston, if the prices were uniform and no discounts allowed, for between 1.50 dol. and 1.60 dol. per 1000 cubic feet, and with an additional 50 cents per 1000 cubic feet to cover the cost of taxes and interest on bonds, together with 10 per cent. on the capital, the citizens in that part of Boston now supplied by the Boston Gaslight Company should be in receipt of gas of 17 or 18-candle power for 2.00 dols. or 2.10 dols. per 1000 cubic feet, and we have heard it asserted by the manager of a large gas-works, that the price of gas must soon find its level at 2.00 dols. in our large cities, for gas of 16-candle power.

And in proof of the capability of improvement in the manufacture of gas in Boston, we may say that in 1876 the figures of the Boston Gas Company show a diminution in the cost of labour of several cents per 1000 cubic feet, and an increase of about 1000 cubic feet per retort in the 24 hours, as well as 1000 cubic feet more per ton of coal.

The Gaslight and Coke Company (Chartered) of London, distributing about 6½ times the quantity of gas that the Boston Company does, gives the total cost of manufacturing, including every charge, except the cost of coal, at 39.1 cents per 1000 cubic feet, and the total cost of the gas, less residuals, at 88 cents per 1000 cubic feet, or to add to that their receipts for the ammoniacal liquor, not utilized here (5.7 cents), we have 93.7 cents as the total cost. In regard to the London companies, it must be remembered that labour is much cheaper, and that a greater price is obtained for residuals than is possible in this country at present. The price of coal, however, was not very different in 1874, being about five cents less per 1000 cubic feet of gas sold.

After a careful inspection of the New York Mutual works, and the process of manufacturing gas there used, it was thought advisable to compare the same with the works of a similar character in other cities; and for this purpose we obtained letters to the President of the Chicago Mutual Company, who received us courteously, gave us all information asked for, and allowed us to examine the process of manufacture at our leisure. Here we found that, under an Act of Legislature, the price of gas was fixed at 3.00 dols. per 1000 cubic feet, and as the city was districted between the People's and the Gaslight and Coke Company at this price, there was no competition, and consequently no such incentive to make a superior quality of gas as exists in the City of New York. Atmospheric air was made to form a large ingredient in the commercial gas delivered to the consumer, who had no alternative but to take such as he could get. The delivery of the Chicago People's Company is about 300 million cubic feet per year, through about 160 miles of pipe on the western side of the river. Coal cost about 6.00 dols. per ton, and yielded about 10,000 cubic feet per ton. This was enriched by 33 per cent. of naphtha gas, which was itself diluted by 40 per cent. of atmospheric air, thus forming a commercial gas of 66½ per cent. of coal gas, 20 per cent. of pure naphtha gas, and 13½ per cent. of air.

This district was supplied with gas of a fair quality, the illuminating power being from 17 to 18 candle power, and the specific gravity being 0.498. The amount of ammonia was quite large, being over 14 grains in 100 cubic feet. The naphtha, stored in iron tanks underground, was fed therefrom to the stills, which were iron drums about 6 feet by 8 feet, with steam coils passing through them, so as to vaporize the naphtha. This vapour was carried through a 2-inch iron pipe, as in the New York Mutual works, to the red-hot retorts, where it was decomposed to a fixed gas, and thence passed to the exhauster and mixed with the purified coal gas. The two gases were not measured separately before being mixed. In the corner of one of the rooms at the works a jet was kept burning, and, by the colour and appearance of the flame, one of the workmen judged of the amount of air necessary to add to the naphtha gas, in order to keep the mercantile gas uniform in quality. The coal gas was made in the usual manner, washed and purified with dry lime, and mixed with the diluted naphtha gas before going to the holder for distribution. The scientific accuracy which was noticeable at the New York Mutual works was not manifest here. The gas burned well, but was not remarkable for its purity, which, however, may be explained by the fact that a new purifying-house was in process of erection, the old one having been found insufficient to meet the demand of so large an amount of gas.

The practice of charging the naphtha gas so heavily with air, as has been already mentioned, does not recommend itself to our judgment, as of any further benefit than to increase the quantity at the expense of the quality of the gas.

Here, as at other works using naphtha, we found a very material advantage over the coal gas companies in the item of labour, since, while the coal requires much handling, the former feeds itself to the retort, which is kept closed, and requires but little other attention than to feed the

furnace fires. The two benches of naphtha retorts here in use were said to furnish as much gas as 20 coal retorts. Naphtha was somewhat cheaper than in New York, costing only 4½ cents per gallon. The leakage ranged from 7 to 9 per cent.

On the other side of the river, the district is controlled by the Chicago Gaslight and Coke Company, which distributes about 400 million cubic feet of gas through about 100 miles of pipe main. This company claims to make about 10,000 cubic feet of 17-candle gas from a ton of Westmoreland coal without any enricher, by the use of the McIlhenny dip seal. The same result has been claimed by the Charlestown (Mass.) Gas Company; but we have not found the process extensively used, or generally in favour with gas companies. This company, from the frequent laying of sewers and raising the grade of the streets, suffers a leakage of about 25 per cent., and yet continues to pay a dividend of 10 per cent., and has built new works from its surplus earnings. The illuminating power of the Chicago gas averages about 17 candles, but was a little richer than this at the time of our tests. The specific gravity of the gas was 0.455, and there was but a small amount of ammonia and sulphur. The Chicago Gaslight Company have a capital of 2,300,000 dols., and have 1,200,000 dols. bonds out. This company use no naphtha or petroleum.

At Detroit we found both companies using naphtha; the Detroit Mutual Company using it by the Gale and Rand process. We examined the works of this company, which are well located, and rank well in character with other works visited. They cost, including 45 miles of mains, about 700,000 dols. Here we found quite a radical change in the method of manufacturing gas. While in New York and Chicago, 33 per cent. of mixed naphtha gas and air was considered to be as large a per centage as could be used to advantage, we saw here a single bench of retorts only used for making coal gas, and another bench for naphtha gas. To the latter, the naphtha vapour was conducted from steam drums, as at Chicago, and from these two benches it was stated that about 60 million cubic feet of gas were supplied annually. The naphtha, costing 3½ cents per gallon, produced about 140 cubic feet of mixed naphtha gas and air (half and half) per gallon; and this mixture constituted, at the time of our visit, about two-thirds of the total bulk of the mercantile gas, one-third only being produced from the coal bench; and it was stated that this could be dispensed with, were it not that the coke from the coal retorts was necessary for heating the naphtha retorts, which require a steady heat, which cannot so well be obtained from coal as fuel. The air is charged in studied proportions into the naphtha gas, so as to keep the commercial gas at about 20 candles. The mixed naphtha gas and air, and the coal gas are measured separately before being mixed. The coal used was small coal, costing about 3.50 dols. per ton, and the purifier used was the iron mixture, which consisted of the sulphate of iron, sawdust, and lime. The specific gravity of the gas was about 0.800, so that a very high pressure was required at the works, in order to have the requisite pressure at the burner.

We afterwards visited the works of the Detroit Gaslight Company, in company with the secretary. Up to within a week they had been supplying coal gas alone, but at this time were, for the purpose of competing successfully with the Mutual Company, making, in addition to their coal gas, a certain amount of "wood gas," which was enriched with naphtha gas. They estimated the yield from the wood to be 30,000 cubic feet per cord, which cost 3.50 dols., or about 40,000 cubic feet from a cord of wood and two barrels of naphtha. This mixture was, without being purified, mixed with the coal gas. This company has about 60 miles of pipe, and supplies about 125 million cubic feet annually to about 1500 consumers, charging 2.75 dols., and 3.00 dols. per 1000 cubic feet to those consumers outside of the district occupied by the pipes of the Mutual Company.

Inasmuch as the competition between these rival companies has now continued for three years without any prospect of adjustment, we may well suppose that, with the low rates of 0.50 dol. and 1.00 dol. per 1000 cubic feet, there is no incentive to make a superior gas; so that about all that we can say in praise of the unpurified wood gas enriched with naphtha, is to repeat the words of some of the officers of the company, who stated that it was "very good fighting gas."

We found naphtha in use as an enricher for coal gas in but one other large works—viz., at Lowell, Mass. This we were somewhat surprised to find after the prolonged hearing before the Lowell Board of Aldermen, and the persistent opposition to the establishment of a naphtha gas-works in the city. This opposition would, however, probably have been as persistent against the establishment of any competing company. Here we found new works of a superior character, with all preparations for the continued use of naphtha as an enricher of the coal gas. The naphtha gas, after being measured, was passed to the hydraulic main of the coal gas, with which it was washed and purified. This probably removed a portion of the rich hydrocarbons, and detracted somewhat from the value of the naphtha as an enricher. Notwithstanding this, the officers consider that the use of the naphtha had resulted in a considerable saving to the company; and they have been able, with a distribution of only about 71 million cubic feet (without the naphtha, from July 1, 1874, to June 30, 1875), and a price of 2.50 dols. (the same price as in Boston) per 1000 cubic feet, to pay to the stockholders a clear dividend of 10 per cent. on the capital. The price was reduced to 2.25 dols. on Jan. 1, 1875, three months before the same reduction was made by the Boston Company. At the same time, the district supplied is not so compact a one as that supplied by the Boston Company, since only 1,747,043 cubic feet are sold per mile of pipe, against 5,633,925 cubic feet in Boston; and, again, the transportation of coal by rail from tide water adds 1.00 dol. per ton to its cost. As an off-set to these disadvantages, there is no discount allowed to any consumer, and a somewhat higher price is obtained for residuals; so that the total cost of manufacture per 1000 cubic feet of gas sold was a little less than at the Boston works in 1875.

We found in the works of the Citizens Gaslight Company, of Brooklyn, N. Y., that crude petroleum was used in the same way that canal coal is used in coal gas-works—i.e., mixed mechanically with the coal before the latter is thrown into the retort, by which means it was considered that about 10 per cent. on the cost of the gas was saved, 12,000 cubic feet being obtained from a ton of coal mixed with about 2½ per cent. of petroleum. This statement, however, was not verified by an examination of the books.

In the previous year (1874) this company manufactured water gas by the Gwynne-Harris process, and mixed this with their coal gas. It is probable, however, that by this method a large amount of carbonic anhydride was made, since the specific gravity of the resulting gas was between 0.700 and 0.800. On this account the consumers used a smaller quantity, and their bills were much less; and for this reason, it was said, the directors of the company ordered a cessation of the process, and a return to coal gas, the result of which has been, according to the president, that 50,000 dols. worth more gas has been sold than during the corresponding period of 1874, when the water gas process was in use, but the net profit has been 8000 dols. less.

About the same method had been used by the People's Gaslight Company of Brooklyn, N. Y., and was discontinued for the same reason by the directors, some of whom were also directors of the Citizens Company.

We need say but little of the various works visited, in which pure coal gas was manufactured, except that at none of them did we find gas of so good a quality manufactured as at the Boston Gas-Works. The Manhattan Company's gas, of New York, has about the same quality as the Boston gas, and at the time their gas was tested by us, it was fully equal to the Boston gas. It averages, however, about 17 candles, while the Boston gas averages about one candle higher. At the same time it must be remembered that the price of gas is 25 cents per 1000 cubic feet higher than in Boston. The gas of the Metropolitan New York Gaslight Companies of New York City averages from 16 to 16½ candles, and the Philadelphia gas about 16½ candles, although at the time of our visit to Philadelphia it happened to be 18½, a result which was obtained not only by us, but by another observer, not connected with the company, in a different part of the city. The gas of the Chicago Gaslight and Coke Company has an illuminating power of about 17 candles. Of the companies in the vicinity of Boston, the gas in Roxburg and South Boston had a candle power of about 17½, that in Charlestown and Dorchester about 17, that in Cambridge only 14½, and in East Boston only 14½ candles. The illuminating power of the gas in the last two places was lower than any other tested; but in regard to the East Boston gas, it is but justice to say that all of the tests were made during a single week. In Cambridge, however, the gas was tested at various times and in different seasons, both alone and in connexion with another expert. At no time should the illuminating power be allowed to fall below about 16 candles, although our law allows it to fall as low as 12 candles. The illuminating power is always within the control of the officers at the works, and can be kept always within the proper limits.

The amount of ammonia was found at the time of our visits to be very large in the Philadelphia gas (52 grains per 100 cubic feet), in the South Boston gas (40 grains), in the Metropolitan, N.Y., gas (25 grains), in Roxburg (19·5 grains), in East Boston (15 grains), and in the Chicago People's (14 grains). In the gas of the other companies there was only a moderate amount; but no gas except the New York Mutual could be said to be free from it. The amount of sulphur was in no case excessive. The illuminating power of the London gas is not allowed to fall below 16 candles, the amount of ammonia is restricted to 2½ grains, and the amount of sulphur to 20 grains in 100 cubic feet, and this sulphur must not be in the form of sulphuretted hydrogen, which can be easily removed by purification. The Massachusetts law does not allow the gas to fall below 12 candles; but this standard is much too low, and should be raised to 16, as is London.

All of the principal works in which water gas is manufactured have also been visited, and all found to yield a gas of good quality. The Harkness process is being used at New London, Connecticut. The essential features of this process are, that anthracite coal is heated to a high temperature in an upright furnace called a generator, and steam is introduced into the top above the coal. This, on passing through the coal, is decomposed, and hydrogen and carbonic oxide, with some carbonic anhydride, are formed. These gases are passed through a hydraulic main and lime-purifier to a small holder. From the holder the carbonic oxide and hydrogen are passed at the rate of 20 cubic feet per minute to one branch of a compound retort, in which they are heated; then to a second branch, where they meet with petroleum gas, the petroleum being introduced into this branch, volatilized and converted into a fixed gas; and finally the mixed petroleum and water gases are passed through the third branch of this retort to a condenser, thence to the meter and holder. The steam is passed through each generator for 20 minutes. The generator is then opened, and 20 minutes more allowed for the coal to rekindle. It is claimed for this process that two generators will give 24,000 cubic feet per day, with the use of 2640 pounds of coal, or 110 pounds of coal will yield 1000 cubic feet of gas. To enrich this 1000 cubic feet there are required about 3¼ gallons of petroleum. Hence the cost of the carbonizing material is—

110 pounds coal, at 7·00 dols. per ton	0·34 dols.
3¼ gallons petroleum, at 12½ cents	0·41 „

Gives for about 1200 feet. 0·75 dols.

To this must be added the cost of labour, purifying material, and fuel for the petroleum retort, since that requires an additional fire. The boiler is heated with the waste coal from the generators. As to labour, two men in each watch can take care of six generators, which gives 18,000 cubic feet per day per stoker, which is about the same as in a coal gas-works. The result is not so favourable as this in New London, since there is a demand for only about 15,000 cubic feet per day; and at the present time (Oct. 1, 1876), the process has been discontinued, on account of the present high price of petroleum, and the gas is made entirely from coal.

The Lowe process was in use in Utica, New York, until the works were burned, and is now used at Manayunk, it having been started in the latter place, Aug. 5, 1876. Up to Sept. 21, about 5 million cubic feet of gas had been made, or about 175,000 daily. The peculiar features of this process are that steam is forced up through white-hot anthracite coal, in an upright generator, into the top of which crude petroleum is introduced. The steam is decomposed in passing through the coal, and the petroleum is vaporized and partially decomposed. These mixed gases are then passed through what is called a superheater, or fixer, a chamber similar in appearance to the generator, but filled with fire-brick, which is kept white hot by the heated products of combustion from the generator. Here all of the petroleum is converted into a fixed gas. From the superheater the gases are passed, through a condenser and purifier, to the meter and holder. In this process the runs are 30 minutes, and then an interval of 30 minutes allowed for rekindling the coal, and reheating the fire-brick in the superheater. One evident advantage of this process over the Harkness is, that but one fire is used for decomposing both the steam and petroleum. It is claimed that, with a daily consumption of 200,000 cubic feet per day, each 1000 feet could be made from 50 pounds of coal, and 3 gallons of petroleum, which would cost, with coal at 7 dollars per ton, and petroleum at 12½ cents per gallon, 53 cents. At Manayunk, petroleum has averaged 10 cents per gallon during August and September, 1876. Two men in each watch can manage six sets of apparatus and the boiler, and one man per day is all of the labour required in the purifying-house. Thus five men are all of the labour required to make 750,000 cubic feet per day (the capacity of each set being about 125,000 cubic feet), but on a basis of 200,000 cubic feet, the labour would cost about 10 dols., or 5 cents per 1000 cubic feet. The amount of gas which can be made per stoker is more than 175,000 cubic feet.

The other principal water-gas process is the Gwynne-Harris process, which is in use at Poughkeepsie, N. Y. In this process the anthracite coal is introduced into an ordinary clay retort, which is provided with a false perforated bottom, through which the steam is introduced. The steam is previously superheated by being passed through clay chambers, set in the hottest parts of the bench. In the other retorts of the same bench, common coal gas, cannel coal gas, or petroleum or naphtha gas can be made. At Poughkeepsie, naphtha, costing 8 cents per gallon, is used at the present time. The gases resulting from the decomposition of the steam are passed into the naphtha retort (or bituminous coal retort), and the mixed gases passed through a lime purifier, to remove the carbonic anhydride, and other impurities, and thence through the station-meter to the holder.

This process was subjected to a careful and scientific investigation, during five months in 1869, by Professors Silliman and Würtz, at New Haven, Conn. These gentlemen concluded their report as follows:—

The evidence set forth in this report sustains the following important conclusions, viz.:—

1. The production of illuminating gas by the Gwynne-Harris hydrocarbon process, on a large scale, and from materials in common use, is a result already well established.
2. The apparatus employed for this process is simple, inexpensive, permanent, little liable to derangement, and easily adapted, at a moderate expense, to all existing gas-works.
3. The average yield of gas obtained by this process from ordinary caking coals, with the addition of small per centages (5 to 15) of enriching coal, is 6½ cubic feet per pound, with an average illuminating power of 18 candles, and for a less candle power (say of 15 candles) 7 cubic feet per pound of coal is easily obtained.
4. The gas obtained by this process is remarkably easy of purification, uniform in quality, and very greatly superior to gas obtained by the old process, in its ability to withstand low temperatures, without sensible loss in illuminating power.
5. The cost of making gas by the hydrocarbon process is less than by the ordinary process, very nearly in proportion as the volume of gas obtained is greater.
6. The analytical investigations herein given show that the average composition of the hydrocarbon gas varies much less from that of common street gas than has heretofore been assumed.
7. The heating power of the hydrocarbon gas is found to be greater than that of ordinary illuminating gas, while the water gas is shown to possess a calorific intensity some 70 per cent. greater than that of a good sample of common illuminating gas.
8. The Gwynne-Harris method is peculiarly applicable to the economical use of very rich cannels, or other enriching agents; thus yielding, in a given apparatus, the greatest possible volume of gas, of a given illuminating power, from a minimum weight of materials.
9. The correctness of the theoretical notions, which lie at the foundation of the hydrocarbon process, has long been recognized by the most eminent gas engineers; but it is believed that the solution of this important problem has been first successfully achieved by the American system herein described as the Gwynne-Harris process.
10. In entire variance with popular belief, our analyses prove that a compound hydrocarbon gas consumes much less atmospheric oxygen, and vitiates a given volume of air to a much less degree, than an ordinary gas of equal illuminating power.

The experiments on which the above conclusions were based, were made chiefly with coal as the enricher, not petroleum or naphtha. It is estimated that by this process 1000 cubic feet of gas can be made from 17 lbs. anthracite coal and four gallons of petroleum or naphtha, which gives a cost of 37·3 cents, with coal at 7·00 dols. per ton and petroleum at 12½ cents per gallon, exclusive of fuel, labour, &c.

The advantages claimed for this process are, that gas can be made continuously, not in runs of 20 or 30 minutes, as in the case of the other processes; that it can be used successfully in connexion with the ordinary coal process; and that ordinary coal gas-works can be easily adapted to it. We have heard of no explanation of why the process was given up in New Haven, where the experiments referred to above were tried.

In all of these water gas processes the large outlay and expense of exhausting the gas, necessary in coal gas-works, is dispensed with.

(To be continued.)

THE CHEMICAL COMPOSITION OF PENNSYLVANIA PETROLEUM.

[A Paper read at the Buffalo Meeting of the American Association for the Advancement of Science by S. P. Sadtler, Ph.D., of the University of Pennsylvania, Philadelphia.]

Pennsylvania petroleum has universally been recognized as a mixture of hydrocarbons of varying gravities and boiling-points. A question of great interest to the chemist is, how many of the homologous series of hydrocarbons known to organic chemistry are here represented. This is a matter which has occupied the attention of some of the most careful workers in our science, and they have given much painstaking and conscientious work to its solution.

Pelouze and Cahours were among the first who submitted samples of American petroleum to fractional distillation, and isolated a number of the members of the first or marsh-gas series of hydrocarbons.

C. M. Warren, of Boston, then took up the matter, and gave several years of the most careful study to the subject. He isolated these members of the paraffin series in a greater state of purity, and determined their boiling-points much more sharply than had been done before. He also considers that he has isolated several members of the next or olefine series of hydrocarbons.

S. F. Peckham, now of the University of Minn., Minneapolis, has given a great deal of attention to Pennsylvania petroleum, studying the products obtained from it by what is termed "cracking;" that is, submitting the oils to a higher heat than is necessary for distillation simply. His work has been mainly, however, with California petroleums, which differ very greatly from those of Pennsylvania.

C. Schorlemmer, of Owen's College, Manchester, England, has probably given the most study to the subject. He has gone so far as to identify not only the normal members of the paraffin series, but isomers which are found to accompany them in the Pennsylvania petroleum.

He has confirmed the presence of members of the olefine series by preparing the dibromides of several of them.

He has also proved the presence of members of the benzol series (or so-called aromatic hydrocarbons) by preparing their nitroderivatives.

A set of some 25 derivatives of Pennsylvania petroleum, including the normal and isomeric members of the paraffin series, the dibromides of members of the olefine series, and a series of nitrobenzols and nitrotoluids, prepared by Professor Schorlemmer, and kindly presented by him to the Chemical Museum of the University of Pennsylvania, was displayed at the Centennial Exhibition, in connexion with material of the Second Geological Survey of the State.

The gaseous exhalations from the petroleum wells have also been examined.

Fouqué, Ronalds, and Lefebvre, have all analyzed these gases, and unite in finding them to consist essentially of the lowest members of the paraffin series, commencing with marsh gas or methane itself.

Professor Henry Würtz analyzed the gas from a well at West Bloomfield, N.Y., which, while made up largely of marsh gas and its homologues, was found to contain some two per cent. of members of the olefine series.

I have also, within the past year, at the instance of the Geological Survey of Pennsylvania, collected and analyzed the gas from four prominent gas wells in the western part of the State. In the case of three of these wells, the gas was either at the time actually being used for fuel in large iron-works, or was about to be utilized in this way. A summary of my results was given in a paper read before the "American Philosophical Society," in Philadelphia, in February last. Suffice it to say, I found the gases chiefly made up of methane with ethan and propan and some free hydrogen and a little carbonic dioxide gas. This, I believe, is the substance of our knowledge of the chemical composition of petroleum. Let us consider now if more information can be reasonably looked for as the result of further study.

What was the material used for these investigations? Were the crude petroleums examined by these different authorities exactly the same, or, if by chance they might have been, are they to be compared with all other crude petroleums now known? Those familiar with the crude oils as produced in the different sections of Venango, Clarion and Butler counties, and very recently in Warren and McKean counties also, will know that

these oils vary in colour, from a light amber to a dark black, and in gravity from 30° to 55° Baumé—from thick lubricating oils to nearly pure benzine. Moreover, they come from very different strata, or "sand-rocks," as they are termed.

I may be pardoned a short extract from a geological report of Mr. John F. Carll, the assistant geologist of the Survey, in charge of the oil district, which will illustrate this statement:—

"These oil-producing sands form a group of themselves, with well-defined beds of slates and shales—at least 100 feet in thickness—both above and below it; and whether composed of three members, as an oil creek—where they were named first, second, and third sands—or split into five or six members, as they usually are to the south-east and east of the central line of the group, they all lie, as a general rule, within a vertical range of 350 feet.

"Each one of these three sand-rocks, where they lie in clearly-defined beds, furnishes an oil peculiar to itself—the first sand, a heavy lubricating oil of from 30° to 35° gravity; the second sand, an oil of about 40° gravity; and the third, the usual light oil of from 45° to 50° gravity. But, while each sand has its own characteristic production, the oil varies somewhat in colour and gravity in different localities in the same horizon. Thus, the third sand produces a green oil from its lower member, and a black oil from its stray or upper member, where the rocks lie in their normal positions, as on Oil Creek; but, where the stratification varies—thus changing the relations of the several members to each other, both as to thickness and composition—the oil is changed in colour accordingly. At Pleasantville, where the lower member is thicker than the upper, but fine and muddy—and the upper, or stray, is coarse and gravelly, and produces the oil—its colour is nearly black. At Pitohole, Cash-Up, and Fagundus, where the lower member has fined down to a thin band of argillaceous flags, and the upper member thickened into a pebbly sandstone, the oil is of a lighter colour. In some parts of Clarion and Butler, where the horizon of the third sand is represented by three or four beds of pebbly sands—sometimes producing oil from one stratum and sometimes from another—the colours shade intermediately between the green and black oils of the upper country. These shades are so gradual and slight that they have not been generally noted, but a critical examination of a number of wells will convince any one of the fact."

It will thus be seen that, if we wish to study the chemical composition of petroleum thoroughly, we have a considerable body of material to choose from. This material must be carefully assorted, too, before any satisfactory study of the petroleum can be made. The great bulk of the crude petroleum that is sent to the refineries, or is exported, is shipped by the pipe-line companies, who have their network of pipes ramifying through whole districts, collecting the entire yield of the neighbourhood, and storing it in their immense tanks. To study such crude petroleum would be like analyzing the sweepings of a mineral cabinet.

The Geological Survey of Pennsylvania has, therefore, proposed to make a more careful chemical investigation of the whole subject.

The material appears at present to be threefold:—

1. The natural gas. This must be considered as of common origin with the petroleum, and, indeed, part of it, being invariably associated with, and always held dissolved in, the crude oils.

2. The crude petroleum themselves. A series of reliable samples of varying physical characters, such as colour and gravity, and more especially from different geological strata, and even different geological horizons, has just been collected. They were taken, in all cases, direct from individual wells. Of lesser importance, yet not to be neglected, are—

3. Certain semi-solid deposits, which accumulate in both gas wells and oil wells, known to the oil men under the general name of "paraffin." A considerable amount of this deposit of buttery consistency has been collected from a large gas well.

The thick material deposited from many crude oils in the bottom of tanks can also be classed in this category.

It is easily perceived that until some study is given to these different materials, it is idle to advance any theories as to the causes of the differences, or as to the origin of the petroleum, apart from general ones based more upon geological than upon chemical grounds. However, as Mr. Carll remarks in his report, "the materials from which the oil is derived must have been sealed up in the measures below ages before, or were then being deposited with the sands themselves, for we can imagine no process by which the oil could be evolved from superior strata, and forced downward into reservoirs below sea-level."

On the first of these suppositions we have founded the theory of Professor Newberry, that the Huron shales underlying all these districts really give rise to the oil and gas by slow processes of distillation. On the second, we must picture to ourselves immense deposits of sea-weeds, supposing the oil-bearing sands to have been deposited by deep-sea currents, or of shallow water vegetable and animal remains, supposing the sands to be beach deposits, as is more probable.

The whole question of origin is a geological rather than a chemical one, and the geologists are the ones to solve it. Still, a careful chemical examination of both the crude oils and the sand-rocks in which they are contained, may contribute something of value to its solution.

It is with this hope that the chemical study of different crude petroleum is about to be begun by the Geological Survey.

BRISTOL WATER-WORKS COMPANY.—The directors have decided to recommend to the proprietors, at their annual general meeting, to be held on the 31st inst., a dividend on the old and new ordinary shares for the half year ending the 31st of December, 1876, at the rate of 10 per cent. per annum, and payment of 7s. 6d. per share to the proprietors of the £25 ordinary shares on account of arrears of dividend.

PURBON GAS COMPANY, LIMITED.—The annual meeting was held on the 7th inst.—Mr. Wardman in the chair. The directors, in their report, recommended the payment of a dividend at the rate of 5 per cent., and that a balance, equal to 1½ per cent. upon the capital, be carried to the reserve-fund. The question of an extension of the company's mains to Ackworth led to a conversation, the result of which was favourable to the step, but the decision on the point was left in the hands of the directors.

REDUCTIONS IN THE PRICE OF GAS.—The Corporation of Middlesbrough have agreed to reduce the price 3d. per 1000, and to increase the illuminating power to 16 candles from the 1st proximo. At Chelmsford the directors of the company have decided to reduce the price from 5s. 5d. to 5s. from the same date, subject to the usual discount of 5d. per 1000, making the net charge 4s. 7d. The price of gas at Plymouth will be reduced next quarter by 2d. per 1000 cubic feet—viz., to 2s. 4d. per 1000 cubic feet.

PROPOSED PURCHASE OF THE STAFFORD GAS WORKS.—At the meeting of the Stafford Town Council on the 7th inst., a communication was read from the solicitor to the Stafford Gas Company, stating that the price the company asked for the works and plant was £73,225, besides £4983 6s. 8d., the amount of the bonds chargeable against the stock of the company. The town-clerk was authorized to retain the services of Mr. Bramwell, civil engineer, on the part of the council, and also any other engineer he might deem necessary, and present his report to a future meeting.

GLASGOW WATER SUPPLY.

QUALITY OF THE LOCH KATRINE WATER.

The annual report of Dr. E. J. Mills, F.R.S., has been published. It refers to the 12 months from March, 1876, to February, 1877, inclusive, and is as follows:—

The numbers represent "parts per 100,000;" these can be transformed into "grains per gallon" by multiplying by 7 and dividing by 10.

Mean composition.—The mean composition and mean departure therefrom are as follow:—

Composition.	Mean Departure.	Mean Departure per Cent.
Total solid impurity	2.75 ..	0.41 .. 15
Organic carbon	0.142 ..	0.020 .. 14
Organic nitrogen	0.021 ..	0.018 .. 86
Ammonia	0.001 ..	0.001 .. 100
Nitric nitrogen	0.002 ..	0.002 .. 100
Total combined nitrogen	0.024 ..	0.019 .. 79
Chlorine	0.74 ..	0.04 .. 5
Hardness (total)	0.46 ..	0.23 .. 50

The figures in the third column show how variable in point of composition is our Loch Katrine supply, as, indeed, must naturally be the case with one in which the amount of total constituents is so extremely small. The individual constituents present certain features of interest, as is shown in the succeeding details.

Total Solid Impurity.—This was at a minimum (2.00) in January, and at a maximum (3.68) in February of this year. In June last its amount was enhanced by the presence of a few particles of iron scale—the only occasion, however, on which that substance was observed.

Organic Carbon.—The variation of the organic carbon very nearly coincides with that of the total solids. Its actual amount is by no means inconsiderable, being about double the proportion actually found in many specimens of unpolluted rain, deep well, and spring waters, though less than half the quantity commonly met with in upland surface waters. Minimum, 0.102, November; maximum, 0.188, December, 1876. It is doubtless chiefly derived from peat. [See *Nitric Nitrogen*.]

Organic Nitrogen.—Having regard to the peaty character of Loch Katrine water, the mean amount of organic nitrogen is low, and extremely satisfactory. In June, August, and December, none was present; the maxima occurred in April, 1876 (0.056), and January, 1877 (0.053). The general ratio of organic carbon to nitrogen is nearly 7 to 1, and calls for no especial remark; but in July, November (1876), and January (1877) it reached the low value of 3 to 1, showing the prevalence at those times of powerful oxidizing influences. The effect in July was probably due to temperature.

Ammonia.—The actual amount is extremely small. In April, July, August, October, and November none was present; the maximum (0.004) occurred in March and September, 1876. Such figures are commonly found in connexion with good waters.

Nitric Nitrogen.—The quantity of nitrogen usually designated as appertaining to nitrates and nitrites presents some noteworthy characters. The mean amount is extremely low. In March, July, August, September (1876), and February (1877) none was present; the maximum (0.009) was found in November (1876). The occurrence of traces of nitrates in a water is satisfactory, inasmuch as it assures us that, among the generally prevailing conditions, the balance has turned in favour of oxidizing influences. And it is actually found that even in November last such influences, then at their climax, were capable of reducing the organic carbon to its lowest amount, the nitrate being at its highest; and nearly as striking an instance is to be found in the water of April last. Such a phenomenon would not be so remarkable in the season of summer. It may, perhaps, be attributed to the chemical action of mist; finely divided water being capable, according to Morin, of producing ozone. I need scarcely add that a low ratio of carbon to nitrogen does not necessarily involve the presence of nitrates.

Total combined Nitrogen.—The mean amount slightly exceeds one-half the quantity encountered in numerous analyses of unpolluted rain water, and constitutes good general evidence of a satisfactory condition. In August, none was present; the maximum (0.063) was found in April (1876).

Chlorine.—The generally prevailing winds in the Loch Katrine district have first traversed the sea. They bring with them a quantity of suspended salt spray, which is, of course, carried down into the loch with the rain. It is natural, therefore, to find chlorine in this water, and to find it in a practically constant proportion. As will have been seen, it is the least variable of all the determined constituents. Minimum, 0.69 in December; maximum, 0.82 in March (1876). Some small fraction, however, of this chlorine must proceed from drainage.

Hardness.—This water is extremely soft, and would be but little surpassed even by distilled water. Minimum, 0.01 in June; maximum, 0.82 in September, 1876.

General Condition.—The general condition of the water has been satisfactory throughout the year. Having regard to the absence of filtration, the enormous volume of the daily supply, and the fluctuations necessarily incidental to a water containing so little of anything in solution, the retrospect is a matter for congratulation. There are only a few points upon which comment seems necessary:—1. The monthly reports contain frequent references to the presence of "vegetable fibres." These are in part due to the residual tow joints of the mains. I am, however, informed that when an old main joint is repaired no tow is at present used, so that this fault is in continual process of amelioration. Perfect freedom from suspended matter can, of course, only be attained by filtration. 2. After a period of heavy rain, and especially of intermittent heavy rain, I have always found the water "ferruginous"—that is, containing dissolved iron. It seems likely that much, if not all, of this iron proceeds from peat. 3. Loch Katrine water has the usual colour of peaty waters. The tint varies much, sometimes from day to day; nor does it admit of any accurate measurement, since peat contains many colouring matters. The colour itself seldom attracts much attention, and is sometimes nearly absent. 4. The discharge of drainage from the hotel at the western extremity of the loch, at a point about two miles from the intake, ought, if possible, to be prevented. The reception of human and animal excreta into a potable water is extremely objectionable, in however small an amount; and, inasmuch as such drainage may at any time become infected, we are bound to regard its presence as a source of danger. 5. The water was at its worst in April, at its best in July. 6. My best thanks are due to Mr. Gale, the officer in charge of the works, for his courteous promptitude in supplying me with information.

GLASGOW WATER SUPPLY.—Dr. Mills, F.R.S., of the Andersonian University, Glasgow, reports that the water supplied to that city from Loch Katrine last month was of a very pale brown colour, and decidedly ferruginous; it contained suspended vegetable fibres. All samples of Loch Katrine water referred to in the previous reports of Professors Bischof and Mills were drawn from a 3-inch distributing-pipe; but the sample here reported upon was taken from a 13-inch main, whence it is intended to draw all future samples.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)
In one or two quarters I hear, at last, of there being some little increase of activity both at the blast furnaces and in the mills. Taken as a whole, however, pig iron remains easy all round for current deliveries on the fulfilment of contracts in the immediate future. Makers, both here and in the surrounding district, however, are very firm in declining to fetter themselves by entering into long-dated engagements at the present prices. Few houses hereabouts are at present engaged beyond the ensuing two months, during which they will doubtless be tolerably well employed.

The most important item of the week in relation to the matters chiefly dealt with by the readers of this JOURNAL is the contract which has been entered into within the past few weeks by the Sheffield Water-Works Company with Messrs. Newton, Chambers, and Co., of the Thorncliffe Iron-Works, for the supply of several miles of pipes. These pipes will be of several sizes, over 12 inches in diameter, and will be laid from the nearest point of the Sheffield Company's mains for the supply of the township of Chapeltown. The order thus deals with several thousand tons of iron, the whole of which Messrs. Newton, Chambers, and Co. are in a position to produce from their own blast furnaces, which smelt their own black-band ironstone mixed with Lincolnshire ore, by means of coal raised in their own mines. I believe I am correct in stating that there were several tenders for the contract; but as the successful firm are very large ratepayers—the largest, in fact, in the township—they doubtless offered more advantageous terms than otherwise would have been the case. I am hardly at liberty to state the exact price at which the order has been placed; but as an indication of the course of the market, I may say that it is between £5 10s. and £6 on the average.

There is no particular alteration to note in respect of the coal trade, except that the firmness of slack, noticed by me last week, continues. On Wednesday last a largely-attended meeting of coalowners was held at Barnsley, for the purpose of considering the coal rates to London, which were stated to operate greatly to the disadvantage of the district. From South Yorkshire to London the present charge over the Great Northern is now 7s. 9d. per ton, having been reduced 6d. per ton on the 12th of March. This was declared to be insufficient, and a deputation was appointed to wait upon the Great Northern directors on the subject.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)
Some of the principal firms in the Manchester district are tolerably busy, and in one or two cases are oversold for the present in nearly every class of fuel; but this is a state of things which is exceptional, and there are still general complaints of the slackness of trade, whilst supplies, as a rule, are abundant in the market. In the large coal-producing districts of South-West Lancashire, the pits in most cases are only working from seven to eight days a fortnight, in consequence of the scarcity of orders, and prices, although they are generally maintained, exhibit a want of firmness, so far, at least, as the commoner classes of round coal are concerned. Best coal still moves off only slowly, Arley, at the pit mouth, being quoted at 9s. 6d. to 10s. 6d.; and Pemberton four-feet at 8s. 6d. to 9s. per ton. Although there has been more demand for common coal for house fire purposes, forge qualities continue a drug, and it is difficult to obtain more than 6s. 6d. to 7s. per ton. Common burgy is still very difficult to sell, but the better sorts and slack meet with a very fair inquiry, and the latter description of fuel has a decidedly upward tendency in price. Common burgy, at the pit's mouth, can be bought at from about 4s. 6d. to 5s. per ton; but, for the better sorts, 5s. to 5s. 6d. per ton is asked, and slack is quoted at 3s. 6d. to 4s. 6d. per ton at the pit.

The shipping trade continues in a very depressed condition. Only very small quantities of best coal are being shipped. For good steam coal delivered at the Garston Docks it is difficult to obtain more than about 7s. 6d. per ton; whilst at the High Level, Liverpool, steam coal is being offered at less than 7s. per ton.

In the iron trade there is no improvement to notice. Merchants continue to push outside brands of iron in this district at extremely low prices, and as the local makers are not disposed to follow the continual downward tendency of the market, they are doing little or nothing in the shape of new business. For Lancashire pig iron delivered into the Manchester district 56s. to 57s. per ton for No. 3 foundry, and 54s. 6d. to 55s. 6d. for No. 4 forge, less 2½ per cent., is still being asked; but Middlesbrough iron is being freely offered at 52s. 6d. per ton, foundry, and 51s. per ton for forge numbers delivered here. The finished iron trade is quiet, and to secure orders makers would give way to the extent of about 2s. 6d. per ton upon late rates.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)
The coal trade of the North of England has not improved. It is very dull, and for the first time in a couple of months the shipments of best gas coal from the Tyne Dock show a falling off. There is a very poor demand from the Baltic. Foreign merchants are very much indisposed to enter upon business until affairs in the East have a more settled appearance. The price of best coals is unchanged. It is not likely to vary very much, as nearly all the large gas companies have contracts running over the year. Gas coals have been shipped from the Tyne to Cork and Limerick, and some other Irish ports. The ordinary quantities have been going to London, France, and Hamburg, and small ships have been in request to load cargoes for the lesser Danish and Sound ports. Second-class gas coals do not vary much in the market. From 6s. 6d. to 7s. per ton is their value. Last year a good deal of this class of coal was sent to the Continent upon consignment. It does not seem to have paid the collieries, as less is going this year. Best house coals keep their value in the market. Medium qualities are from 10s. to 11s. per ton; best, of course, are higher than that. The steam coal trade is no better. All the collieries are working short time, and prices are comparatively low. The prospect of an early opening of the Baltic is having no effect upon it.

In the freight market coasting rates are low—4s. 3d. to 4s. 6d. per ton is paid to steamers, and 5s. 6d. per ton to sailing ships, to load coals for London; £8 10s. per keel is the figure paid sailing ships to load gas coal for France, 6s. to the East coast, and from 7s. to 7s. 6d. to the English ports of the British Channel. Some fire-bricks and gas-retorts are being shipped from the Tyne to London and the Continent. A very moderate business is done in coals and goods to the Mediterranean, and freights are low to the Baltic.

The manufacturing iron trade is looking better; water and gas pipes are being got ready for shipment, not only coastwise but abroad. New gas-works are being opened on the Continent. The iron trade, however, recovers very slowly.

HOWDEN GAS COMPANY.—At the annual meeting on the 5th inst., a satisfactory report was presented, the profits enabling the directors to recommend payment of a dividend at the rate of 6 per cent., which was accordingly declared.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a meeting of the directors of the Coupar-Angus Gas Company, held on Saturday, the 10th inst., it was resolved to erect an additional gas-holder, capable of containing 15,000 cubic feet of gas, at a cost of upwards of £700.

On the evening of Monday, the 12th inst., a meeting of the directors of the Coatbridge Gaslight Company was held, when it was reported by Mr. Mitchell, the manager, that the drainage of the ground, forming the site of the new works at Burnbrae, had been completed in a satisfactory manner. It is confidently expected that these new works will be in operation in time for next winter's gas supply.

The report of Mr. J. Falconer King's examination of the gas supplied to the City of Edinburgh, on the 9th inst., shows that the Edinburgh Company's gas had an illuminating power of 28·51 candles; that of the Leith Company being 27·36 candles. In both cases hydrosulphuric acid was absent, but the presence of ammonia was distinct.

On Friday last the Dundee Gas Bill passed the Committee of the House of Commons without any alteration being made in the clauses.

The question of the Burghs Gas Supply (Scotland) Act, 1876, was under consideration at a meeting of the Police Commissioners of Johnstone, held on Monday, the 12th inst. It was reported by the clerk that no remonstrances had been lodged with him against the action of the Commissioners regarding the adoption of the Act. He was then instructed to apply to the sheriff for registration; after which the Provost stated that a Gas Committee could be appointed to carry out the provisions of the Act. Since then Sheriff Cowan has declared the Act to have become law in the burgh, and has ordered the adoption of the Act to be recorded in the Sheriff Court books at Paisley, the county town for Renfrewshire, that in which Johnstone is also situated. The commissioners of that young burgh are naturally taking some credit to themselves for having been the first to adopt the provisions of Sir Windham Anstruther's Act. The movement which has thus just terminated began by the holding of a special meeting of the commissioners on the 2nd of November last, when the proposal to adopt and apply the Act was unanimously approved of, the question being again considered, and with the same result, at another special meeting, held on the 8th of February.

On Wednesday last, at a meeting of the Police Commissioners of Ayr, Provost Steele called attention to the extent to which the gas accounts, both of the corporation and of private consumers, were increasing, and moved that it be remitted to the Lighting Committee to have a suitable place for testing the gas provided, and that the quality of the gas be tested at least once a week. The proposal was agreed to.

At the last meeting of the Town Council of Paisley, it was reported by the Gas Committee that Messrs. Henderson and Dimmack, coalmasters, Coatbridge, had notified their inability to implement their contract to supply 1000 tons of gas coal, their seam of coal having become exhausted. They were willing to supply another description, a specimen of which had been sent, but, after some conversation, the general opinion seemed to be that it would be better to make a new contract.

The Corporation Water Commissioners of Dunfermline have accepted a tender for the cutting of the pipe track and other works, forming No. 2 Contract, of the Glensherup water supply scheme. There were 17 offers lodged, ranging from £7487 17s. 9d. to £17,512 10s., the lowest being the one accepted.

Works for the supply of water to an elevated suburb of Glasgow—Springburn and Bulgray districts—in which the Loch Katrine supply has hitherto not been available, have just been commenced, at a probable cost of about £13,000, including reservoirs, pumping-engines, &c.

The price of pig iron was very low on Tuesday and Wednesday, but an improvement took place on Thursday, and on Friday there was a strong market, in anticipation of a strike amongst the miners against the reductions of wages that have been announced. A rise of 8d. per ton took place, but ultimately 2d. was lost, and the week closed with the price 2d. higher than on the preceding Friday, and 1s. above the lowest price at which business was done during the week.

Little or no change has taken place in the coal market since last report, the shipping department is duller, but in the local trade an average amount of business is doing. Prices are unaltered, but in several cases lower quotations have been accepted.

BARNSELEY GAS COMPANY.—The annual meeting was held on Monday, the 19th of February—Mr. Inns, chairman. The directors, in their report, congratulated the shareholders that the anticipations they ventured to express on the last occasion—namely, that at the end of 1876 there would be "no inconsiderable balance to carry to the reserve-fund," had been realized. After providing for the maximum rates of dividends on the called-up capital (which had been increased by £4000 during the past year), the sum of £836 9s. 1d. was left as a balance to be carried to the reserve-fund; and the directors had, therefore, no hesitation in recommending the payment of the full statutory dividends. They felt justified, too, in announcing their intention, with a view to paying off the balance owing on the capital account, to make a fourth call on the E shares, payable on the 31st of March inst., and a fifth and final call, payable on the 30th of June next. And, if the current year should prove as satisfactory as the past, they proposed to consider whether a reduction in the price of gas in the borough might not, and indeed ought not to, be made. The directors had to report the works to be in a thorough and efficient state of repair. They reminded the shareholders, however, that, having regard to past experience, a large sum for repairs and renewals would probably have to be expended year, by year by reason of the frequent disturbances from mining operations to the ground in which the mains and pipes were laid, and the consequent injury such mains and pipes sustained. Not only was considerable expense incurred in relaying them, but serious loss arose in the large waste of gas by leakages; and from these causes considerable delay must ensue before the reserve-fund could be raised to the maximum amount of one-tenth of the nominal capital. The report concluded by alluding to the vacancies which had arisen at the board, and expressing the deep regret of the directors that two of those vacancies had arisen through the deaths of old and valued colleagues.

Dr.	Revenue Account, for the Year ending Dec. 31, 1876.	Cr.
Gas	£15,308 11 9	Coal, 9876 tons £4,940 7 6
Meters	925 13 0	Lime, 633 tons 380 0 6
Coke	1,646 3 2	Salaries, viz.—
Tar and lime	951 18 5	Secretary & manager, assistant-
Ammoniacal liquor	535 8 3	manager, auditors, solicitor,
Sundries	144 19 3	and office clerks 821 18 4
Carriage of coke	81 2 11	Wages 3,484 8 8
Premium on E shares sold	127 15 0	Rates and taxes 624 0 5
Bad debts recovered	5 4 4	Repairs and renewals 1,182 15 6
		Law charges 0 18 10
		Carriage of coke 86 14 10
		Commission and interest 228 13 11
		Interest on loans 343 1 0
		Directors' allowance 100 0 0
		Discounts, abatements, & bad debts 593 6 4
		Net profit, carried to divd. account 6,940 10 3
	£19,726 16 1	£19,726 16 1

MELTHAM GAS COMPANY, LIMITED.—The annual meeting was held on the 5th inst.—Mr. R. Mellor in the chair—when a dividend of 5 per cent. was declared, and a balance of profit, amounting to £180, carried forward.

BELPER GAS COMPANY.—The half-yearly meeting was held on the 27th ult., when the usual dividend of 5 per cent. for the half year was declared.

HUNSTANTON GAS COMPANY.—The half-yearly meeting was held on the 22nd ult., and a dividend at the rate of 3 per cent. per annum was declared.

BIRMINGHAM WATER SUPPLY.—Dr. Hill, the Medical Officer of Health for Birmingham, reports that the water supplied to that town during February was clear and yellowish, and of a little better quality than the previous month.

QUALITY OF THE DUMFRIES GAS.—Mr. A. Malam reports that the illuminating power of gas, as tested on the works, for the week ending the 16th of March was as follows:—

March 10	27.61 candles.
" 11	27.14 "
" 12	27.61 "
" 13	28.00 "
" 14	28.57 "
" 15	28.57 "
" 16	27.61 "

Average illuminating power, 27.87 candles.

EXTINGUISHING A PUBLIC LAMP.—AN EXPENSIVE FREAK.—At the Hull Police Court, on the 10th inst., a young man, named T. W. Robinson, was charged with being drunk, and also with extinguishing a public gas-lamp in Savile Street. A police-constable deposed to seeing the prisoner climb a lamp-post and put out the light. Mr. Gorwood, on behalf of the British Gas Company, stated that the offence was one of very frequent occurrence in Hull, and it was very rarely the offenders could be discovered. Wherever burglaries had been committed of late, it was found that the public lamps in the locality had been put out. The magistrate fined the prisoner £5 on the second charge, stating that he intended the case to be a warning to others who might commit such objectionable acts.

HULL GAS SUPPLY.—Mr. James Baynes reports that the gas sent into the Sculcoates and Myton district, during February, by the British Gas Company gave the following results, free ammonia and sulphuretted hydrogen being at no time present to the ordinary test:—

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16.60	15.80	16.03
Grains of sulphur per 100 feet	31.00	28.70	29.90
Mean barometer and temperature in experiment-room: Bar., 29.90; temp., 53°.			
	Max.	Min.	Mean.
Illuminating power standard sperm candles	16.23	15.85	16.04
Grains of sulphur per 100 cubic feet	—	—	9.15
Grains of ammonia per 100 cubic feet	—	—	7.43
Mean barometer and temperature in experiment-room: Bar., 29.47; temp., 55.5°.			

NEW GAS-WORKS AT MUIRKIRK.—With the view of providing an improved supply of gas for their works, offices, workmen's houses, &c., at Muirkirk, Ayrshire, the Eglinton Iron Company have recently completed the erection of new and very substantial gas-works, which are capable of producing and delivering about 20,000 cubic feet of gas per day. The various parts of the works occupy the four sides of a square. On the back line there is a capacious retort-house, which is also intended for the storage of coal. It measures 30 feet by 26 feet inside, the height of the side walls being 14 feet; and it is covered by a substantial slated iron roof. In the rear of the retort-house a shoot has been constructed for receiving the coals from an adjoining railway, which lies at a considerable elevation above the level of the works. The retort-house contains five retorts in three ovens, arranged so as to suit the requirements of the different seasons of the year. Adjoining the retort-house there are the chimney, which is 80 feet in height, and the condensers. Then there is a suitable house in which are placed two 6-feet by 4-feet purifiers, with travelling gear complete; and, connected with the purifier-house, there is a capacious lime store. The buildings forming the front line of the works include the manager's dwelling and office (separated from each other by the gateway to the works), and the meter and governor house. The gasholder is 35 feet in height by 12 feet in diameter. It works in a cast-iron tank, and is guided by four cast-iron columns, braced together at the top by means of four ornamental lattice girders. The whole of the connecting-pipes are of 6 inches bore. Messrs. Laidlaw, Sons, and Caine, Barrowfield Iron Works, Glasgow, supplied the street-mains, and all the rest of the iron-work, with the exception of the governor, which is one of the patent forms devised and manufactured by Messrs. D. Bruce Peebles and Co., Edinburgh. Its working and bye-pass valves are furnished with ornamental standards and hand-wheels. The entire works present an unique and substantial appearance, and were constructed from plans prepared by Mr. George R. Hislop, manager of the Corporation Gas-Works, Paisley. The total cost of the works will be upwards of £2000.

COMPOSITION OF PETROLEUM AND THE PROPER STANDARD OF SAFETY.—At the monthly meeting of the Chemical Section of the New York Academy of Sciences on the 12th ult., Professor Chandler, Ph.D., read a paper on this subject. He stated that, although petroleum had been known for centuries, it had only recently come into general use for illumination, for the reason that suitable lamps had been wanting. Lamp chimneys were invented about the beginning of the present century, previous to which time there had been only smoky lamps, such as are found at Pompeii. The inventor of lamp chimneys had done a great deal for civilization, by making it possible to read at night. In 1856 the manufacture of oil from Boghead coal was begun, and in a short time coal oil, or kerosene, had come into extensive use. Lamps had been devised for burning this coal oil, and proved suitable for burning petroleum. A company was organized to collect the petroleum, which was soaked up by blankets from the surface of pools of water. The speaker then described the boring of the first well by Colonel Drake, the subsequent excitement, the quantity of oil produced, and other incidents connected with it. The oil, he said, usually comes from Devonian rocks, which are much older than the carboniferous or coal measures. Petroleum contains about 85 per cent. of carbon to 15 per cent. of hydrogen. It consists of a series of hydrocarbons of the simplest kind, known as the marsh gas or paraffin series, CH_4 , C_2H_6 , &c., or of the general formula, $\text{C}_n\text{H}_{2n+2}$. The oils of Italy do not contain any of the lighter oils, which have already evaporated. In Pennsylvania the rocks are impervious, and evaporation is consequently impossible. In California, where the oil is more plentiful on the surface, there is but little beneath, as it has all run away or evaporated. There is another series of hydrocarbons called olefines, of the general formula C_nH_{2n} , but these do not occur to any considerable extent in American petroleum. They are distinguished from the paraffin or marsh gas series by the fact that they are attacked by sulphuric acid and converted into alcohol, so that the manufacture of alcohol from illuminating gas is a possibility. Alcohol was exhibited at the Paris Exhibition, made in that way. There is some doubt at present

whether the white solid which we call paraffin belongs to the paraffin or the olefine series; probably there are some of each series. There is another series of hydrocarbons known as the aromatic series, benzol C_6H_6 , &c., which is found in Rangoon tar, but not in our petroleum. When benzol is treated with nitric acid, it is converted into artificial oil of bitter almonds. Dr. Chandler thought he had noticed this odour in treating petroleum with nitric acid. After a digression on artificial alizarine, the speaker described the method of refining petroleum by fractional distillation, the destruction of colouring matter and gummy substances by sulphuric acid, and washing with soda, to remove traces of the acid. Sluggish acid is the name given to the acid after it has been in contact with the oil, and it is from this acid that we derive the foul odours wafted to this city from Long Island City by every easterly breeze. This acid is used in the manufacture of fertilizers. In regard to testing safe and dangerous oil, Dr. Chandler showed some interesting experiments. Some oil was placed in an open tester, and gradually heated on a water-bath with a thermometer. It was found to flash, or give off combustible vapours, at 110° Fahr., and it burned at 118°, being what is called very safe oil. He then placed some of this same oil in a closed vessel resembling a metal lamp, but provided with a cork instead of the common head or burner, and having electric wires attached. On heating the oil to 85°, and sending a spark through the vapours, an explosion took place which blew out the cork with a loud report, showing that oil, which has been considered safe, gives out explosive vapour at ordinary summer heat.—*Scientific American*.

RECENT STUDIES OF LUMINOUS FLAMES.—For a long time Sir Humphrey Davy's explanation of the luminosity of flames—that it was due to the presence of highly-heated solid particles—sufficed for all observed phenomena. A serious blow to its sufficiency was given, however, when Frankland discovered that certain flames were luminous under conditions which left no reason for supposing that solid matter could be present. For instance, hydrogen and carbon-monoxide, burned in oxygen under a pressure of 10 to 20 atmospheres, yield a luminous flame giving a continuous spectrum. So likewise the non-luminous flame of alcohol becomes bright when the pressure is increased to 18 or 20 atmospheres. Frankland inferred, from experiments like these, that the luminosity of flames was due rather to the presence of the vapours of heavy hydrocarbons, which radiate white light, than to incandescent solid matter. Still further doubt of the prevalent theory was raised by the experiments of Knapp, which proved that the diminished luminosity of a flame on the admission of air could not be due, as had been supposed, to an oxidation of the carbon suspended in the luminous gas, since the same effect was produced when nitrogen or carbon-dioxide, or other indifferent gas, was used as a diluent. Stein and Blochmann attributed this effect to the direct influence of the diluting gases in separating the particles of carbon, so that the oxygen of the air might unite with them more quickly than under the ordinary circumstances of combustion. Wibel held, on the contrary, that the diminished luminosity was due entirely to the absorption of heat by the diluting gas, and supported his view by some very ingenious experiments. The correctness of this conclusion has been, in turn, controverted by the later experiments of Stein and Heumann, particularly the latter, which seem to show that the diminished luminosity consequent upon dilution is due not solely to dilution nor wholly to the cooling action of the added gases, but to both these causes acting together, and frequently supplemented by a third cause—namely, the energetic destruction of the luminous material by oxidation. Heumann's experiments, which have been particularly ingenious and careful, lead to the following results:—That hydrocarbon flames, which have lost their luminosity by the withdrawal of heat, become luminous again by the addition of heat; that flames rendered non-luminous, by dilution with air or indifferent gases, become luminous again on raising their temperature; that flames rendered non-luminous by excess of oxygen, which brings about energetic oxidation of the carbon, are rendered luminous again by diluting the oxygen with indifferent gases. In most cases of diminished luminosity, two or all of these causes are at work. Another unsettled question with regard to flames has been the cause of the non-luminous space between the opening of a gas-burner and the flame, or between the wick of a candle and the luminous envelope. Blochmann attributed it to the inability of the surrounding air to mix at once with the stream of gas so as to make it combustible. Benevise, on the other hand, thought the dark space due to the mechanical action of the issuing gas, whereby the air is driven to a distance from the orifice of the burner—greater or less, according to the pressure on the gas, leaving a space wherein the gas is deprived of the requisite amount of oxygen, and consequently remains unburned. Both these explanations are shown to be insufficient by the single circumstance that a flame never directly touches any cold body held within it. In all such cases Heumann finds an explanation of observed conditions in the cooling effect of its surroundings—burner, wick, cold iron, or what not—upon the gas. For a certain space around the cooling body the gas remains at a temperature too low for ignition. Where the gas issues under high pressure, or is greatly diluted, the distance of the flame is attributed partly to this same cooling action of its surroundings, but more especially to the fact that the velocity of the stream of gas in the neighbourhood of the burner is greater than the velocity of the propagation of ignition within the gas.—*Scientific American*.

Register of New Patents.

1205.—GARSIDE, C., Glossop, "Improvements in rotatory engines, applicable also to exhausting, forcing or raising, and measuring fluids." Patent dated March 21, 1876.

The principle of this invention consists in causing the steam to press against vanes or pistons on the periphery of a flanged pulley, revolving within a cylinder, which is fixed. A block fixed to the cylinder, and fitting steam-tight in the periphery of the pulley, confines the steam, so that it must act on the pistons and force the wheel round. The space between the periphery of the pulley and the cylinder is rendered steam-tight by means of ordinary rings; the pistons and block also are rendered steam-tight by means of plates pressed to their seats by springs. For measuring fluids the machine at every revolution will discharge a quantity equal to the capacity of the space in the periphery of the wheel, less the quantity displaced by the two piston plates. This will be the case whether the machine is propelled by the fluid or made to force the fluid.

1223.—PORTER, G., Cullum Street, London, "Improvements in glass, opal, and other shades and reflectors, and method of supporting and affixing them on to gas and oil burners." Patent dated March 22, 1876.

This invention consists in forming a shade or reflector in one or more pieces, the lower portion having a foot, so as to be affixed to the burner by means of set screws, clips, rings, or other fastening, or it may simply rest upon the burner. When made in more than one piece, the outer edge of the lower portion or screen has either a plain edge or turned-up flange, so that the upper portion or reflector may seat into or rest upon it. The outer edge of the upper portion or reflector has either a plain edge or turned-down flange, so as to rest upon or seat into the lower portion or screen, thus forming a complete shade and reflector.

1230.—M'JANNET, J., Greenock, "A new or improved ball-cock." Patent dated March 22, 1876.

This invention consists of a vertical branch, by which the water is led from the supply-pipe to the cistern or other vessel to be supplied. The lower part of this branch terminates inside a hollow casing, having a discharge orifice at its lower end or side. Beneath the end of the vertical branch, and extending through the casing, is a shaft, and to the portions of it projecting outside the casing the lever with the ball at the end is attached, so that as the ball rises or falls according to the level of the water in the cistern, the shaft is moved round on its axis through an angle corresponding to the motions of the ball, and a valve being carried on the shaft, it is raised against or lowered from the orifice of the branch within the casing, so that the supply of water is either cut off or thereby regulated in quantity.

1232.—WILSON, E., Exeter, "Improvements relating to pump and other valves, and to the securing of the same and parts connected therewith in their chambers or boxes." Provisional protection only obtained. Dated March 22, 1876.

According to this invention, in the valve chamber or box is provided a cylinder or cylinders with two or more valves in each cylinder properly arranged in relation to the suction and delivery apertures. The flange of the valve at one end of the cylinder rests on the outside of a flange or rim on a seating fitted therein, and the lips of the valve extend inward. At the other end of the cylinder the flange of the valve rests upon the inside surface of a flange or rim on the cylinder.

On the flange of the first-named valve there is placed a metal ring, which has a cross-bar at the back, and outside or over it is a cross stay formed or secured inside the valve-chamber. Through this stay passes a hand screw, the inner end or point of which bears against the cross-bar of the metal ring, so that by turning it the ring will be compressed upon the flange of the valve, and will bind and secure the same firmly on its seating. The latter rests on a cylindrical distance piece, which bears against the flange of the other valve, and by means of this distance piece the pressure of the screw is transmitted to the latter valve, and makes the same fast on the flange or rim.

The first or upper valves in the above arrangement are the suction valves, and the second or lower valves are the discharge or delivery valves. The ports leading to the cylinder ends are between the valves.

1246.—WILLIAMS, R. H., St. Austell, Cornwall, "Improvements in apparatus for preventing explosion and spontaneous combustion in coal on board ship." Provisional protection only obtained. Dated March 23, 1876.

For the purpose of carrying out these improvements, to prevent either the explosion of the gases evolved or the spontaneous combustion of the coal itself in ships, there is provided a series of tubes, pipes, or cylinders, of cast or wrought iron or other metal, and of various lengths and diameters, the internal diameter of one pipe exceeding the external diameter of the other. These are placed alternately, a large pipe first, then a small one, and so on throughout the length, depth, and width of the cargo of coals, each large pipe being entered a few or more inches by the smaller one, as necessity requires.

The pipes are placed by hand in the cargo as it is being put on board the ship, and by the arrangement of large and small can be easily added to and lengthened. The large pipe being of larger diameter internally than the small one externally, will allow almost any amount of flexibility of the whole length. The pipes are carried through the cargo as taken on board the ship, from end to end, either in her main hold, bunker, store, or other compartment used for conveying coals on board ships.

These tubes or pipes should be put in when 6 feet of coal is in the hold of the vessel from forward to abaft and bulkheads, and for each 6 feet of coal in height after the first 6 feet; thus 12 feet requiring one run only, 18 feet requiring two runs in height. If the ship is very large and of great beam, there is placed laterally a run of pipes or tubes every 6 feet, as for a hold 12 feet wide one run of tubes, for 18 feet wide two runs, and so on for increase of width. These tubes are closely perforated all over their entire length, and where fitted into each other a considerable annular space will allow ingress of vapours or gas. Close to and secured at the bulkheads at each end of the vessel's hold, bunker, or other coal compartments, are perpendicular pipes or other contrivances going up through the deck, and terminating (in steamboats) either in the funnel or under the furnaces, or over the deck in funnel-shaped escape ways or other outlets. These perpendicular pipes are so constructed that connexions may be most easily effected by the trimmers of the coals with the perforated tubes or pipes running through the cargo.

1256.—LAKE, W. R., Southampton Buildings, London "Improved combustible compounds and apparatus for the production of gas for domestic, manufacturing, military, and other purposes." A communication. Patent dated March 24, 1876.

The object of this invention is to utilize gaseous substances which ignite spontaneously when brought into contact with air, such, for example, as arsenidimethyl phosphorette and siliciuretted hydrogen, sodium, ethyl. These substances are employed for purposes of lighting with flame, for the priming of guns and of projectiles used in warfare, for giving light and for heating, and may be used either alone or mixed with other combustible gases which possess the same properties of compressibility or liquefaction and vaporization or expansion, and to which they communicate the property of igniting spontaneously. The liquefaction by pressure or by reducing the temperature may be effected either before or after the mixing. The mixing may also be effected with liquid carburet of hydrogen evaporating at low temperatures.

According to this invention gases which ignite spontaneously by contact with the air are produced by the ordinary means known to chemists, and are collected in gasometers and the like, or they may be mixed with other known combustible gases, such, for example, as methylin. The gas alone, or the mixture, is compressed and liquefied by means of pumps, and in suitable receptacles. From these receptacles the liquid flows into a small portable apparatus, from which it can, at the will of the person using it, vaporize, and be allowed to escape, to ignite on coming in contact with the air.

1264.—LAWRENCE, P., Blackfriars Road, London, "Improvements in gas and other stoves." Patent dated March 24, 1876.

This invention relates to improvements in the arrangement and construction of gas and other stoves, whereby the heat generated by the combustion of gas, oil, spirit, fuel, or other heat-generating means in the combustion chamber is caused to circulate in a series of chambers, so as to absorb and transmit the heat to the room or chamber in which the stove is situated, the combustion chamber being so arranged as to apply the heat generated therein for cooking and other purposes if required.

For this purpose, above the combustion chamber an oven is arranged if required, but if the stove is simply required for warming and ventilating purposes only, then the oven may be dispensed with. Over the outlet from the oven or from the combustion chamber, as the case may be, a cover or cap of cylindrical or other suitable form is placed, which receives the heat from the chamber below, and over this cap or cover a series of two or more

other caps or covers are placed or arranged, a comparatively narrow space being left between each of them, so that the heat can circulate between them by passing through suitable inlet and outlet passages formed through them, the heat and products of combustion finally escaping by an outlet in the top of the outer cap or cover into the room or chamber to be heated, or by a pipe or flue into a chimney if desired.

APPLICATIONS FOR LETTERS PATENT.

835.—ALSING, G., Bradford, York, "Improvements in the treatment of sewage and other polluted waters and their deposits, and apparatus therefor." March 2, 1877.

840.—WIRTH, F., Frankfort-on-the-Maine, Germany, "A new filling for gas-meters." A communication. March 2, 1877.

842.—TRULL, C. K., New York, U.S.A., "An improved apparatus for lighting gas." March 2, 1877.

843.—HAMILTON, W., Glasgow, "Improvements in combined steam-engines and pumps." March 2, 1877.

857.—BARKER, E. D., Bedford Row, and HARRIS, A. G. R., Dorset Square, London, "Improvements in ball-valves and other draw-off valves." March 3, 1877.

860.—HANSON, J., Dewsbury, York, "Improvements in treating sewage and other foul water, and in softening clarified water for re-use." March 3, 1877.

922.—BROTHERS, W., Blackburn, Lancs, "New or improved apparatus to be used in the manufacture of clay pipes, gas, and other retorts, and other articles made of clay." March 7, 1877.

952.—HALLSWORTH, S., and BAILES, R., Leeds, "Improvements in the means or method of treating and clarifying sewage or other impure waters." March 9, 1877.

959.—HARDISTY, G. E., Nottingham, "Improvements in cocks and taps." March 9, 1877.

965.—FOX, W. P., Sheffield, "An improvement in spanners or wrenches." March 10, 1877.

966.—SILLAR, W. C., Blackheath, Kent, "Improvements in and in apparatus for separating the fluid from the solid portions of sewage sludge, peat, and other matters." March 10, 1877.

995.—CALDWELL, A., Strathbungo, N.B., "Improvements in apparatus for measuring and controlling or regulating the flow or supply of water." March 13, 1877.

997.—BRÉMOND, L., Versailles, France, "Improvements in means to be employed for preventing the deposit of naphthaline in gas apparatus, mains, and fittings." March 13, 1877.

1009.—MOYSEY, J., London Street, London, "Improvements in pumps." March 13, 1877.

1033.—LIVESY, J., Westminster, London, "Improvements in filters for water and air." March 15, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

3949.—BROOK, E., and WILSON, A., Middlesbrough-on-Tees, York, "Improvements in apparatus for making gas." Oct. 12, 1876.

4087.—KING, J. T., Liverpool, Lancs, "Improvements in chandeliers, brackets, and bracket arms, and in apparatus employed in the manufacture of the same." A communication. Oct. 23, 1876.

4424.—HELLYER, S. S., Strand, London, "Improvements in receptacles for house sewage or waste, and in the means for trapping the same." Nov. 15, 1876.

4788.—ANDREWS, W., Lisbon, U.S.A., "Improvements in water-gauges or stop-valves." Dec. 11, 1876.

4848.—RYDILL, G., Highgate, London, "Improvements in treating sewage, extracting filtration, preparing disinfectants and manure." Dec. 15, 1876.

4935.—JENNINGS, G., Lambeth, London, "Improvements in water-closets and latrines, and in valves for regulating the supply and discharge of water, and preventing percussion in water-pipes." Dec. 21, 1876.

5006.—HECK, J. H., Perry's Close, London, "Improvements in direct-acting steam-pumps." Dec. 27, 1876.

97.—COLLINGE, T. A., and PATERSON, T. O., Rochdale, Lancs, "Improvements in the production of material for and method of purifying coal gas, and in apparatus used for that purpose." Jan. 9, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

653.—SCOTT, H. Y. D., "Improvements in the treatment of sewage and in the manufacture of manures therefrom." Feb. 20, 1874.

679.—LAKE, W. R., "Improvements in air-tight joints for gas-retorts." Feb. 23, 1874.

702.—WESTON, J. H., "Improved means of and apparatus for purifying, carburetting, and increasing the illuminating power of coal gas." Feb. 24, 1874.

717.—ROBINSON, A. H., "Improvements in meters for measuring water and other liquids, and in motive-power engines, parts of such improvements being also applicable to flushing water-closets and preventing waste of water." Feb. 25, 1874.

733.—SOMERVILLE, J., "Improvements in the method of manufacturing gas for lighting and heating, and for the apparatus used therein." Feb. 27, 1874.

766.—BECK, W. H., "Improvements in the manufacture of illuminating gas, and in apparatus employed therein." March 2, 1874.

800.—FORBES, Rev. G. H., "A new or improved compound for use as fuel, or for the manufacture of gas for heating and illuminating purposes, capable also of being used in the production of a material suitable for the purification of gas." March 4, 1874.

810.—WESTON, J. H., "Improved means and apparatus for increasing the illuminating power of gas in lamps, and other mediums of lighting, portable, and otherwise." March 5, 1874.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

315.—JOHNSON, J. H., "Improvements in gas and other pressure regulators." Feb. 3, 1870.

364.—WIGNER, G. W., "Improvements in the mode of and apparatus for treating and purifying sewage." Feb. 8, 1870.

463.—LEONI, S., "Improvements in apparatus for cooking, heating, and lighting by gas." Feb. 17, 1870.

506.—LEOPARD, J., "Improvements in treating and filtering sewage, and in apparatus to be employed for these purposes." Feb. 21, 1870.

565.—HOLDEN, J. J., "Improvements in apparatus for charging and discharging gas-retorts, and for other similar purposes." Feb. 25, 1870.

713.—LUNDY, J. J., "Improvements in effecting the decolorization, deodorization, and purification of foul and waste waters and sewage, and of supernatant sewage water." March 10, 1870.

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NOTICE TO SUBSCRIBERS.

In consequence of the Easter Holidays, the next Number of the JOURNAL OF GAS LIGHTING will not be published until Wednesday, April 4.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

A LOVER OF FAIR PLAY.—We cannot insert anonymous correspondence.

H. asks: "Is it the practice of gas engineers, generally, to bye-pass the condenser same as subsequent apparatus?"—If there be more than one condenser, one or both should be bye-passed, or partially so, in case of low temperature, or throwing out for cleaning or repairs. If there be only one, it is a good plan to be able to bye-pass a part in case of low temperature.

N. T.—Your mode of washing does not appear to us to be effective, and we fear that unless the water be supplied at such a pressure as to convert it into a spray, it would be almost useless. According to the arrangement shown, the water would dribble away through two or three holes, and no impurity would be removed thereby.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 27, 1877.

Circular to Gas Companies.

ABOUT the time we went to press last evening, Mr. Raikes, the Chairman of Ways and Means in the House of Commons, was moving the adoption of a new Standing Order of the House, to follow Standing Order 188, relating to private business. It was, no doubt, adopted, and is to the following effect:—"In every Gas Bill, by which an existing Gas Company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender, at the best price which can be obtained." Now, much as we love all auctioneers, and glad as we should be to see their opportunities increased, so that they might be induced to attend more

to their own business, and indulge in fewer insults to gas officials, we are bound to say that we see no especial advantage to anybody in auction clauses. Thanks to Earl Redesdale, the dividend on the additional capital of Gas Companies is now limited to seven per cent. When such capital is put up to auction, it fetches a price which reduces the interest to the investor to about five per cent.—the amount paid above the nominal value of the shares, or the premium, as it is called, being considered capital not entitled to dividend. We fail to see any special virtue in this non-dividend bearing capital; but, on the contrary, regard it as offering many temptations. We think, therefore, it would be far better if the Legislature would abolish the hammer-work, with its inevitable commission—and what auctioneer would not rejoice over the smallest reduction in the expenses of a Gas Company?—and at once say that the maximum dividend on additional capital shall be five per cent. In this way, existing shareholders would get what the Legislature has in past times assigned to them, and the public would be spared the payment of two per cent., while a good deal of unnecessary trouble, and some little expense, would be saved to the Gas Companies concerned. We write this with the conviction that, before these lines meet the reader's eye, the Standing Order will have been adopted; but, nevertheless, we think it right to put a protest upon paper.

For the advantage of our Irish friends, we may call their attention to the Public Health (Ireland) Bill, which proposes to do for Irish Local Authorities and Gas Companies exactly what the English Public Health Act, 1875, has done for us in this country. We may say that up to this time the English Act has done no harm to gas interests, but it is capable of being made an instrument of wrong-doing, and, therefore, we give to our Irish brethren the advice we have repeatedly tendered to English Companies, and say that no Company of any standing, or with prospects, should neglect to clothe themselves, as early as possible, with statutory powers, either by Provisional Order or by special Act. These, so long as the Company do their duty to the public fairly, constitute a coat of mail, proof against the attacks of a Local Authority; without them the Company are at the mercy of any Board in their district.

How important it is that a Gas Company should have statutory powers, is shown by a report we shall publish in our next number. It is no fault of the Colne Valley Gas Company that they have not statutory rights. They tried to obtain them last session, but were unsuccessful, being opposed by the Longwood Gas Company, already in possession of the greater part of the limits they proposed, and being incorporated with statutory powers. The Colne Valley Company seem to have had their origin in the opposition of some millowners along the valley to the Longwood Company, whose gas they considered too dear, and hence desired to set up a competing supply. Now, according to the present state of the law, no competition between a statutory and a non-statutory company is possible. The Legislature might confer competing powers under peculiar circumstances, but, without such authority, competition is out of the question. It cannot be too widely known among non-statutory Gas Companies, that no authority save Parliament can enable them, with impunity, to break up a public road. Any one—he need not, we believe, be a resident in the district—can indict a Company, who break up a highway, for committing a nuisance. Under such circumstances, it is, as we have said, the duty of Gas Companies to clearly define their limits, and obtain legislative sanction for their undertaking. When the limits proposed overlap those of another Company, Parliament must decide between the contending parties.

It may well be supposed that the Chartered Company, in accordance with the suggestion of the Board of Trade, will introduce into the Bill they are promoting a clause or clauses to remove the difficulty that arises from the impossibility of specifying the particular manufacturing station from which gas or defective illuminating power is delivered. The great sulphur battle will not be fought for some weeks, and the issue is somewhat doubtful. In the meantime, the Board of Trade have intimated to the Metropolitan Board of Works their intention, if the Bill of the Chartered Company should fail to obtain the sanction of Parliament, to consider the propriety of introducing a short Bill to remove the difficulty above referred to. This is very kind. It appears that some correspondence has taken place between the Board of Trade and the Gas Referees, about the purification of gas from sulphur. We have not yet received a copy of this correspondence, but shall endeavour to obtain one, and allow our readers to form their own judgment of its value.

The Metropolis Gas Act, 1860, was one of the most equitable measures ever passed by Parliament. It did justice to the Gas Companies, while it offered to consumers and Local Authorities,

full powers for compelling compliance with its provisions. It is hardly necessary to say, that the Vestries and District Boards, for the most part, took no interest in the matter. A few did set up testing-places, and appointed utterly incompetent examiners. The only serious attempt to enforce the provisions of the Act was made by the Corporation of the City of London; but the single prosecution instituted by that body broke down on a purely technical point. Nothing like that failure could have occurred in the case of any Vestry or District Board in the Metropolis; but no one of them ever took any steps to enforce the Act. Now, in this year of grace, 1877, the Vestry of Rotherhithe, who have had for sixteen years full powers, under the Act we have mentioned, to test the gas of the Surrey Consumers Company, apply to the Metropolitan Board of Works, who have no power of the sort, to cause the gas supplied to the parish to be tested for them. They were very properly snubbed, and told that the law gave them all the powers necessary, if they would only put them in force. That a London Vestry should not know the protection conferred by the Act of 1860 is extraordinary, and seems to show that they must have a treasure of a clerk. How he earns his salary—which, in the case of most vestry-clerks, is really “princely”—we cannot imagine. We wonder whether he spends his princely emolument (hours of duty, say, from ten a.m. to four p.m.) on pictures.

The gas disputes at Wigan have attracted much attention all over the kingdom, for there is hardly a town in which similar disputes have not, at some time or other, arisen. We print, in another place, the report of Mr. Newbigging to the Committee of the Gas Consumers Association. Our readers will remember that the Committee nominated the gentleman, whose report we print, together with Mr. Littlewood, of the Manchester Gas-Works, to make the inquiry; but it seems that the Gas Committee of the Corporation of Manchester refused Mr. Littlewood permission to join in the investigation, alleging that it is contrary to their practice to allow their servants to undertake duties outside their own gas-works. This seems curious, since everybody knows that whenever a Gas Company are attacked in Parliament by municipal body, Sir Joseph Heron invariably turns up as a witness. In the instance under notice, the one Corporation might with propriety have assisted the other, the more so as the Corporation of Manchester are not altogether free from the complaints brought against the sister Corporation of Wigan.

Mr. Newbigging's report is of much interest, but it travels over more ground than we have space to follow. There can be no doubt that he satisfactorily explains the cause of the apparently anomalous increase in the amount of the consumers gas bills. It would seem clear that the gas supply of Wigan can never be in a satisfactory state until the whole undertaking is remodelled. All our readers will sympathize with the unfortunate manager, condemned to keep up a sufficient supply under the circumstances described. In the account of the mains, certain revelations are made which demand a most strict inquiry. The circumstances are, as far as our recollection serves us, altogether unprecedented. We never before heard, or read, of an instance in which the mains of a Corporation or Gas Company were tampered with as described by Mr. Newbigging. It is, however, very satisfactory to learn that, with all their difficulties—and their plunder, some will say—the Corporation of Wigan made last year a profit of £11,000 by the supply of gas, and it is supposed that a reduction of price will soon be announced.

The Sheffield Gas Company are about to reduce the price of gas, and comic writers are anticipating that the gas bills will, in consequence, be higher than ever. People say the same at Wigan, so Companies and Corporations equally find it difficult to satisfy their customers. The fact is that a gas consumer is like a man under castigation with the cat-o'-nine-tails. There is no pleasing him.

The Corporation of Worcester have cast longing eyes on the Gas Company, but, up to recently, have taken no steps towards confiscation. Now, however, they have instructed their Town-Clerk to write to all other Town-Clerks, and ask whether or not their Corporations possess a gas undertaking, and, if they do, whether or not it is profitable, and to what extent. We hope that all Town-Clerks will receive the communication with equanimity, and freely supply all the information requested. The returns, when made up, will form a very interesting document, which we shall hope to be able to lay before our readers. We do not suppose that it will frighten the Corporation from their purpose. It cannot be denied that the great majority of the gas undertakings in the hands of Municipalities are sources of profit. To the questions about to be asked, we think that another might have been added, the answer to which might have been useful to one, at all events, in the Corporation of Worcester. It should have been asked what the Municipalities, who have bought up Gas Companies, have paid for the undertakings. It will be seen in

the report that the Alderman who leads the attack proposes to acquire the Worcester Gas Company, by giving to the shareholders bonds to the amount of £25,000, bearing interest at the rate of ten per cent. The sum named, we suppose, represents the expended capital of the Company; but, according to the worthy Alderman's own showing, the Company have, beyond their capital, spent on the works £50,000 or £60,000 out of profits. Does he expect to get the value of this expenditure for nothing? If he do, he will soon be undeceived, when the matter comes before a Parliamentary Committee.

The Warrington Gas Purchase Bill has practically been passed, of course, without opposition, and thus another Gas Company disappears.

By the passing, unopposed, of the Blackburn Borough Gas, Water, and Extension Bill, with a slight modification, the Blackburn Gas Company are also extinguished. The Company, at the last moment, withdrew their opposition, and consented to sell by agreement, the terms being already arranged. What these are we do not, at present, know; but shall, of course, learn in due time.

The case of the Ramsgate Local Board Bill, before a Committee of the House of Commons, dragged its slow length along for more than a week, when the Board put forward a witness—a gas-fitter—who swore that the gas supplied by the Isle of Thanet Gas Company to Margate was so impure that he had seen it escape from a leak in a gas-pipe in the shape of a yellow vapour. This was enough for the Committee, and although the counsel of the Board stated that he had several more witnesses to call, the case for the promoters was promptly closed. That for the Gas and Water Companies was opened without any speechifying, and after the examination of several witnesses, the Committee, on Friday last, on adjourning, expressed a hope, as they had done a week previously, that before they met again on Monday, some agreement would be come to by the contending parties. On reassembling yesterday, however, they found that no agreement had been arrived at, and we do not see how it could. It was impossible that the Companies could give way, and in the end (to cut the story short for this week) the Committee declared the preamble of the Ramsgate Local Board “not proved,” and they passed the preambles of the Bills of the Isle of Thanet Gas and Ramsgate Water Companies. There remains to be a fight over the clauses in both Bills, which will take place when the Committee meet again after Easter. The main obstacle to a prompt settlement of the dispute appears to be some question as to the amount of “Improvement Stock” to be allowed; and on this point we shall offer no opinion as the matter now stands, being certain that the Companies will propose only what is just.

The accounts of the Alliance and Dublin Company for the past half year, with the report of the Directors, have been published. It is gratifying to see that the Directors are able to propose a ten per cent. dividend, after the payment of which, free of income-tax, there will be the respectable balance of £5201 to carry forward. We shall refer to the accounts again, and shall now only congratulate the shareholders on the success achieved.

At Preston, the Borough Accountant publishes a yearly analysis of the accounts of the Gas Company. That for 1876 has just been issued. It is hardly necessary to say that it shows the Company to be in a very prosperous condition. Full dividends have been paid, while the reserve-fund has been added to, so that it now stands at almost the maximum amount. There is no doubt that this excellently-managed Company give perfect satisfaction in the borough, and we hear nothing at Preston about making a compulsory purchase. We shall give the analysis next week.

A deputation from the Liverpool Land and House Owners Association have had an interview with the Home Secretary, to protest against the repeal of the Borough Funds Act, the advisability of which the Association of Municipal Officers urged upon Mr. Cross the other day. Although we have regretted the operation of the Borough Funds Act in Liverpool, we entirely agree with the deputation, in claiming for the ratepayers a direct control over extraordinary expenditure. The circumstances at Liverpool are, it seems, a little peculiar. The greater number of members of the Corporation are not residents in the borough, and are, consequently, but small ratepayers, and the deputation, who professed to represent the large ratepayers, objected to the Town Council having an uncontrolled command over the real ratepayers purses. The Home Secretary was, of course, reticent; but we do not think Gas Companies need fear the repeal of the Borough Funds Act this session.

A formal commencement of the proceedings in connexion with the purchase of portions of the gas undertaking of the Corporation of Birmingham, by several outlying Local Authorities,

was made on the 18th inst. The arbitrator appointed by the Corporation is Mr. T. Hawksley, and the Local Boards have selected Mr. F. J. Bramwell. These gentlemen have chosen Sir H. A. Hunt as umpire. The inquiry will necessarily be protracted, and as it would be extremely inconvenient for the arbitrators and umpire to be absent from London, until the Private Bills before Parliament have been disposed of, the proceedings at Birmingham have been adjourned until the end of July, the precise day not having been fixed.

The accounts of the South Metropolitan Company, for the past half year, have been issued. They show a balance applicable to dividend of £26,230 19s., and as the payment of full dividends will only absorb £21,500, there is a substantial balance to carry forward. In the current half year, the advanced price of gas and the meter-rents will, no doubt, result in a still more favourable balance-sheet.

The accounts of the London Gas Company for the half year show a balance applicable to dividend, on ordinary capital, of £30,517. The amount required for payment of full dividends is £19,185; there is, therefore, a sum of £11,332 to be carried forward to the current half year.

The Crystal Palace District Company are scarcely less fortunate. The Directors propose to pay full dividends, and when they have done so, there will remain a balance of £390.

Correspondence.

ESTIMATION OF SULPHUR IN COAL GAS.

SIR,—My attention has just been directed by Mr. Heisch to a paper by Messrs. Silliman and Sadler "On the Volumetric Estimation of Sulphur in Coal Gas," published in the current issue of your valuable JOURNAL. The enclosed paper* upon the same subject was at that moment lying on my table, waiting transmission to you. You will notice that, although the principle is precisely the same as that involved in the former paper, the apparatus used is different, the form I recommend is more simple, and, moreover, is at hand in most large English laboratories where gas-testing is carried on.

I am very glad to find that Messrs. Silliman and Sadler confirm my results so perfectly, and trust, under the circumstances, you will kindly find space for my paper in an early issue.

I may add that the successive stages in my experiments were perfectly well known to Mr. Heisch, and that the fact of my applying standard alkaline solutions to this purpose is known to Mr. Trewby, of the Beckton works (indeed, Mr. Bush, of the same works, tried experiments with my standard solutions nearly two years back), to several of the metropolitan gas examiners, and many others.

W. C. YOUNG, F.C.S., &c.,
City of London and Metropolitan Gas Examiner.

Gas Examiner's Laboratory, Beckton Road, North Woolwich, E.,
March 21, 1877.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MARCH 19, 1877.

Petitions were presented in favour of the Blackburn Borough Gas, Water, and Extension Bill from (1) Inhabitants of Blackburn, (2) Spinners, weavers, and operatives of Blackburn; and in favour of the East Worcestershire Water Bill from Local Board of Redditch.

TUESDAY, MARCH 20.

The Examiners reported that the further Standing Orders applicable to the Sittingbourne Gas Bill had been complied with.

The Select Committee on the Blackburn Borough Gas, Water, and Extension Bill, reported that they had not proceeded with the consideration of the Bill, having found that the petitioner had no *locus standi* before them.

The Lowestoft Water, Gas, and Market Bill was reported, with amendments.

The Duke of RICHMOND and GORDON gave notice that on Friday, March 23, he would move for a select committee, to inquire into the operation of existing statutes in regard to the formation of, and proceedings by, Commissioners of Sewers, Drainage, and River Navigation Boards; to consider by what means such bodies may be more conveniently and inexpensively constituted, their procedure improved, and their powers enlarged, so as to provide more efficiently for storage of water, the prevention of floods, and the discharge of other functions appertaining to conservancy boards.

THURSDAY, MARCH 22.

A petition in favour of the East Worcestershire Water Bill was presented from the Local Board and Town Commissioners of Bromsgrove.

FRIDAY, MARCH 23.

The Sittingbourne Gas Bill was read a second time and committed. The Lowestoft Water, Gas, and Market Bill was read the third time, passed, and sent to the Commons.

The Dublin Improvement Acts Amendment Bill was read the first time. A petition against the Sittingbourne Gas Bill was presented from the Milton-next-Sittingbourne Town Improvement Commissioners.

PREVENTION OF FLOODS AND STORAGE OF WATER.

The Duke of RICHMOND, in moving for a select committee to inquire into the operation of the existing statutes in regard to the formation of and proceedings by Commissioners of Sewers, Drainage, and Navigation Boards, and to consider by what means such bodies might be more conveniently and inexpensively constituted, their procedure improved, and

their powers enlarged, so as to provide more efficiently for storage of water, the prevention of floods, and the discharge of other functions appertaining to conservancy boards, said that, considering the state to which the country was brought during the last autumn and winter, from the prevalence of floods, he thought it would not be deemed surprising that the Government had taken up the matter to which his motion referred. The powers vested in the commissioners, though useful for ordinary occasions, were evidently not sufficient at periods of great floods. Another object which made the appointment of a committee desirable was that an inquiry might be instituted respecting the storage of water in different parts of the country.

The Marquis of RIFON entirely approved the motion, and suggested that the inquiry should be completed as soon as possible. He also thought that each separate river should be maintained under local management.

Earl FORTESEUE trusted that no time might be lost in legislating on the subject.

The motion was agreed to.

HOUSE OF COMMONS.

MONDAY, MARCH 19, 1877.

The Gaslight and Coke Company Bill was read a second time, and committed.

The Examiners reported that the further Standing Order applicable to the Colne Valley Gas Bill has been complied with.

A petition in favour of the Ramsgate Local Board Bill was presented from Ratepayers of High Street, Ramsgate.

The following petitions against the Leeds Improvement Bill were withdrawn:—(1) Great Northern Railway Company, (2) Aire and Calder Navigation Company, (3) Fire insurance companies, (4) Owners of houses, &c., in Leeds, (5) Leeds and Liverpool Canal Company.

METROPOLITAN VESTRY CONTRACTS.

Mr. BECKETT DENISON gave notice that early after Easter he would move for a select committee to inquire into the system of metropolitan vestry contracts, in so far as they affect the paving, lighting, cleansing, and watering of the streets of the Metropolis outside the City of London, and the removal of refuse from dwellings.

TUESDAY, MARCH 20.

The North Cheshire Water Bill was read a second time, and committed. On the motion of Sir CHARLES FORSTER, it was ordered that the minutes of the evidence taken before the Referees on the Leeds Corporation Water Bill, in session 1867, be referred to the committee on the Leeds Improvement Bill.

A petition in favour of the Hanley Corporation Gas Bill was presented from Inhabitants and ratepayers of Hanley, in public meeting assembled.

The petitions were withdrawn of (1) Earl Cowper, (2) Middleton Estate and Colliery Company, Limited, and others, against the Leeds Improvement Bill; and of (1) Corporation of Newcastle-upon-Tyne, (2) Corporation of Gateshead, against the Newcastle and Gateshead Water Bill.

The Glasgow Corporation Water and Perth Water Bills were referred to a Select Committee, consisting of Lord Eslington (chairman), Sir Nathaniel de Rothschild, Mr. Fay, and Mr. Fremantle; to meet on Tuesday, April 10.

The Bolton Improvement, Bishop Auckland District Gas, and Newcastle and Gateshead Water Bills were referred to a Select Committee consisting of Sir John St. Aubyn (chairman), Mr. Bromley Davenport, Mr. Finch, and Mr. Browne; to meet on Wednesday, April 11.

Mr. Cawley's motion in regard to Private Bill Legislation was further deferred from Tuesday, March 27, to April 17.

STORAGE OF WATER FOR THE USE OF VILLAGES.

Mr. RYDER asked the Secretary of State for the Home Department whether the kindred question of the storage of water for the use of villages will be referred to the Select Committee of the House of Lords which is to be appointed to consider the subject of the Prevention of Floods.

Mr. CROSS said that the Lord President of the Council would give notice in the House of Lords very shortly—probably that evening—of his intention to move for a Select Committee to consider the subject of the prevention of floods. The same committee would also consider the kindred question of the storage of water for the use of villages.

WEDNESDAY, MARCH 21.

The Heywood Water Bill was read a second time and committed. A petition in favour of the Leeds Improvement Bill was presented from the Leeds Chamber of Commerce.

A petition against the Crystal Palace District Gas Bill (the petitioners not praying to be heard) was presented from the Bromley Union Rural Sanitary Authority.

AUCTION CLAUSES IN GAS BILLS.

Mr. RAIKES gave notice that, on Monday, March 26, he would move the following new Standing Order:—

"Gas Companies—Additional Capital.—In every Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender, at the best price which can be obtained."

THURSDAY, MARCH 22.

The Examiners reported that the further Standing Order applicable to the Newport (Monmouthshire) Gas, and Waterford Gas Bills has been complied with.

A petition in favour of the Perth Water Bill was presented from the Glover Incorporation of Perth.

The Select Committee on the Glasgow Corporation Water and Perth Water Bills was altered by the appointment of Mr. Heygate (chairman) and Mr. W. E. Price, in place of Lord Eslington and Mr. Fay.

FRIDAY, MARCH 23.

The following Bills were reported:—Maryport District and Harbour Gas; Middlesbrough Corporation; Rotherham Corporation; Warrington Corporation Gas.

The Edinburgh and District Water Bill, as amended, was considered, and amendments made.

The Falmouth Water and London Corporation Bills, as amended, were considered.

The Longton Corporation Bill, as amended, was considered, and an amendment made.

The Examiners reported that the further Standing Order applicable to the Woolwich, Plumstead, and Charlton Consumers Gas Bill has been complied with.

Mr. WHALLEY gave notice that on Monday, March 26, he would move for leave to bring in a Bill to give further facilities to landowners of limited estates in England and Wales to charge such estates with the expense of constructing reservoirs for the storage of water.

* Mr. Young's paper is given on page 464.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

SATURDAY, MARCH 24.

(Before Vice-Chancellor MALINS.)

In re THE EUPION GAS COMPANY.

The further hearing of the motion in this matter was resumed this morning.

Mr. HIGGINS, Q.C. (with him Mr. DIBDEN), stated that, after full consideration, he had come to the conclusion that the decision given by his lordship on March 17, in Henry Kelsall Aspinall's case, applied equally to all the cases of original allottees. The following persons would, therefore, be placed upon the register for the number of shares held by them:—Mr. John Eames Aspinall, 500 shares; William Christian Aspinall, 250; Henry Edward Aspinall, 600; Guy White, 600; John Holmes, 25; William White, 1000; and G. P. Knocker, 1200. The next case was that of John Richardson, whom it was sought to put on the list for 20,900 shares. As the facts were different to those in the former case, he would call his lordship's attention to them. Since the proceedings had been instituted Richardson had died, and he was, therefore, represented by his legal personal representative.

Mr. GLASSE said that the official liquidator was quite willing Richardson's name should be taken off the list in respect of 15,000 out of the 20,900 shares, they being vendor's shares.

Mr. HIGGINS said that, as those shares had been transferred to him without notice, it was clear that the call order could not be supported.

The VICE-CHANCELLOR: I understand that the official liquidator gives them up.

Mr. GLASSE said that was so. He was quite content to keep Richardson on the list for 5900 shares.

Mr. HIGGINS said he might mention that the decision in this case would also govern the cases of Ernest Dawson and Alexander Cloy. These three were transferees of fully paid-up shares, the transfers being deposited with the company, who accepted them as transfers of fully paid-up shares. Richardson before his death made an affidavit, in which he stated that until the 7th or 8th of September, 1874, he never heard of the company, and knew nothing of its creation, that at the request of Joseph Aspinall he allowed his name to be used as a transferee of fully paid-up shares, and that he acted solely as Joseph Aspinall's agent. The case was clearly within the authority of Carling's case, *In re The Western of Canada Oil-Works Company*, and therefore Richardson's name must be taken off the list.

Mr. GLASSE, Q.C. (with him Mr. MONTAGUE COOKSON, Q.C.), for the official liquidator, said that, on the date of the transfer in question, there were 50,000 shares in the company, and at the request of Joseph Aspinall, Richardson and his two clerks, Dawson and Cloy, voluntarily took a transfer of 25,870 shares, and on the same day they executed a blank transfer of the shares, which they put into the hands of Joseph Aspinall, and not one single shilling was paid upon the shares. Richardson, in his affidavit, gave the following account of the transaction:—"At the request, and as the agent of Joseph Aspinall, I permitted my name to be used as transferee for fully paid-up shares in the company, amounting altogether to 20,900, and I acted solely as Joseph Aspinall's agent. The shares were represented to be, and they were described, as fully paid-up shares. I paid no money in respect of them, nor have I ever received any money or interest in any shape or form for the use of my name, either from Joseph Aspinall or from any one else whomsoever, and had the shares not been represented to me as fully paid-up, I should not have taken them, or permitted my name to be used by Aspinall. Immediately after signing the transfer of the shares to me, I, at the request of Aspinall, executed a transfer of every one of the shares from myself, in the usual form of transfer, with a blank left for the name of the transferee, to be filled in by Aspinall." That was Richardson's own statement, and he put it to his lordship whether that was not part of the original fraud.

The VICE-CHANCELLOR said it appeared to him to be so.

Mr. HIGGINS said the evidence did not bring home to either Richardson, Dawson, or Cloy any knowledge of the company's fraud.

Mr. GLASSE said he did not wish to impute fraud to the three persons. If any one chose to throw himself into the arms of Joseph Aspinall, as Richardson did, he must take the consequences of so doing.

The VICE-CHANCELLOR said that if merchants would lend themselves to such transactions, by which a fraud was committed upon the public, they must take the consequences. If Mr. Higgins thought he could make anything of the case, he would hear it upon another occasion. As it was past the time for the rising of the Court, the case would stand part heard for Mr. Higgins to reply.

Mr. HIGGINS thought it would be useless, after his lordship had expressed such an opinion, to occupy the time of the Court further.

The VICE-CHANCELLOR said that Richardson had, upon his own showing, aided, abetted, and assisted Joseph Aspinall in the perpetration of the fraud for which he had been convicted; therefore his name would remain upon the list for the 5900 shares. Dawson and Cloy would also be put upon the list in respect of the shares held by them. If persons did not fend themselves to such transactions as the present, the frauds upon the public would not take place.

Mr. HIGGINS said the next case was that of Joseph Aspinall, who was settled on the list for 2200 shares. As to 2000 of them he was a transferee, and, therefore, after his lordship's judgment, it would be useless to contend he was not liable. But as to the 200 shares, his case was that he paid for them by a cheque on his own private bankers, and that he never got the money from the company at all. Therefore he should submit that Joseph Aspinall ought not to be put on the list for the 200 shares.

Mr. GLASSE said it was perfectly plain, from the books, that Joseph Aspinall got the money from the Midland Bank in the first instance, that he then paid it into his own bankers, then to the company, and afterwards back to the bank.

The VICE-CHANCELLOR considered that he must be put on the list in respect of the whole number.

Mr. HIGGINS asked that Richardson's costs might be paid by the company, he having succeeded upon the greater part of his case, being relieved of liability in respect of 15,000 out of 20,900 shares.

The VICE-CHANCELLOR said he could not give any costs. The costs of the official liquidator would be borne jointly and severally by the parties who had lost.

ILFRACOMBE SPECIAL SESSIONS.—TUESDAY, MARCH 20.

(Before Mr. N. VYE, Chairman; Rev. H. W. TOMES, and Mr. G. N. MAULE.)

ALLEGED NUISANCE AT THE ILFRACOMBE GAS-WORKS.

In this case, three summonses had been taken out by the Local Board, as the Urban Sanitary Authority, against the Gas Company, for nuisance; the first being for unlawfully carrying on the business of manufacturers of sulphate of ammonia, which was noxious and offensive, and which was established after the passing of the Public Health Act, 1875, without first obtaining the consent, in writing, of the local board, the board being the Urban Sanitary Authority for the district. The second summons was for

unlawfully carrying on the business of manufacturers of sulphate of ammonia, so as to cause effluvia, which was a nuisance, or injurious to the health of the inhabitants. The third summons was for unlawfully carrying on the business of gas manufacturers, so as to cause effluvia, which was a nuisance, or injurious to the health of the inhabitants of the district.

Mr. THORNE, who appeared with Mr. BARRETT to prosecute for the local board, said he proposed to take the third summons first. This summons was taken out under the 114th section of the Public Health Act, 1875, which provided that if any manufactory, building, or place used for any trade, business, process, or manufacture, causing effluvia, was certified to the Urban Authority by the Medical Officer of Health, or by any two legally qualified medical practitioners, or by any ten inhabitants of the district, to be a nuisance, or injurious to the health of any of the inhabitants of the district, the Urban Authority were bound to direct complaint to be made before a justice, who might summon the person by or on whose behalf the trade so complained of was carried on, to appear before a court of summary jurisdiction. In the present case, there was no ill-feeling against the company by the local board, but these proceedings had been instituted in consequence of a certificate having been presented to them, signed by ten or more inhabitants of the district, in conformity with the Act, and calling upon them to take the matter before the justices. He did not wish it to be inferred, however, that the local board differed from the opinions stated by the inhabitants; he simply stated the fact to prevent an inference being drawn one way or the other. The certificate of the inhabitants complaining of a nuisance arising from the gas-works was then read, and Mr. Thorne proceeded to explain the nature of the alleged nuisance, stating that the escape of sulphuretted hydrogen was the principal cause of the nuisance. That was a gas which was of a highly injurious character, as was shown by Dr. Blyth's "Dictionary of Hygiene and Public Health," which stated that it was an active poison, and when breathed undiluted was immediately fatal; it was absorbed by the blood, and thus circulated in all the tissues of the body, and it was a nuisance most decidedly injurious to health. Another matter which caused a bad smell was the manufacture of sulphate of ammonia, and Dr. Letheby had laid down, in a lecture, delivered in January, 1875, how the evils arising from sulphate of ammonia might be avoided. Mr. Thorne concluded by stating that the local board had no desire to have a fine inflicted on the gas company, but only that the nuisance should be abated. There was no doubt that lately they had been setting their house in order, and he thought litigation might have been prevented had the gas company frankly asked the board to visit the works, and see what they were doing.

Formal proof was given by the clerk to the local board (Mr. W. E. Langdon) of the receipt of the certificate of complaint.

Mr. Joseph Brand, grocer, of High Street, stated that he signed the certificate. The smells in question had been a nuisance to him and his family for a long time past, especially on the 18th of January and 6th of February. Latterly it had not been so bad, but some time back it used to occur about once a week. The smell was very nauseous, worse than the smell from a drain; the effect it had upon him was to make him sick. In his opinion the smell proceeded from the gas-works. He had seen droppings of stuff like lime in the streets, and had traced them to the gas-works. The stuff presented the appearance of lime reduced to a kind of mortar, with a mixture something like brimstone in colour, and he had seen this stuff carted away from the works in open carts. His wife had suffered in a similar way to himself. The smells generally lasted two or three hours. He had on many occasions been obliged to leave his house. The gas pendants in his house frequently got discoloured, but he did not know enough of the subject to say whether the discolouration was caused by the sulphuretted hydrogen.

Mrs. Barrett, wife of a schoolmaster, living at No. 1, Brookfield Place, who also signed the certificate, deposed to the bad smells from what she believed to be the gas-works. The smells occurred three or four times a week. She was obliged to shut all the windows and doors in order to exclude the smells. It generally had the effect of making her sick.

Lieutenant Williams, residing at Watermouth Castle, stated that he was the principal complainant in the case. He had obtained the signatures to the certificate, because he was informed that it was necessary to do so. He had some property near the gas-works, and, on Jan. 18, in consequence of a communication from the wife of his tenant (Sir Thomas Hepburn), he immediately came into the town, and in the district of the gas-works he noticed an abominable and intolerable stench, just as if a dozen cesspits were being simultaneously emptied. He then went to the first ten inhabitants, and got the certificate signed. He had been obliged to have another window made on the opposite side of his house, so as to counteract in a slight measure the smells.

Mr. Richard Lock said he very often noticed a disagreeable smell issuing from the gas-works. In cross-examination, he stated that it did not injure him or his family, for he did not take much notice of the smell of gas.

Mrs. Hookway, wife of a baker, deposed to noticing bad smells which made her sick, but when the wind blew from her house towards the gas-works, the smell was not so bad.

Mr. Barrett, schoolmaster, spoke as to the bad smells, which he likened to that arising from a rotten egg.

Mr. Coats, of High Street, stated that he had suffered from sickness and headache very much from the smell, which was very bad on Jan. 18, 26, 29, 30, Feb. 6, 7, 17, 19, and March 2, 13, and 14. He had no doubt that it arose from the gas-works. His wife often vomited when the smell came into their house. On Jan. 29 it was very bad, lasting nearly all day. It was generally worse about eight o'clock in the morning.

Mr. and Mrs. Blackford and Mrs. Baldon gave similar testimony, the latter stating that the smells sometimes were sufficient to suffocate her. She was able to taste the gas with her food. It had affected the appetites of her children. It had made her always feel very unwell.

At this stage of the proceedings the Court was adjourned, and the magistrates paid a visit to the gas-works. On resuming,

Dr. Slade-King, the Medical Officer of Health to the Local Board, was examined. He stated that he had some familiarity with the process of making gas. His attention had been called to the prevalence of bad smells existing at the gas-works, and in consequence he had gone there, and had sometimes found strong effluvia, and sometimes not. He had also seen the product of sulphate of ammonia. The smell would affect people in different ways. The symptoms of which the previous witnesses had complained were what might reasonably be expected. Sulphuretted hydrogen would be found in the manufacture of sulphate of ammonia; the purifiers also gave off a stinking compound of ammonia and sulphur. The purifying substance the gas company used was ordinary white lime, which he had seen there; he had also seen the spent material in transit from the works. When brought in contact with earth the smell of the lime would not be so great. He had seen the lime covered with ashes, but the dry earth system was the best. The witness suggested certain improvements with respect to the purifiers, the carting of the lime, and the working of the scrubbers, stating that he believed the leak in the scrubbers was now remedied. The lime had been permitted to remain in the purifiers longer than it should, and the purifiers had become surcharged. The lime should be more frequently changed.

Mr. FRINCH, who appeared for the gas company, read a report made by Dr. King on the state of the gas-works in the year 1876, which stated that he did not consider the manufacture of gas in the town a nuisance, and asked Dr. King when he had reason to change his mind.

Witness stated, that he had reason to change his mind when an immense quantity of ammoniacal liquor was turned into the stream. He did not think that the effluvia arising from the Ilfracombe Gas-Works, particularly during the past six months, were injurious to health so as to cause disease, but he believed them to be a nuisance in the broader sense of the term—they were noxious. He believed when cholera prevailed, the neighbourhood of gas-works was healthy.

Mr. Pile, surveyor to the local board, stated that he visited the gas-works the previous week, and saw a lot of lime exposed to the air. The smell was very bad indeed, he being able to smell it in the High Street. The lime was entirely uncovered.

This was the case for the prosecution.

Mr. FRINCH, in addressing the Bench on behalf of the gas company, contended that there had not been a single item of evidence upon which they could rely to convict the company of having created a nuisance; in fact, he claimed the evidence of Dr. Slade-King as being on his side, for he positively stated that the smell was not injurious to health. He himself (Mr. Frinch) acknowledged that there had been a smell, and that there had been a leakage in the scrubbers, but that was now rectified.

Mr. Wivell, chairman of the gas company, stated that in 1872 the company obtained an Act of Parliament, and they then laid out between £5000 and £6000 in remodelling and reconstructing their works.

Mr. Willey, gas engineer, of Exeter, stated that he remodelled the gas-works recently, and he considered they were well constructed. He believed the works were well managed, and conducted with the least amount of annoyance to the public. Every possible modern improvement was introduced, and the company had spared no expense to provide themselves with the very best apparatus. It would be unwise to cover over the purifiers, as great danger would arise therefrom. The works for the manufacture of sulphate of ammonia were properly erected, and could, therefore, cause no nuisance. The smell from the works was not, in his opinion, a nuisance.

Mr. Frederick Child, manager to the gas company, deposed to having all the best appliances at the works. They had a scrubber with a wooden top, and the heat of the sun had caused an aperture, but that had now been rectified. He lived at the works with his wife and two children, and none of them suffered from any illness. The sulphate of ammonia works were worked for four or five days in December last, and the last time previous to that was in April.

Mr. Rafarel, manager of the Barnstaple Gas-Works, deposed that the Ilfracombe Gas-Works were of the most modern construction. He did not think it was practicable to work the saturator with a cover on it, as the cover would have to be removed so many times, as Mr. Child had stated. He could not suggest any improvements at the works. Gas could not be manufactured without a certain amount of smell, but whether that was a nuisance was another question. He had never suffered from the smell himself. He did not know an instance of earth being mixed with lime.

Miss Dart, mistress of the National School, close to the gas-works, said she had 170 pupils. She occasionally smelt the gas, but it did not affect her health nor the health of her pupils.

William Harris, who had been a stoker at the gas-works for two years, said he was in very good health. There was a nasty smell sometimes, but it only made him hungry.

William Beer, who looked after the manufacture of sulphate of ammonia, at the Barnstaple Works, said no one enjoyed better health than he did. He could dine at the works.

James Jennings, a gardener, near the works, said his plants and trees were healthy.

Dr. Blyth, analytical chemist, said the Ilfracombe Gas-Works seemed to be constructed on the same principles as other gas-works he had gone over. He had made a quantitative analysis of the amount of sulphide of ammonium, which was the principal ingredient evolved from the gas-works. He found that there were 294 grains of ammonium in a million cubic feet of air. Sulphate of ammonia was given as medicine in doses as large as three grains, and he pointed out to the directors that, supposing the purifiers were being emptied during the whole of 24 hours, a man could not possibly take into his system more than 2-25ths of a grain of sulphate of ammonia from the quantity he estimated at the works. With regard to sulphuretted hydrogen, it was his opinion that it did not emanate from the gas-works, except from the saturator; certainly not from the lime, which was complained of. He did not think the smell from the works was injurious to health.

In answer to Mr. THORNE, witness stated that he would recommend the gas company to erect a new purifier, and also to have a covered cart for the purpose of carrying away the refuse lime. It depended on the quantity, whether sulphuretted hydrogen was injurious to health.

Mr. Richard Lake, one of the directors, stated there had been no delay in carrying away the lime.

This concluded the case, and Mr. THORNE stated that he did not wish a fine imposed, but he was willing for an order being made that the company should carry out the alterations suggested by Dr. Blyth.

The BENCH asked Mr. Frinch if the company were willing to carry them out.

Mr. FRINCH said in reality the alterations were being made, but they would undertake nothing. If the magistrates liked to suspend their judgment, and see if the alterations would be carried out, they would see that they were done, but the company would undertake nothing, because he objected to the Court's jurisdiction under the Act.

Mr. THORNE said in that case the magistrates had power to order that the things be done.

Mr. FRINCH complained that the company were brought into Court after the local board knew they were carrying out the suggested alterations.

After some further discussion, the BENCH said they were of opinion, from the evidence, that effluvia prejudicial to health had emanated from the works.

Mr. THORNE then said it was incumbent on him to ask for an order of some kind, and the Bench decided to inflict a fine if the alterations were not carried out. They adjourned the case to the Comb Martin Sessions in May, for the purpose of giving the company time to carry out the improvements, at which sessions they would give their judgment.

RICHMOND PETTY SESSIONS.—WEDNESDAY, MARCH 21.

(Before Sir H. PARKER, Chairman, and a Bench of Magistrates.)

ALLEGED NUISANCE AT THE RICHMOND GAS-WORKS.

Mr. James Eldridge, manager of the Richmond Gas-Works, was summoned, at the instance of the Rural Sanitary Authority, for allowing the Black Horse ditch to be so foul as to be a nuisance and injurious to health.

Mr. J. Wood, clerk to the Rural Sanitary Authority, appeared in support of the summons, and having opened the case, called

Mr. James Wigan, of Cromwell House, Mortlake, who deposed to the noxious smell proceeding from the works, and stated that he wrote to the

medical officer, and asked him to bring the matter before the Rural Sanitary Authority. He had heard complaints from others.

Dr. Adams, the medical officer, deposed that on several occasions he had observed a nuisance arising from the Black Horse ditch, and on two recent occasions he directly traced it to the gas-works. On Feb. 24 the inspector of nuisances called his attention to the ditch, and they went to the spot. The water in the ditch at Littleworth end was polluted, but the water at the Richmond end was tolerably clear. There was a drain leading from the works, and the contents were running into the ditch. The water produced was taken from the ditch. There was a hole dug about 6 feet away, and a pump and carrier had been rigged up to convey the liquid to the ditch. The liquid was of such a nature as to be a nuisance and injurious to health.

Mr. T. Davis, the inspector of nuisances, corroborated, and added that on questioning a workman at the works the man said that the pipe had broken, and they had taken up the ground to put in a new one. He had frequently visited the works, and always found them in a most satisfactory state.

Mr. Eldridge did not deny there was a nuisance, but contended that it was the back flow from the ditch, and not from the works at all. He was very careful that fluid like that produced should not escape from the works. He received the summons late on Saturday night, and the connexion was totally cut off on Monday morning by nine o'clock.

The BENCH decided that there was a nuisance, and an order was made for its abatement.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

COURT OF COMMON COUNCIL.—At the meeting of the Council on Thursday last, the Gas Committee reported on the reference to them of the Bill of The Gaslight and Coke Company, and recommended that it should be opposed. The report was agreed to.

METROPOLITAN BOARD OF WORKS.—At the meeting on Friday last, the clerk read a letter from the Vestry of Rotherhithe, stating that complaints have been made as to the quality of the gas supplied in Rotherhithe by the Surrey Consumers Gas Company, and requesting the Board to give instructions to have the gas tested for purity and illuminating power. It was resolved that a reply should be sent to the vestry, informing them that the Surrey Consumers Company are not under the control of the Board, but that the vestry themselves have the power, by the 27th section of the Metropolitan Gas Act, 1860, to cause the gas to be tested. A letter was read from the Board of Trade stating that in the event of the Bill of The Gaslight and Coke Company not receiving the sanction of Parliament, the Board will be prepared to consider the advisability of introducing a short Bill, for the purpose of removing the difficulty pointed out by the Gas Referees as to specifying the station from which gas is delivered before forfeiture for defective illuminating power can be recovered. Another letter also was read from the Board of Trade, referring to their letter of the 11th of December last, and copy of correspondence with The Gaslight and Coke Company, relative to the nuisance alleged to be caused by the purification of gas by means of lime; and transmitting copy of correspondence between the Board of Trade and the Gas Referees in regard to the purification of gas from sulphur. Both communications were referred to the Works and General Purposes Committee.

BERMONDSEY VESTRY.—At the meeting of the vestry on the 19th inst., complaints were made of the trouble and annoyance given by the Surrey Consumers Gas Company. Owing to the great number of lamps allotted to each man, it was impossible for the work of cleaning them to be done satisfactorily. The defects in the nipples and regulators were scarcely or never removed, thus diminishing the consumption of gas. Bills were often stuck upon the posts, but the company never took any steps to remove them. The glass of the lanterns was often broken, but the company never prosecuted the offenders, so that constant repairing of the lanterns was necessary. The clerk said he trusted the vestry would adopt some measure that would assist him in placing the district in the same position as those districts supplied by the Phoenix and South Metropolitan Gas Companies. It was decided that the clerk should inquire into and report upon the matter.

METROPOLIS WATER SUPPLY.

Major Bolton reports that the state of the water in the Thames and Lea was indifferent during the month of February. The water taken in being muddy and turbid. The water in the river Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated), was turbid and coloured during the whole of the month of February. The highest flood state of the river was 2 feet 10 inches above the (6 feet) summer level, and the lowest was 1 foot above summer level. The highest temperature of the water taken at Seething Wells was 48°, and the lowest 40°, while the highest temperature of the air at the same place was 57°, and the lowest 33°. The condition of the water in this part of the river was indifferent throughout the month. The highest flood state was 4 feet 2 inches above, and the lowest 2 feet above summer level. These observations were made daily at 9 a.m. The rainfall for the month was 1.89 inches.

WATER SUPPLY OF CHAPELTOWN.—It was announced some time ago in these notes that the Sheffield Water-Works Company had agreed to supply the township of Chapeltown with water delivered in a tank at Potter's Hill, at the maximum rate of 7½d. per 1000 gallons. The township itself will provide and lay the supply pipes from the tank. We are now enabled to state that Messrs. Newton, Chambers, and Co., of the Thorncliffe Iron-Works, have received orders to make the pipes, which will be required to traverse the five miles or so between Sheffield and Potter's Hill, and that the work will be at once proceeded with.—Engineering.

LEGACIES TO GAS WORKMEN.—The South-Eastern Gazette says: "An interesting incident has taken place at the Margate works of the Isle of Thanet Gas Company, in connexion with the bequest by the late Mr. Barker of £5 each to the stokers, lamplighters, and others there employed. The deceased gentleman had left written directions that the men should be assembled to receive the legacies, and that previous to their distribution a paper which he had left should be read to them. The tenor of this message was that he (Mr. Barker) having found by experience the great advantage of carefulness in the employment of money, hoped that the recipients of this mark of his interest in their welfare would invest it in the Savings Bank, and that it might prove the nucleus of future savings, as a store against a rainy day. The men, eighteen in number, were accordingly gathered at the gas-works, King Street, on Saturday, the 3rd inst., when the testator's directions were carried out by the executors, who handed to each of the men a £5 note."

CAGLIARI GAS AND WATER COMPANY, LIMITED.

The Ordinary General Meeting of the Shareholders of this Company was held at the Offices, No. 3, Lothbury, London, on Tuesday, March 20—ERASMUS WILSON, Esq., F.R.S., in the chair.

The SECRETARY (Mr. Rod. Mackay) read the notice convening the meeting; and the following report and statement of accounts were submitted:—

The receipts on revenue account for the past year amount to £17,434 14s. 8d., and the expenditure to £8161 14s. 1d., leaving a clear net revenue for the year of £9273 0s. 7d. The amount available for dividend, including the balance brought forward from the previous year, as shown on the balance-sheet, is£10,661 5 7 Out of which an interim dividend at the rate of 5 per cent. per annum was paid for the half year ending June 30, 1876. £3,596 10 0 The directors recommend a dividend at the rate of 7 per cent. per annum for the half year ending Dec. 31, 1876, amounting to5,056 2 0

Leaving a balance to be carried forward to next year's account of . . . £2,008 13 7 The water receipts for the year show an increase of £182 7s. 4d. over those of the previous year.

The gas receipts for the year show an increase of £216 14s. 7d. The loss from gas leakage has averaged 9 per cent. of the make over the whole year. The amount paid for rates and taxes in Cagliari during the year, and the loss of exchange on remittances to this country during the year, still press somewhat heavily on this company. It will be seen that during the past year £7500 has been raised by the issue of debenture bonds bearing interest at 6 per cent. per annum. The mortgage for £5000 previously existing has been discharged. The directors retiring by rotation are Mr. John James Barrow and Mr. Joseph Quick, who, being eligible, offer themselves for re-election.

Dr. Revenue Account, for the Year ending Dec. 31, 1876.		Cr.	
EXPENDITURE.		RECEIPTS.	
Maintenance of water-works—		Water—	
Reservoirs and filters in Co-rangiu	£87 17 5	The Italian Government, Province of Cagliari and Municipality of Cagliari . .	*9,600 0 0
Main to town	24 18 10	* By the 11th Article of the Concession, the fixed annual payment for the water supply in Cagliari is:—For the first 30 years, from 1867 to 1897, £9600; second 30 years, from 1897 to 1927, £7600; third 30 years, from 1927 to 1957, £5600.	
Reservoirs & mains in Cagliari	85 3 6	From sundry customers, viz.—	
Horse keep & miscellaneous	112 1 6	For extra supply in Cagliari . .	1,282 17 4
Gas manufacture—		For supply beyond Cagliari . .	580 18 6
Wages	727 7 7	For supply to shipping	67 7 3
Coals	1,923 6 10	Gas—	
Stores	278 5 7	Public lamps	1,822 3 9
General charges in Cagliari—		Private lights	2,035 0 8
Salaries	1,279 2 0	Products	1,445 18 4
Office rent, stationery, travelling expenses, &c. . .	228 19 0	Transfer fees	4 0 0
Rates and taxes in Cagliari.	871 15 6	Sundry work and sales of material	596 8 10
General charges in London—			
Directors and auditors fees .	281 10 0		
Salaries and office rent . .	250 0 0		
Stationery, bill stamps, and petty disbursements . . .	83 18 8		
Prem. on insurance of works	30 0 0		
Exchange on remittances . .	1,220 10 8		
Interest and discounts . . .	426 17 0		
Sinking-fund	150 0 0		
Reserve-fund	100 0 0		
Balance—Net profit for year carried to gen. balance sheet	9,273 0 7		
	£17,434 14 8		£17,434 14 8

Capital Account and Balance-Sheet, Dec. 31, 1876.

Gas and Water-Works—		Capital, authorized by Memorandum and Articles of Association, 7500 shares of £20 each	£150,000 0 0
Total amount expended, including preliminary expenses, to Dec. 31, 1875, per last account	£150,472 8 0	7223 shares, subscribed to Dec. 31, 1876	144,460 0 0
Expended during year . .	697 19 11	Debenture bonds	7,500 0 0
Cash at company's bankers .	416 19 2	Sundry debts due by company	1,953 1 8
Bills receivable	280 8 7	Bills payable	889 11 6
Stores on hand at Cagliari—		Sinking-fund	1,839 9 8
Coals	199 16 0	Special reserve-fund . . .	200 0 0
Products	160 4 0	Revenue account, net profits—	
Sundry debts due to the company	6,706 16 10	Balance at Dec. 31, 1875	£9,300 11 0
Special works executed . .	1,805 11 0	Less div. paid for the year 1875	7,912 6 0
Goods in transit	1,216 14 11		£1,388 5 0
Investment in share capital of company (sinking-fund)	1,800 0 0	Year to Dec. 31, 1876	9,273 0 7
Investment in share capital of company (special reserve-fund)	200 0 0		10,661 5 7
Payment on account of dividend, Oct. 9, 1876 . .	3,596 10 0		
	£167,503 8 5		£167,503 8 5

The CHAIRMAN, in moving the adoption of the report, said he was happy to be able to inform the shareholders that the affairs of the company were going on in a satisfactory manner, and that they were doing as well as they had any reason to expect. They did not anticipate making that progress in a foreign country which might naturally be looked for at home, nor did they calculate upon presenting such enormous figures as might perchance be reckoned upon in their own country. But taking the separate items which constituted the balance-sheet of this undertaking, he thought the meeting would agree that there had been a very satisfactory increase, though not a very large one, in the receipts for water, while the gas receipts, which last year left a balance against the company, in consequence of the reduction made in the price charged to consumers, now exhibited a balance in their favour. Added to this was the fact that the loss by leakage had been considerably diminished, averaging now only 9 per cent. in lieu of 11½. There still remained the old difficulty with regard to rates and taxes, and loss by exchange on remittances to this country, but in reference to the latter he was in hope that time would produce some amelioration. He need not say that any explanation concerning the accounts, or as to the state of the company, would be willingly furnished to the shareholders, particularly on the present occasion, when he had the opportunity of introducing to the meeting their much trusted and highly esteemed engineer and manager, Mr. Simmelkjer, who was now on a visit to England. The directors had had a conference with Mr. Simmelkjer that morning, with a view to a further extension of the company with reference to the water supply of Cagliari. Mr. Simmelkjer had the most thorough mastery of all the intricacies of the company's undertaking; he had been with them from the beginning, and had always had the fullest confidence of the board.

Mr. JOHN AIRD seconded the motion, which was put and carried unanimously.

The CHAIRMAN moved—"That the interim payment on account of dividend on the 9th of October last be and is hereby confirmed, and that a dividend for the half year ending Dec. 31, 1876, at the rate of 7 per cent. per annum, less income-tax, be declared payable on and after the 7th of April next."

Mr. H. P. STEPHENSON seconded the motion, which was put and carried. The retiring directors and auditors were re-elected.

Mr. SIMMELKJØR, on the invitation of the chairman, addressed the meeting. He said he would in a few words give a history of the company up to the present time. The company were formed for the purpose of supplying both water and gas. As to the supply of water, that had always proved to be the chief part of the undertaking, and had required the largest part of the capital to be embarked in it. In a hot country like Cagliari, the demand for water would always be more than for gas. The concession obtained by the company was for the supply of a certain quantity of water to the town free of charge—so much in the summer, and so much in the winter months. For that supply the company were to receive £9600 sterling each year. The company, however, were desirous of increasing their revenue from this portion of their undertaking, and they proposed to the town to lay on the water to the houses of the inhabitants, because the payment of the £9600 was only for a certain number of taps in certain places. But the proposal was simply laughed at; the people said, "We have 150 public taps in the streets, and we do not care to have water brought into the houses." A year or two passed away, and the company had only the £9600 as revenue from the water supply; but, after all, they obtained permission to lay water on to certain houses at a certain rate. When the town came to see that something was to be made out of this, they began to think they should like to get some of the money, and they set the lawyers to look at the concession. They then found it was illegal, because the concession said the company were only to supply water to the Municipality and local authority, so that they had no right to supply the householders. The authorities accordingly gave the company orders at once to discontinue the supply, and said they would take it upon themselves. This would have been a serious matter to the company; but, fortunately, all the mains and all the works belonged to them; so they said to the town, "You may go on supplying the people and the houses, but we cannot let you do it through our pipes." They were obliged then to see that the company were right, and, therefore, they asked them to come to some arrangement. The result was that, after long negotiations, the company and the authorities came to their present agreement, which was to the effect that the company supplied water to the houses of the inhabitants, charging according to a rate which the authorities put on it, they taking one-half the amount produced, and the company the other half. This arrangement was entered into three years ago, and, under it, the company received last year £1300 sterling—a sum which would increase every year in future. At the present time very few houses were fitted up; but as the inhabitants began to feel the benefit of this extra supply, the company's revenue would be larger, while the expenditure upon the company's works had a tendency to decrease, which he considered was a good feature. In fact, the works had been so constructed that, whether supplying 10,000 or 100,000 gallons a day, the cost was the same. It was all a gravitation scheme; there was no pumping, so that, if more water was required, it was only necessary to open the tap a little wider. At present the company's reservoirs were so very large, that even when rain fell during the month of October, not more than one-third their capacity was utilized. And even if they were filled, it would be easy to add another 15 feet to their height, so that, for his part, he felt sure that during the 90 years of the company's concession it would not be necessary to spend more capital on extensions in that direction; nor would it be required to expend more than £300 a year for maintenance, workmen's expenses, and everything else. The chairman had mentioned the fact that there had been some little difficulties in reference to rates and taxes, and the rate of exchange. No doubt this was very disagreeable as long as it lasted. The Italian finances were in a very low state, and they had to put on very heavy taxes; but even in this matter the company were very fortunate in getting their taxes reduced, although still very high. As to the gas-works, he might remark that Cagliari, like most Italian towns, did not consume much gas. People lived very much in the *cafés* and streets, and there were no large theatres or public buildings to be lighted. It, therefore, took some time to introduce gas, and to obtain from its supply such a return as they could wish. The gas-works belonging to this company had been built very large—a fault, but a fault in the right direction—so large, indeed, that they would never be called upon to spend a farthing more capital upon them during the concession. There were eight retort-beds, with five retorts in each, and as yet there had never been more than three beds lighted during the longest day's consumption. In the same retort-house there was room for eight more beds, and there was also one gasholder not yet in use. The greatest profit from the gas-works was in the sale of coke, the company having been very fortunate in introducing the use of coke into people's houses. It was all sold by retail, and realized as much as £2 per ton. At the same time freights out to Cagliari were always very low, much lower than to other Italian towns, the Government having large salt and iron works there. The last cargo of coals shipped—Pelaw Main—cost into the retort-house 21s. 5d. per ton, and as the coke yielded £2 per ton, this was a satisfactory state of things. As for tar, there was little use for it, and it was generally burned under the retorts. The ammoniacal liquor was thrown away, there being no market at all for that product. To encourage the sale of gas he had supplied fittings on hire, and in that way had obtained many customers. Latterly he had commenced selling fittings at a reduced price, even at a small loss to the company, because he found that some persons who had been supplied with them on hire discontinued the use of gas after a few months, and he thought if they had fittings of their own they would be induced to go on with it. He did not know that he could furnish further information, but would be very happy to answer any questions that might be put to him.

Mr. H. P. STEPHENSON said he thought the shareholders would be wanting in courtesy if they allowed the present opportunity to pass without passing a special vote of thanks to Mr. Simmelkjer, for the energy and perseverance he had shown in the conduct of the affairs of the company at Cagliari. He thought the settlement effected by Mr. Simmelkjer with the Municipality, with reference to the supply of water to private houses, was a most satisfactory one. But for that arrangement, he felt sure the company would not have progressed as they had done, but would have continued to pay only 4 or 5 per cent. as they did some years ago. He had much pleasure in moving a special vote of thanks to their engineer and manager for the ability and energy with which he had conducted the business of the company.

The motion having been seconded,

The CHAIRMAN said it was a most worthy vote to a most worthy man, and it was very satisfactory to think that the proposal came from the shareholders as it had done. He was sure Mr. Simmelkjer would carry back to his own country a pleasant recollection of the manner in which his services had been recognized.

The vote was very cordially adopted.

Mr. SIMMELKJØR said he was much obliged for the kindness thus shown to him. In his country it was a saying that good masters made good servants. He could only say that it had always been a pleasure to him to carry out to the best of his ability the instructions received from the board of this company.

A vote of thanks was then given to the chairman and directors, and the proceedings terminated.

COLNEY HATCH GAS COMPANY.

The Half-Yearly Meeting of Shareholders in this Company was held on Friday, the 16th inst., at the Works, New Southgate—Mr. G. K. SMITH, chairman, presiding.

The SECRETARY (Mr. W. H. Hardy) read the notice convening the meeting.

The following report was submitted:—

The directors herewith present to you the audited accounts of the company for the half year ending Dec. 31, 1876. A satisfactory improvement is shown in comparison with the accounts for the corresponding period of the year 1875.

The directors have to report that shortly after the last ordinary meeting of the company they had reason to suspect the accounts of their late accountant, W. H. Wood, who absconded upon the institution of a strict investigation of the whole of the company's books. Defalcations were ultimately disclosed amounting to £360 9s. 2d., and of this sum £600 belonged to accounts of periods previous to June, 1876. Although the directors felt they were in no degree liable for these losses (and were so advised by counsel), they thought fit, for several reasons, in the interests of the company, to put beyond question the accounts which had been passed by the company in general meeting, and, therefore, decided upon subscribing among themselves the sum of £600, and this sum has been paid to the credit of the company. The remainder, or loss, being £172 4s. 11d., has been charged against revenue in the accounts now before you.

From the profits available for division, the directors recommend you to declare a dividend at the rate of 4 per cent. per annum, free of income-tax, and payable on the 4th of April next.

Dr.	Revenue Account, for the Half Year ended Dec. 31, 1876.		Cr.		
Manufacture of gas—			Sale of gas—		
Coals	£975	19 4	At 5s. per 1000 cubic feet	£690	1 6
Purifying materials	44	12 8	At 6s. per 1000 „	1690	17 3
Wages	276	7 0	Meter-rental	81	2 3
Repairs and maintenance of works and plant, including renewal of retorts, &c.	65	13 2	Residual products—		
Distribution of gas—			Coke	279	2 1
Repair, maintenance, and renewal of mains and service-pipes	3	1 10	Tar and lime	127	18 2
Repairing, renewing, and re-fixing meters	7	10 6	Services	6	17 4
Rates and taxes	111	17 11			
Management—					
Salaries of secretary, accountant, and collector	131	13 4			
Stationery, printing, & general establishment charges	148	1 5			
Directors fees to Oct., 1876	50	0 0			
Auditor	5	5 0			
Bad debts and allowances	89	11 7			
Defalcations of late accountant	£360	9 2			
Less amts. not charged to consumers, since recovered. .£88 13					
Less subscribed by directors,600 0 0					
	688	4 3	172	4 11	
Total expenditure	£2081	18 8			
Balance carried to profit and loss account	793	19 11			
	£2875	18 7			
				£2875	18 7

The CHAIRMAN, in moving the adoption of the report, said he had a most unpleasant task before him, more especially as the past six months had been one of great anxiety to himself and co-directors. He alluded to the defalcations of the late assistant secretary. He hoped that the course the directors had adopted, and the way in which they had dealt with this painful business in a financial point of view, would meet with the approval of the proprietors. The business of the company in other respects was progressive, and was steadily increasing.

Mr. J. B. PADDON, in seconding the report, gave a very satisfactory explanation of the accounts, and stated that, although the company had been so unfortunate, he still was sanguine for their future success. Although the price of gas had been increased to 6s. per 1000 feet, the distribution of gas had increased nearly 10 per cent. The results obtained during the past half year showed a great improvement on former years, notwithstanding the drawback from the low price obtained for residuals. The frauds committed by Wood, who had been eleven years in the service of the Brighton and Hove Gas Company, were carried out in a systematic manner, and, although for some time such proceedings escape detection, yet eventually they come to light. Wood had two modes of carrying out his purpose—first, by using false and duplicate books, placing the spurious ones before the auditor; and, secondly, paying one account under the other, and thus the customers in arrears one quarter for gas or coke did not appear the next. However, as the local press had given great publicity to the affair, he would not add any further details. The directors felt themselves morally bound to replace the amount of defalcation as exhibited and discovered to the 30th of June, 1876, and thus place the company's affairs under this head in a sound condition by paying off the whole amount.

Several PROPRIETORS inquired the probable extent of loss to be incurred from Wood's frauds.

Mr. E. HOMAN replied by stating that the present balance-sheet showed the entire loss, and the company would not be called upon to pay a single penny expense for the prosecution. Wood had been captured, and was now on his way home.

On the motion of Mr. CLARK, a vote of thanks was passed to the chairman and directors; and, on the motion of Mr. HOMAN, the thanks of the shareholders were conveyed to the secretary, for the able and energetic manner in which he had dealt with the accounts in the face of the difficulties he had to contend with.

Mr. PADDON, in moving that a vote of thanks be given to the auditor, stated that the proprietors might rely upon the work being efficiently performed. The directors expressed every confidence in Mr. Randall, from his practical experience and knowledge of accounts, and his long connexion with a neighbouring gas company.

A vote of thanks was also accorded to Mr. Oatley, the manager, for his services to the company.

MELBOURNE (AUSTRALIA) GAS AND COKE COMPANY.

A Special General Meeting of Shareholders was held at the Company's Office, Collins Street West, Melbourne, on Tuesday, Jan. 23—Mr. T. MOWBRAY in the chair.

The SECRETARY (Mr. John Scott) read the following report:—

Your directors submit the usual audited statement of accounts for the year ended Dec. 31, 1876.

The general reduction in the price of gas to 7s. 6d., which took effect on the 1st of July last, has, of course, diminished the revenue from that source, although, taken as a whole, under the circumstances, results, it is thought, will not be considered unsatisfactory.

The half year's working, with the balance brought forward, has left at credit of profit and loss £9317 5s. 9d., from which a dividend was declared at the rate of 6 per cent. per annum, absorbing £7500, leaving unappropriated and carried forward to the next half year £1817 5s. 9d.

The works have been carefully maintained in an efficient state, and operations throughout have been conducted with economy and regularity.

The construction of an out-station gasholder, for the better supply of districts south of the Yarra, is being pushed forward diligently, and will, it is confidently expected, be available for next winter's requirements.

Dr.		Revenue Account, for the Half Year ending Dec. 31, 1876.		Cr.	
Apparatus, &c.	£4,140 7 3	Gas-rates.		£43,023 18 3	
Stationery, printing, and advertising	233 8 6	Residual products—			
General charges	10,625 17 4	Coke		5,168 17 8	
Repairs	593 7 11	Tar, &c.		2,679 3 9	
Coal purchased	20,240 4 10	Deposits from contractors and others		218 10 0	
Lime purchased	719 7 9	Commercial Bank, June 30, 1876		7,568 2 1	
Dividends to shareholders	7,589 2 0	Cash on hand, June 30, 1876.		404 15 2	
Interest on debentures	750 0 0				
Deposits refunded	214 15 0				
Commercial Bank, Dec. 31, 1876	13,700 13 2				
Cash on hand, Dec. 31, 1876.	256 3 3				
	£59,063 6 11			£59,063 6 11	

The CHAIRMAN moved the adoption of the report and balance-sheet, and in doing so said the directors considered the financial position of the company was very satisfactory. Their constant aim had been to carry on the works with economy and efficiency, and in this object they had been ably seconded by the secretary, Mr. Scott, and the manager, Mr. Kelly. The directors had entered into a very satisfactory contract for coal for the incoming year, and altogether the affairs of the company were much more satisfactory than at the meeting in July last.

Mr. B. BENJAMIN seconded the motion, which was carried unanimously.

Mr. W. H. CROPPER drew the attention of the chairman to the large sum of money owing to the company by consumers, and suggested that an allowance of 5 per cent. should be made to consumers who paid their accounts within in the month, so as to encourage them to pay their accounts more readily.

The CHAIRMAN said the suggestion should receive the consideration of the directors.

After a vote of thanks to the directors, the meeting adjourned.

SILBER LIGHT COMPANY, LIMITED.

The Ordinary General Meeting of this Company, was held on Thursday, the 16th inst., at the Victoria Rooms, Queen Victoria Street, London—Mr. R. J. JENKINS in the chair.

The following report of the directors was presented:—

The directors beg to submit to the shareholders the fourth yearly report on the business of the company, with general balance-sheet, audited to Feb. 28, 1877, and regret the aspect of affairs as presented.

The gross profits, including £381 13s. brought forward from last account, and interest and transfer fees received, amount to £9151 2s. 6d.; from this a reduction has to be made of £6617 10s. 3d. for depreciation in the value of the stock on hand; the directors and auditors remuneration and working expenses (including balance of discount account and bad debt account), amount, as shown in profit and loss account, to £9558 13s. 8d., against £11,359 1s. for the preceding year, and with a provision of £300 to meet anticipated losses on doubtful debts, and £375 written off preliminary expenses and £289 3s. 4d. (being 10 per cent.) off fixture account, there shows a deficit of £7989 4s. 9d.

There has been a considerable diminution in the amount of the sales, consequent upon the great depression of trade, which has been generally experienced during the past year. The directors think, however, that, with the great improvement which has been effected in the articles from which the company has hitherto derived its principal revenue, and various other facilities which have been introduced for the better development of the business, should there be a revival in trade, there is every prospect of the business of the company greatly improving during the current year.

The directors regret to have to inform the shareholders that, owing to prolonged and serious illness, Sir John Farquhar, Bart., has been compelled to vacate his seat at the board. The vacancy so caused was filled by the appointment of Major Brackenbury, who, however, found it inconvenient to attend the board meetings, and he has consequently resigned.

At this meeting one director (R. J. Jenkins, Esq.) retires by rotation, according to the Articles of Association, and, being eligible, offers himself for re-election.

The auditor (Frederick Maynard, Esq.) also retires, and offers himself for re-appointment. The remuneration of the auditor will have to be fixed by the meeting.

The CHAIRMAN, in moving the adoption of the report, expressed the deep regret of the board at the resignation of Sir John Farquhar, through prolonged illness, and of Major Brackenbury, who was appointed to the vacancy so occasioned, through his other engagements. The directors very much regretted that the accounts for the financial year ending Feb. 28 last, showed a loss of £7989 4s. 9d., the principal part of which had been caused by the large amount which was necessary to be written off for depreciation of stock. This loss was the more disappointing, because he could assure them that the directors had given their most earnest attention to the company's business, to extending their operations, and reducing the expenses. They might say the expenses were still very high, but in a business of this sort they must provide not only for the present business, but for possible business. The expenses were almost precisely the same as last year, but they would observe that there was £954 for advertising, which had been incurred in consequence of an expression of opinion at the last meeting, that it would be well to bring the company more before the public. In this respect the results up to the present time had been disappointing, but he hoped they would have better results in future. Last year the sum appearing as directors remuneration was £1625, and this year it was £256; he himself was the only director receiving remuneration at the present time, and as a business man, giving up his time, he considered that he was entitled to some recompense. The other directors (Mr. Andrade and Mr. Silber) had given their services for nothing. The great depression of trade generally during the past year had very adversely affected the company; the shipping branch, one of the most profitable, had changed very much in its character, and cheaper lamps were now used in place of the former expensive lamps, which were so profitable to the company. There had been a rise in petroleum of 200 or 300 per cent., which was a very important item to the company, more particularly as the price of gas had decreased as the price of petroleum had risen. Under these circumstances, he thought the reduction in the gross profits was satisfactorily accounted for. There was an amount placed to suspense account, in connexion with the case of *Sugg v. Silber*, but it would be unwise to discuss that question on this occasion. He believed there was a future for the company, and he could only say the directors would use their best exertions to bring about success.

Mr. SILBER (managing director), in seconding the motion, referred to the system of conveying oil through pipes, which the company had not at present brought into operation, excepting upon their own premises. He had used this system at his house of business for nearly three years prior to the incorporation of the company; and they had had it in constant use at Whitecross Street ever since they took possession there in 1873. Before they could so use it, they obtained the consent of the leading insurance companies in which their premises and stock were insured; and they also obtained their permission to keep three barrels of petroleum without any enhancement of premium. When, however, in consequence of the development of their business, they were compelled to increase their warehouse accommodation in Beech Lane, they were prevented from laying on oil-pipes there in consequence of the insurance companies having demanded a prohibitory premium. This and other minor causes had been contributory to the neglect of a contrivance which was not likely to lead

to any immediate profitable result, although the admirable way in which this system of lighting had answered confirmed his own opinion that the patent was a valuable one. Similar objections were raised by the insurance companies at the time of the introduction of gas into this country, and before even the smallest gas-fitting could be removed from one part of a room to another, the inspectors of the insurance companies had to indorse every such change upon the policy. They all knew that there was a certain amount of danger from gas in every house where it was laid on; but it was a recognized fact that, with ordinary care, this danger might be reduced to an insignificant minimum. He had done his best to convince the directors of the several insurance companies that the dangers attendant upon "laying on of oil" were certainly no greater than those of gas; but, to his great disappointment, he had been completely unsuccessful. Passing on now to the departmental divisions of the business, he might say that the perfecting of railway carriage roof-lamps, and adapting them to all carriages, had had his first and chief attention; and, after having been successful in so constructing these lamps that either light or heavy mineral oils could be burned in them, it was disappointing that, for some reason (still unaccountable to him), the oil in the glass of one of the lamps ignited—a circumstance which had seriously interfered with their sale. Nevertheless, the company had since sold a considerable quantity for other purposes, and it was gratifying to know that they had given the greatest satisfaction. Their signal, station, tail, head, and other railway lamps, burning mineral oils, were now introduced on some of the principal railway lines, and the repetition orders which they received for them were the best proofs of their excellence. Still, taking into consideration the whole of the business done by them with railway companies during the four years of their trading, he was of opinion that they had made no profit in this direction. However, they had now no further experiments to make in this department, and hence he was under the impression that a profit would ultimately be made, if the sales continued to increase as they had done of late, and if the lamps were adopted by the companies which had been trying them for two years with success. It had required more than ordinary patience and perseverance, besides an extensive outlay of capital, to obtain even the small measure of success which had attended their efforts in this direction. He could only speak in the same disparaging manner of the business yet done with their ship lamps, but he was bound to observe that he was hopeful for the future of that department. Passing on to the department for the sale of lamps for domestic purposes, to which their utmost energy had been directed, and deducting the loss sustained in the balance-sheet, without calculating or including the loss sustained by the non-paying departments, they had earned in this department alone, during the course of their four years trading, the whole of the profits which had been divided. During the season of the year 1874 they were able to sell their lamps almost as fast as they could procure them, and at their own prices; and at that time they had only a limited staff, and but one or two travellers. Then, too, they only sold their best moderator and double air-current petroleum lamps, and he was sorry to admit, with regard to the latter, that the construction was such, although every lamp was tried with a properly constructed air-pump before being sent out, that many leaked after being in use for only a day or two—a circumstance which naturally militated against the company. They then introduced a burner which gave about the same illumination as that given by the double air-current lamp, but which could be affixed to any description of oil container, thus obviating the leakage difficulty; yet, notwithstanding the fact that this burner possessed all the advantages which they claimed for it, and although they sold over 60,000 of them, a difficulty in adjusting the wick proved an objection, and, as a natural consequence, the sale of those lamps fell off. Their trade in best lamps underwent an entire change in the year 1875. The best and largest houses, which alone could buy good lamps, would only buy their burners from the company, and imported their lamps themselves. For some time they declined to supply them with burners only; but they were mortified to find that the parties referred to purchased the very cheapest lamps, and stripped them of their burners in order to attach them to their own lamps of better class. Many thousands of their petroleum lamps were sent to the colonies; and these, possessing the defects he had already pointed out, injured the reputation of the company as lamp makers, in a market which they had hoped would prove the most profitable. In the month of June, 1875, they introduced their new burner, in which the objections to the former burner had been surmounted. The new burner appeared to give general satisfaction, but, unhappily, the mischief was done. Shopkeepers had had their burners returned to them to be trimmed, repaired, and exchanged, and, consequently, had lost faith in their goods. As a result of those untoward circumstances, their trade, instead of increasing, showed a continued falling off, especially from October, 1875, to about the same period of 1876. To induce a trade in this country, and to introduce the new burner, they had to sell at very moderate profits; and to recover lost ground they had to send special travellers to every part of Great Britain and Ireland, so that they might give ocular demonstration of the improved manufactures to those of their customers who had lost faith in them. He might remark that a gratifying proof of the success of this new burner was afforded by the fact that complaints were now very rare indeed, but the sale was still very small. After referring to the large interest held in the company by himself and friends, and the efforts and sacrifices he had himself made to make the company a success, he proceeded to give further details of the difficulties attending the conduct of the business. With regard to the future, he anticipated an increased trade in railway lamps, as well as in ship lamps, but he thought it doubtful whether the profit to be derived would be beneficial. Trade in the cheaper kinds of domestic lamps was well organized, and the company were in a fair way to an increase in that branch. He anticipated that their expenses would be much less than during the past year. The stock would be decreased, and, if the trade was not worse than last year, they must be gainers; so that, on the whole, he thought they would be in a better position before that day twelvemonth. Should he be obliged to change his opinion then or before, he would not lose a moment in advising the board to call a special meeting at which to lay the position of the company fully before the shareholders. He concluded by referring to a private meeting of shareholders held a day or two previously, and strongly animadverted upon the conduct of certain parties who, he said, had bought a few shares with the evident intention of trying to wreck the company; and the question for the shareholder was whether they would support the directors, who were doing their best to promote the welfare of the company, or whether they would support those persons who were trying to ruin it. He and his co-directors held 7000 votes out of 12,000, but they should not use them to influence the decision of the shareholders in any way. He had a very large interest in the company, and it was his interest to see it go on and prosper, and he hoped, with a return of general prosperity, there would be a future for the company.

Mr. F. MAYNARD, the auditor, bore testimony to the clear and correct manner in which the books were kept.

Mr. WHITE said he had no reason to do otherwise than respect Mr. Silber, but he must say he was extremely disappointed with the report, and he thought that some stringent investigation was required. He did not

advocate winding-up, but thought a committee should be appointed. He moved an amendment, appointing a committee to investigate the books of the company, with power to add to their number, and deferring the passing of the accounts till the committee's report was presented to an adjourned meeting.

Mr. M'NAGHTEN seconded the amendment, which, after a long discussion, was put to the meeting and lost, and the original resolution was then carried, with four dissentients.

The retiring director and auditor having been re-elected, the proceedings terminated.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

The following statements of account for last year have just been published:—

Dr.—Profit and Loss, for the Year ending Dec. 31, 1876.

To Coals.	£25,271 14 9
Purifying materials and process	836 1 11
Repair and maintenance of meters, mains, service-pipes, and other works.	4,850 9 11
Wages	8,090 1 2
Lamps—providing, lighting, extinguishing, cleaning, and repairing.	460 16 6
Rent, rates, and taxes	1,022 4 9
Salaries, collectors commissions, and payments to directors	4,296 5 6
Interest on loans	2,334 6 4
Professional charges and incidental expenses	189 5 6
Estimated discounts and bad debts on rental	224 12 0
Dividends paid to proprietors, viz.—	

Per Cent.	Paid Up.	Class.	Raised under Act.	Amnt.
9 1/2	£100,000	Original ordinary	Vict. 2, c. 38	£9,500
7	25,000	A ordinary	" 29, c. 184	1,750
6	50,000	B preference	" 29, c. 184	3,000
				14,250 0 0
				11,615 14 3
				£73,441 12 7

Cr.—Profit and Loss.

By Balance brought from last year's account	£8,802 17 2
Sale of gas	50,504 2 2
Coke and breeze	10,280 9 3
Tar and other residuals	3,854 4 0
	£73,441 12 7

Dr.—Balance-Sheet.

To Capital raised under Act—	
Vict. 2, c. 38, original ordinary shares	£100,000 0 0
Vict. 29, c. 184, A ordinary shares	25,000 0 0
Vict. 29, c. 184, B preference shares	50,000 0 0
	£175,000 0 0
Debtenture stock	45,000 0 0
Amount of loans	12,000 0 0
Reserve-fund	1,810 13 2
Capital in trade	6,210 4 8
Amount owing by company	3,202 17 11
Unclaimed dividends	310 18 0
Balance, as above	11,615 14 3
	£255,150 8 0

Cr.—Balance-Sheet.

By Cost of works to Dec. 31, 1875	£204,686 3 2
Ditto (add extensions made during the year)	11,194 2 8
	£215,880 5 10
Amount owing to the company for gas, coke, residual products, &c., exclusive of estimated bad debts	21,666 6 2
Coals in stock	3,268 0 9
Residual products and other stocks	1,197 11 2
Cash in hands of treasurer, cashier, &c.	£3,494 8 9
Cash advanced on account of contracts	9,643 15 4
	£255,150 8 0

TESTIMONIAL TO MR. R. W. EGG, OF DARTMOUTH.—On Wednesday evening, March 14, the directors of the Dartmouth Gas Company, with a number of other gentlemen, took supper together at the Castle Hotel, on the occasion of the presentation of a testimonial to Mr. Richard Webber Egg, in recognition of his valuable services as managing director, on his retirement from that office, after having fulfilled its duties for a period of nearly twenty years. The meeting was also made the occasion of acknowledging the long and able services of Mr. R. W. Creed, chairman of directors, who had also announced his intention of retiring from the duties of that office. Mr. R. W. Creed, presided, the vice-chair being filled by Mr. R. Cranford, secretary of the company. The mayor and other influential persons in the town were amongst the guests. The chairman in making the presentation, said Mr. Egg had been connected with the gas company since the commencement, and they all knew with what zeal and ability he had carried out the duties of the office, and how much his services had contributed to the success of the company. He (the chairman) had much pleasure in handing the testimonial to Mr. Egg, and hoped he would live long to enjoy it. The testimonial consisted of a handsome English lever gold watch, by Benson, London, on which was engraved the following inscription:—"Presented to Richard W. Egg, Esq., by the directors, shareholders, and staff of the Dartmouth Gas Company, on his retirement as managing director, after eighteen years satisfactory service.—1876." Attached to the watch was a massive Albert eighteen-carat gold chain, both being enclosed in a suitable morocco leathercase. This handsome present was accompanied by a purse of 15 sovereigns. Mr. Egg, in acknowledging the gift, and the graceful manner in which it had been presented, expressed the satisfaction he felt in knowing that the list of subscribers contained the names of many of the workmen who had worked under him, and were still doing so. Referring to the progress of gas lighting in Dartmouth, he said it was about 19 years since the town was placarded by Messrs. Holcombe and Co., the proprietors of the then works, announcing that they would no longer be able to supply gas at the then existing price—viz., 8s. 6d. per 1000, and £3 10s. each for the public lamps for eight months in the year. A new company was then projected, and after a successful canvass of the town, was set afloat. He was asked to become honorary treasurer, which post he accepted, and from that emanated his connexion with the company. The result was that an entire new set of works was erected on the site of the old ones. Gas was lit for the first time on the 14th of August, 1858, at a reduction in the price from 8s. 6d. to 5s. 10d. per 1000, and public lamps at £3 5s. per lamp for nine months, instead of £3 10s. for eight months. Taking a view of the history of the company, he thought the consumers had not much to complain of; the public had been gainers, and the investors had no reason to be dissatisfied. The secretary of the company, in highly complimentary terms, then proposed the health of the chairman, which was most cordially responded to. The healths of the secretary, himself, and of the directors were heartily received, and the evening was spent in a very agreeable manner.

THE CORPORATION OF WORCESTER AND THE GAS COMPANY.

At the Meeting of the Town Council on Tuesday, the 20th inst., Alderman Woodward, according to notice, moved—"That the town-clerk be instructed to apply to the town-clerk or other authority of the various cities and boroughs in England, to ascertain if the gas-works are the property of the corporation; and, if so, whether the possession of them is profitable to the corporation or not. If profitable, to what extent, and how that profit is appropriated. If the acquisition of the gas-works is unprofitable, to what extent. And generally to ascertain if municipalities think their respective communities would be benefited by the supply of gas being in the hands of the corporation." In doing so, he said: The next business is the resolution I have given notice of in the agenda. I regret exceedingly that at such a late hour I should have to say what I have to state on a question of such immense importance. My motive in bringing it forward is to ascertain what our neighbours and other towns in the kingdom are doing with regard to having the supply of gas in the hands of the corporate body. I think you will agree with me it is very desirable we should know that; for I think it to be of the utmost importance that the supply of light, which is now one of the essentials of existence in cities and large towns, should, the same as water, be under the control of the governing body. I may say that late last night I received a statement, showing that at Stafford they have obtained compulsory powers to purchase the gas-works; that the purchase is completed, and I believe the works were handed over within the last week. I find also that in the little borough of Evesham they are doing precisely the same thing. At Hereford they have already done the same thing. A similar process is going on in all communities where they have an eye to the best interests of those they represent. I believe it is so in Droitwich and in Bristol. I see that in Huddersfield the profit made by the corporation during the past year was £3000. What did they do? They immediately reduced the price from 3s. 4d. to 3s. I cannot tell you what the illuminating power was; but I have no doubt that in Huddersfield, as in most of the northern towns, they have gas of a very high illuminating power, and very likely, therefore, 3s. would represent what we should have to pay 5s. for. I ask the council to adopt this resolution, if they agree with me that it is most important that the manufacture and sale of gas, which has very much to do with our streets and other public matters, should be in the hands of the corporation. I find, on referring to the report of Messrs. Carter and Carter, given, I think, in 1873, that they estimated that up to the year 1866 the gas company had appropriated, in extensions of works, mains, &c., £35,000, that ought to have been in the pockets of the ratepayers. I find that from 1866 to 1873 they added another sum of £15,000, making £50,000. If the same process has been going on from 1873 to 1877, there is another £10,000 to be added, making £60,000. If that £60,000 had been in the hands of the corporation, and expended on various improvements in the city, we should have been saved a large amount of discussion, and we should not have been squabbling this morning about repairing a house at a cost of £6 5s. Looking to these things, and feeling that it is to the best interest of the city that we should be in a position to see exactly what has been done, and what ought to be done, I have to move the resolution of which I have given notice.

Mr. HUGHES: I beg to second the proposition. No doubt some members of the council are shareholders, and I hope, when the time comes for decision, they will really show that they are willing to do something for the benefit of the city which they always speak of being proud of.

Mr. BIRBECK: It appears to me that the worthy alderman, like many others who have a hobby, seems to be determined to ride his hobby to death. I also think that probably, if it had been the worthy alderman's fortune to have been a considerable shareholder in the gas company, we should have heard nothing of this matter. I will call your attention to a paragraph which appeared in a Sheffield paper of Wednesday last:—"In the course of a very long and heated discussion in the Sheffield Town Council on Wednesday some extraordinary revelations were elicited. In 1870 the corporation went to Parliament for the purchase of the gas and water-works, and soon after proceedings were taken, the water company obtained an injunction against them from using any of the funds of the ratepayers for that purpose. Some members of the corporation, however, gave the town-clerk a personal indemnity, under which expenses were incurred amounting to upwards of £7000. The corporation proceedings in Parliament were unsuccessful, and consequently the whole of the expenses fell upon the town-clerk. A voluntary rate to pay them off yielded only £2500, and the town-clerk now stated that he was out of pocket to the amount of £5600. With considerable emotion he stated that he had been sued for the expenses incurred by the corporation, that he had been put in the Bankruptcy Court for them, and that he had had to sell property in order to meet some of the claims." I sincerely trust, whatever the result of this discussion may be, we shall not see our town-clerk in the unfortunate position the town-clerk of Sheffield was. I have made some inquiries relative to the number of gas-works in the hands of local boards, and those belonging to companies. If the town-clerk should be called upon, as I trust he will not be, to make all these elaborate inquiries, I think he will find the result to be this; the governing bodies in boroughs have in their possession gas-works to the number of 200, of which 100 are paying their way. As to the others, it is best to say nothing about them. The number of gas-works that are in the hands of companies is no less than 1100, of which nine-tenths are paying a very good dividend. I trust the council will seriously consider the question, and not get into a position out of which we may not be able to see our way. Since the gas-works at Birmingham have been in the hands of the corporation, the price of gas has been raised. We are here having first-rate gas, of which none of us can complain, at a very moderate price. I trust nothing will be done in this council which will cause us to get out of what Alderman Woodward would have you believe is a frying-pan into the fire.

Mr. NOAKE: I am not without misgivings that the gas business would be managed worse by the corporation than by the company. At the same time, I shall support Alderman Woodward's resolution, because I feel it to be most necessary that we should have every information we can get from towns where the plan has been tried. We find that all the surrounding districts, even the smaller towns, are now coming to the system of purchasing the gas-works. At Droitwich they are buying the works. At Evesham I see the Local Government Board are willing to permit the Town Council to buy the works and extend the repayment of the debt over 50 years, making it comparatively easy. I shall vote for the resolution merely for the purpose of getting as much information as we can on the subject.

Mr. E. LECHMERE PUGH: I think there can be no possible objection to the motion. When we have obtained the information it will be time to discuss the matter, for we shall then thoroughly understand what we are talking about.

Mr. FISHER: I have great pleasure in referring to what Alderman Woodward said at the last council meeting—that he had no desire to interfere with the gas company unduly, but that he wished them to profit by their works as far as they legally should do. I think we are all of the same feeling on that matter; but we have a duty to perform to the whole city. This question has been raised, certain statements have been made, and unless we ascertain how matters stand a little further than we have already

done I think we shall be wrong. We commit ourselves to nothing by this motion.

Alderman JOSIAH STALLARD (chairman of the gas company): I do not at all object to these inquiries being made, especially if they embrace some further information. There will be no great addition to the cost when we are going to the expense of applying to a very large number of towns, and I think the information I refer to will be very useful. It may be within your recollection that, a short time ago, we printed a statement as to the working of the water-works, and there it was shown that for several years the city had suffered a serious loss. My object in rising is simply to suggest to Mr. Woodward that he should add to the resolution after the word "gas," the words, "and water," so that we may know in what towns the corporations possess the gas and water-works, and whether they are going on prosperously or not, and thus get all possible information necessary to guide the council. I feel, for one, that there has been a great many—I will not say wilful—misrepresentations made in regard to this subject, and that it is very essential that not only the council, but the city, should know precisely what is the result of the working of the water-works, and what would probably be the result of the working of the gas-works, assuming the council had the control of them. If Mr. Woodward will accept my suggestion, and have inquiry made as to water-works as well as gas-works, so that the two subjects may be thoroughly elucidated, I shall be perfectly content. I think we shall get a great deal of information that will be very valuable to us and to the ratepayers.

Mr. LOVSEY: I think Mr. Woodward's motion does not go far enough. Wherever there is a profit, it would be very valuable information to us to know at what price per 1000 feet the gas is sold, and the illuminating power.

The TOWN-CLERK: I have been noting these things. I have a very vivid recollection that the illuminating power in Plymouth is something like 20 candles, and from a paragraph which has been going the round of the papers this week, we find that, although they are so much more distant from the coal-fields than we are, they are now supplying gas at 2s. 2d. per 1000 feet. I think it very important to ascertain what the cost is there, and especially with regard to the public lamps. I agree with Mr. Pugh, that we can all vote for this motion with a little addition, and that the time to discuss the matter will be when the information is obtained. As to the question of water, I do not know that it is at all necessary to mix up the two questions, because I apprehend that where the corporate bodies have both gas and water supply under their control, the accounts of the two things are kept separate and distinct. It does not follow that if there is a loss on the water-works, there cannot be a gain on the gas-works. We are perfectly satisfied as to our water-works, and we want to be satisfied as to the gas.

Alderman WOODWARD: I am quite willing to adopt the suggestion of Mr. Lovsey, that we should get to know the illuminating power and also the price. That, I think, is a very important element. I endeavoured to make my resolution so mild and so gentle that I thought there would not be the smallest possible opposition in the council. With regard to what Alderman Stallard has said, I certainly do not think that very many of you will agree it is a good thing to mix gas and water. We have the water question settled, and if there is any loss to the ratepayers, it arises from the fact that our water-works were constructed as much for sanitary purposes as for anything else. Therefore, if we do not get a large return, the city, generally, reaps a very great benefit from it. I should like it to be borne in mind—I have stated it over and over again—that according to the Acts of Parliament under which the present company are established, they can only divide 10 per cent., no matter how large a sum they may realize as profit. It may be that this question will have to be carried further, and that ultimately we shall have to apply to Parliament for compulsory powers; but I hope and trust the wisdom of the board of directors, and the wisdom and foresight of the shareholders of the gas company, will see that it is better to settle it amicably among ourselves than to go for compulsory powers, as has been done in other places. I think we could settle it on such just and equitable terms as would be to the benefit of all parties. I would give the shareholders of the gas company bonds for £25,000, bearing interest at 10 per cent., guaranteed by the city. I would allow them to take that very delicate and very well manipulated fund called the reserve-fund. I do not wish to go into these matters, because, as Mr. Birbeck says, it has been my hobby. So long as I am a member of the council, I shall endeavour to discharge my duties honestly and faithfully. I have no other hobby to ride than that which I think is for the best interests of my fellow-citizens.

The TOWN-CLERK suggested that after the word "ascertain," in the last sentence of the resolution, should be inserted the words, "the particulars as to the supply of gas by municipalities and."

Alderman WOODWARD accepted this addition, and the motion was then carried without any dissentient.

Mr. LOVSEY: Would you refer this matter to any committee, or appoint one specially? It is a very large matter, and will require some consideration before it is presented to the council.

Alderman WOODWARD then moved—"That the replies received to the foregoing communication be referred to the Watch and Lighting Committee to consider and report thereon."

Mr. PARTINGTON seconded the motion, which was agreed to.

THE GAS QUESTION AT WIGAN.

REPORT OF MR. T. NEWBIGGING, C.E.

To the Committee of Gas Consumers of the Borough of Wigan.

Gentlemen,—The instructions which you placed in my hands when I undertook, at your request, to make the present inquiry, are as follows:—

"Wigan, Feb. 23, 1877.

"Sir,—The Gas Consumers Committee request us to state that they wish you to understand your instructions to be as comprehensive as possible, dealing with the whole question of the general management of the gas-works, the manufacture of the gas, and the distribution of the same.

"We venture, also, to offer you the following suggestions, which have occurred to us.

"Yours faithfully,

"ALFRED BIRKETT, } Hon. Secs.
"JOSEPH JOHN BELLIS, }

"To Thomas Newbigging, Esq.

"1. Inquire as to the quality of the coal used, and also that used from September to December, 1876.

"2. As to the time the charges are allowed to remain in the retorts, and the condition of the coal when placed therein.

"3. Examine the manner in which the exhausters are worked.

"4. Examine the present state of the condensers, scrubbers, and purifiers.

"5. Is the substance used in the purifiers suitable for retaining in it the impurities of the gas, and giving to the consumers a pure gas?

"6. What is the kind of burner used in testing the illuminating power of the gas? and is it according to the Act of Parliament?

"7. Can the gas be kept at so uniform a standard as reported by the borough analyst?

"8. Will Wigan consumers have an undue pressure by reason of the

gas supplied to the out-townships—viz., Ince, Pemberton, Upholland, and Standish—having to be forced through the mains used in the borough?

"9. Are the governors at the works of any special practical use for the out-townships only?"

"10. Is the increase in the gas bills for the past quarter, varying from 20 to 100 per cent., satisfactorily accounted for in the manager's report?"

"11. Taking into consideration the quality of the coal used, is the coke offered to the public at a reasonable price?"

"12. Are the proposed alterations, as suggested at the meeting of the Gas Committee on Thursday, the 15th inst., such as you could recommend?"

You also drew my attention to a resolution passed at a meeting of the Town Council, on the 7th ult., as follows:—

"It is resolved that, in compliance with the request of the ratepayers, permission be given for any gas engineer whom they may appoint, to inspect the gas-works, and the mode of working the same, at any time, and that Mr. Hawkins be instructed to give him every facility for so doing."

Pursuant to these instructions, I have spent some time at Wigan, and having given careful attention to the various matters referred to me, I beg to report as follows:—

The gas-works, taken as a whole, have a dilapidated appearance, the only portions which may be excepted from this general description being those which have undergone renovation at the hands of the present manager during the past 12 months.

The retorts are in settings of seven in a bed, and are contained in two stacks of benches, being 18 feet and 20 feet throughs respectively. They are 98 in number, making a total of 196 mouthpieces. The charges are of six hours duration, and each mouthpiece is capable of producing, on an average, about 5000 cubic feet, or, on the whole, close upon 1 million cubic feet of gas per diem of 24 hours. All these retorts were in action during the depth of the winter.

The coal used is the Wigan four-foot and Arley Yard—both of fair quality for gas and coke producing purposes—mixed with 11 per cent. of Wigan cannel of good quality. These, the manager informs me, have been in use throughout the winter, mixed during the earlier part of the season with a portion of Hucknall cannel left in stock from a previous contract.

There is no covered storage room for coal at present; but it is intended to erect a roofed shed 84 feet long by 60 feet wide. This will hold about 1200 to 1500 tons of material, equal to a fortnight's stock, calculating on the maximum use; and this, in my opinion, is ample, taking the locality into consideration. The coal is deposited in the open yard, in the vicinity of the retort-house (except such small portion as can be placed within the retort-house itself), and exposed to the deteriorating influences of the weather. This, during the past extraordinarily wet season, has been particularly objectionable.

The coke in stock, which is of fair quality, reaches the large quantity of 6000 tons. It has been allowed to accumulate, I understand, in anticipation of better prices being obtained.

It is a mistaken policy to store coke to any large extent at any gas-works, and especially in a place like Wigan, in the midst of a rich coal-field, if customers can be got to purchase at almost any price. The cost of storage is heavy, and the deterioration of the material immense. Probably not more than 70 per cent. of the present stock will ever be sold, the rest will be converted into breeze and dust. The present retail price is 8s. 4d. per ton (5d. per cwt.), and one or two large lots of 1000 tons have recently been sold at 5s. and 6s. per ton, loaded into railway waggons.

An unused gasholder-tank, 70 feet diameter and 21 feet deep, less 6 feet for the brick arches that have been erected to cover it in, has been utilized by the present manager for the storage of the tar and ammoniacal water. This was a sensible arrangement, as the previous storage room for these products was altogether insufficient, and the occasion of loss of revenue to the undertaking by reason of the almost constant overflowing of the well in the winter season.

The contract price of these residuals is 32s. per ton for the tar, and for the ammoniacal water 2s. per ton for each degree of Twaddell. These are the ruling market prices at the present time.

From the retorts the gas passes through the hydraulic main to the condensers, of which there are two, of the ordinary vertical description; 36 pipes in each, 12 inches in diameter, and 18 feet long. These are just about 50 per cent. too small for the work they have to do; and they are in a most unsatisfactory condition, patched and hooped in numberless places, and leaking in several.

There is only one scrubber, 10 feet in diameter and 30 feet high. This is 66 per cent. too small in capacity, and 50 per cent. deficient in regard to height. The water-distributing arrangements are also imperfect, and altogether the vessel is practically useless in its present condition.

There are two new Jones's rotary exhausters, driven each by its own engine, with governor and bye-pass, each of capacity sufficient to pass 50,000 cubic feet of gas per hour. One of these was in action at the time of my visit, and was being worked as near as possible at a level gauge. Taking into account the leaky condition of the condensing apparatus, it is advisable to work the exhauster so as to allow of a slight back pressure, in order to avoid the risk of drawing air.

It is an unfounded suspicion, but one very widely entertained amongst consumers, that one of the purposes for which the exhauster is used is to force air into the gasholder along with the gas. This is an entire misapprehension; no manager in his senses would attempt any such thing. The small quantity of 3 per cent. of air mixed with the gas would destroy its illuminating power to the extent of 18 per cent. The object of the exhauster is to relieve the retorts of the pressure that would otherwise be thrown back upon them by the weight of the holders, and the passage of the gas through the dense materials contained in the purifying apparatus; and its effect is to increase the illuminating power of the gas, by preventing the deposition of the rich carbon on the sides of the hot retorts.

There are two steam-boilers, having their steam-pipes feeding the engines coupled together, with valves inserted; the intention being to make either the one or the other available whilst its fellow is being cleaned. The valves, however, are in so leaky a state that it is impossible to clean one without stopping both; and as it is indispensable that the exhausters be kept going during three-fourths of the year at least, both boilers have to be constantly at work. The result is that no cleansing or examination has been possible for months, and it is simply hazardous working the boilers under present circumstances. I am unable to certify as to their condition for the reasons given; but, taken singly, they are too small for supplying steam to drive the exhausters, and do the other necessary pumping that is required.

The purifiers are four in number, 20 feet square, and 5 feet deep each. These were originally constructed with a division-plate or mid-feather across their middle, the gas rising up one side and passing down the other. The present manager wisely altered this arrangement, by cutting holes in the division-plates and raising the gas outlet to the top of the vessels.

This, by doubling the area for the passage of the gas, not only reduced the back-pressure, but rendered the purification more effective and economical. Notwithstanding this, however, the purifying area is 50 per cent. too small for present requirements, without taking into account the great increase in the consumption that may be expected to take place.

The bulk of the purifying material used is oxide of iron, but a layer of lime is placed at the bottom of the purifiers for the purpose of arresting a portion of the carbonic acid, and another layer of muriate of iron to take up the ammonia which ought previously to have been eliminated by the scrubbers. Perfect purification of the gas cannot be attained by the process followed, but Wigan is in no worse position than most other places in this respect. After the gas leaves the scrubbers, there are three principal impurities remaining, which it is desirable to eliminate. These are sulphuretted hydrogen, carbonic acid, and bisulphide of carbon. To accomplish satisfactorily the perfect purification (practically speaking) of the gas from these impurities, three sets of purifiers are required, and the use of lime has to be largely resorted to. The *modus operandi* is as follows:—The first and second sets are charged with lime, the third with oxide of iron. On the gas from the scrubber entering the first set, the lime is acted on by the carbonic acid and sulphuretted hydrogen simultaneously, leaving the bisulphide of carbon, at the beginning of the process, to pass unabsorbed. After they have worked for some time, the sulphuretted hydrogen in the first set is gradually expelled by the incoming carbonic acid, for which the lime has a stronger affinity. The second set is now being fouled with sulphuretted hydrogen, the lime being wholly or in part changed in character, having become sulphide of calcium, in which state it has an affinity for, and consequently arrests, the bisulphide of carbon and other sulphocarbon compounds; whilst the unabsorbed sulphuretted hydrogen passes on to be finally taken up by the oxide of iron, with which the final set of purifiers is charged.

It is only in the Metropolis where the legal restrictions are such as virtually to compel the adoption of the process described, and there the nuisance arising from the use of lime is found to be so intolerable as to induce the Chartered Company to introduce a Bill during the present session of Parliament, giving a relaxation of the restrictions in this respect.

In using oxide of iron only, the sulphuretted hydrogen is entirely removed; but the two other impurities, carbonic acid and bisulphide of carbon, are left untouched. It is generally admitted, however, that the small amount of sulphur thus left in the gas is not injurious to health in any degree, and the principal effect the carbonic acid has is to deteriorate the illuminating power. But if this is maintained at the parliamentary standard, there can be no ground for objection on that score.

The station-meters, of which there are two, capable of passing 35,000 cubic feet and 50,000 cubic feet per hour respectively, are sufficient in size, but they are placed as inconveniently as possible, back to back, in separate rooms, the floors of which are some distance below the general level of the yard.

There are two gasholders. One of them is telescopic, averaging 97 feet diameter, and 40 feet deep; the other, single, 98 feet diameter, and 29 feet deep; their combined capacity being half a million cubic feet, supposing them to be in proper order. The single holder, however, is in but very indifferent condition, its capacity being curtailed by the bottom row of sheets being corroded into holes. The actual working capacity is, therefore, somewhat under the amount stated.

It is a well-known rule, that, for economical working, the storage capacity of the holders should be at least equal to the maximum daily make. This, at the Wigan Gas-Works, is 950,000 cubic feet, the largest quantity sent out on one day being 1,250,000 cubic feet. The storage capacity is, therefore, barely one-half what it ought to be, and this deficient storage is particularly objectionable in large manufacturing towns, where the great proportion of the night's consumption, amounting in places like Wigan to nearly one-half of the whole, is given out during the hours from five to half-past seven o'clock in the evening, in the depth of winter.

Looking at the apparatus on the works generally, I can sincerely commiserate the manager on the difficulties he has had to contend against, and the anxious and harassing time he must have experienced during the past season. I am satisfied that it has only been by the exercise of devoted attention and great experience and skill that the difficulties of the position have been surmounted.

The governors are three in number, and arranged by means of valves to control the pressure, each in its own particular district. Provision is also made by which, should the necessity arise, all the three districts can be supplied through any one or two of the governors. The arrangement is as follows:—

No. 1 is on the main supplying the higher parts of the town, and Standish.

No. 2, ditto, Chapel Lane, Wallgate, Poolstock, New Town, Pemberton, and Upholland.

No. 3, ditto, passing through Darlington Street to Higher and Lower Ince, Aspull, and Haigh.

There can be no question that, for some considerable time prior to the recent enlargements, the arterial mains leading from the works, through the town, towards the outlying districts, were utterly inadequate for the purposes of supply, according to the Act (Wigan Improvement Act, 1874, section 79 [3]), which prescribes that "the pressure shall be such as to balance from midnight to sunset a column of water not less than six-tenths of an inch in height, and from sunset to midnight a column of water not less than eight-tenths of an inch in height at the main," under a penalty, according to section 36 of the Gas-Works Clauses Act, 1871, not exceeding £20, if it should be proved to the satisfaction of two justices that on any day the gas supplied by the undertakers was under less than the prescribed pressure.

The following is an enumeration of the principal enlargements that have been made in the mains during 1876:—

Two 18-inch mains out of the north end of the works, in lieu of one 15-inch.

One 18-inch to top of King Street, in lieu of 6-inch.

One 16-inch to top of Market Place, in lieu of 6-inch.

One 8-inch in Market Place, in lieu of 8-inch.

One 8-inch from Douglass Bank House, near the Infirmary, to Boar's Head, in lieu of 4-inch.

One 6-inch from Boar's Head to Standish, in lieu of 3-inch.

One 10-inch in Pemberton District to Robin Lane end, in lieu of 6-inch.

One 10-inch to Lamberhead Green, in lieu of 6-inch.

In addition to the above, several serious defects in the mains have been discovered and remedied. For instance, in three different parts of the district—viz., at Standish, Ince, and Amberswood—mains 3 and 4 inches in diameter were found to have been severed (one of such being clearly an intentional severance), a piece of the pipe several feet in length removed, the connexion between the severed pipes being made with a length of wrought-iron tube of $\frac{3}{4}$ -inch and 1-inch diameter thrust into both ends, and cemented round. On one of these connexions in the township of Standish a 1-inch stop-cock was fixed on the inserted wrought-iron pipe, ostensibly for the purpose of admitting of the gas being shut off from the consumers beyond, when a better than the normal supply of gas was

required on occasions of festivity at Standish Hall. In the very centre of Wigan also, in the market place, there was an interval of 95 yards between the 6-inch mains, filled up with a 3-inch.

Notwithstanding the enlargements and improvements mentioned, and the maintenance of a high initial pressure, the supply to some portions of the outskirts is barely up to the requirements of the Act. Proof of this statement is furnished by the fact that, although many of the borough consumers accounts have increased in amount from 20 to 100 per cent., the average increase over the entire gas district is barely 13 per cent., the actual figures being:

Gas sold, quarter ending December, 1875 . . .	47,777,500 cubic feet.
" " " " " 1876 . . .	53,967,200 " "

Increase	6,189,700 cubic feet,
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being at the rate of 12.95 per cent.

It is extremely desirable, both in the interests of the consumers and the gas undertaking, that before the next lighting season such further enlargements of the mains may be made, particularly of those supplying the districts of Higher and Lower Ince, Aspull, and Haigh, as shall admit of the supply being maintained at a materially reduced initial pressure. It is only by such means that the heavy leakage, amounting to 23.8 per cent. for the twelve months ending December last, can be reduced to any satisfactory extent.

The bulk of the old service-pipes are of half-inch wrought iron, a size that should not be placed in the ground under any circumstances whatsoever. The fixing of these costs as much as pipes of greater diameter, and their extensive use entails a high initial pressure throughout the district. I saw a large number on the gas-works premises that have recently been taken up and replaced by pipes of wider bore.

The meters in use amongst the consumers are of the wet description, and these, in my opinion, are the best to be employed. I understand they are all, or nearly all, stamped in accordance with the Sales of Gas Act. No consumer is justified in harbouring for any length of time a suspicion in regard to the correctness of his meter's registration, as he can take the necessary steps to have it tested by the official inspector, of course paying the expenses incurred, in the event of its being found correct.

The record of testings by the borough analyst between the dates of December 2nd and February 26th last, show a remarkable uniformity in the illuminating power of the gas, the highest being 18.46 candles on January 22nd, and the lowest 17.57 candles on February 12th, or a difference of only .89 of a candle.

I tested the illuminating power of the gas twice during my visits, and found it the first time 19.40 candles, and the second time 20.42 candles value. The proportion of cannel employed must have been increased during the time of my visit to give this high illuminating power. I regret that this should have been so, as there was no necessity for it.

The instrument used in testing is that known as the Lefebvre photometer, and the burner is a 15-hole Argand, with a 7-inch chimney. The experimental meter and other appliances are of Sugg's best make, and all in accordance with the Act of Parliament—viz., sections 47 and 48 of the Wigan Gas Act, 1861, which, by section 79 of the Wigan Improvement Act, 1874, is made to apply to the Corporation Gas-Works.

Wigan Gas Act, 1861.

Section 47.—All the gas supplied by the company shall be of such quality as to produce from an Argand burner, having 15 holes and a 7-inch chimney, and consuming 5 cubic feet of gas per hour, a light equal in intensity to the light produced by 18 sperm candles of six in the pound, each burning 120 grains per hour.

Section 48.—The company shall, within 12 months after the passing of this Act, cause to be erected, in some part of the works, an experimental meter, fit for testing the gas manufactured by the company, furnished with an Argand 15-hole burner and a 7-inch chimney, or other approved burner and chimney capable of consuming 5 cubic feet of gas per hour, and other necessary apparatus, so situated or arranged as to test the illuminating power of all the gas supplied to the consumers.

Wigan Improvement Act, 1874.

Section 79.—(4.) The prescribed number of candles, and the prescribed burner, shall be such as are respectively prescribed by section 47 of the Wigan Gas Act, 1861.

(5.) With reference to section 28, the prescribed time and testing-place shall be such as are respectively prescribed by section 48 of the Wigan Gas Act, 1861.

The gas was free from sulphuretted hydrogen. Ammonia was present in considerable quantity, as might naturally be expected from the deficiencies of the condensing and scrubbing arrangements.

The more regular and efficient inspection of the meters during the past twelve months has, doubtless, had its effect in increasing the amount of the consumers bills. It must be mentioned, also, as assisting to explain the cause of the heavier gas bills, that the past season has been an unusually dark one, and Wigan is not singular in its complaint of increased accounts. But the increase is principally due to the recent enlargement of the mains, and the high initial pressure, reaching 30-10ths, that was maintained during the earlier lighting hours.

It is here, in my opinion, wherein consists the true ground of the consumers complaints, and justifies the agitation that assumed such formidable proportions. Some reasonable advice ought to have been tendered to the consumers, as to the effect the high pressure would have, and the remedies necessary to be applied.

The circumstances in which the manager was placed were onerous and difficult. On taking the post, twelve months ago, he found a wide outlying district in the hands of the corporation, which they had undertaken and were bound to supply with gas. The evidence which has been laid before me, and the result of the pressure-tests which I have personally taken over the district, convinces me that the resources at the manager's command when he arrived were altogether inadequate.

In addition to their own borough, the following local board districts are supplied with gas by the corporation:—Pemberton, Orrell, Upholland, Standish, Aspull, and Ince. From most of these bitter complaints were received of the inefficiency of the supply, and threats of "other measures to be taken," beyond mere complaints, were made, if an improvement was not speedily effected. Even in Wigan itself, complaints of deficient pressure were numerous. This is only what might be expected from the small size of the mains, and the numerous services of half-inch wrought pipe that were in use.

During the summer and autumn of last year the extensive enlargements of the mains were made, both through the town and in portions of the out-districts. This, with the continued high pressure, partially remedied the deficiencies in the outskirts; but the effect in the town itself has been the enormous increase that has taken place in many of the accounts of the consumers, due to their having consumed a much larger quantity of gas under the altered conditions of supply.

It would appear, however, that there is considerable irregularity in the rate of increase of many of the accounts of consumers in the immediate locality of the enlarged mains, and this circumstance is very naturally remarked and commented on, and my opinion asked as to the cause. The

reason of these differences is as easily explained as the other, but perhaps the explanation may not be so readily understood or accepted. In my opinion (and I speak from experience) they arise in this way. It will be found almost without exception, that wherever the service-pipes have been renewed, an increased account has been the result. On the other hand, where no material increase in the consumption has taken place, the old service-pipes have remained either wholly or partially undisturbed. The majority of these are of small bore, and much corroded, and although the augmented pressure would force an increased quantity of gas through them equally with the newer pipes, yet, by reason of the augmented pressure, the accumulated dirt in the interior would be driven forward till arrested by an angle or internal roughness, and, in consequence, the clear passage of the gas would be still further reduced. It may be set down as an absolute fact, that where the service-pipe has been renewed, there has been an increased consumption and a heavier account. In many instances this will be so where no renewal has taken place; but in such cases the supply-pipe is of ample size, and less corroded.

The idea that systematic errors have arisen in the taking of the meter-states may be dismissed as untenable. An occasional mistake may be made, it is true, but these are quite exceptional. It is just as easy to read the dials of a meter as the dial of a clock, and any person, with ordinary eyesight and intelligence, can accomplish the one as readily as the other. With very small meters, having only two dials, it is possible to make a mistake of 10,000 cubic feet, owing to the fingers of the dials having both made a complete revolution during the intervals of inspection, but in such cases the gas authorities are usually the sufferers, and if it occurred on the other side, any consumer making an objection to his account on that score would easily be able to satisfy the manager of the validity of his complaint.

The Gas Committee might save themselves and the manager some trouble, and allay the suspicions of many of the consumers, by circulating one of the useful pamphlets that are published, giving instructions, not only for reading the meter, but for burning the gas to the best advantage. I venture to give the names of some of these that occur to me at the moment:—

"How must I Manage the Gas?" by J. O. N. Rutter.

"The Gas Consumer's Manual," by E. S. Cathels.

"A Guide to Gas Lighting," by Alfred H. Wood.

These are all excellent, and are written by men who have made the subject a life's study.

Instructions for reading the meter-dials might also be printed at the head of a card left with each consumer, and on which the states at the end of each quarter could be recorded by the meter inspector.

The old iron flat-flame burner, I observe, is very generally in use, the result being the destruction of the light to the extent of 30 to 50 per cent. As an example of the general ignorance that prevails in regard to burners amongst the consumers, I may state that one of them, whose account was in excess of previous quarters, expressed to me his astonishment at the circumstance, and the small illuminating power of the gas, stating that he had now in use the identical burners that were inserted 15 years ago. Important improvements have been effected in the construction of burners within the period named, but, even when using the best kind, their frequent renewal is both desirable and necessary for securing the proper development of the light.

There are many excellent burners in the market, constructed on true principles, to be purchased at prices within the means of every gas consumer. Of these, Sugg's, Brünner's, and Bray's may be specially recommended. But whatever the kind of burner adopted, the pressure of the gas must be controlled and regulated to obtain the maximum of light. This cannot be accomplished satisfactorily, by checking either the taps on the fittings, or the stopcock at the meter, because the pressure in the mains is continually varying according to the consumption that is going on. There is a small instrument called a governor or regulator that does this effectually. It may be fixed on the pipe leading from the meter outlet. It is automatic in its action, and when weighted to afford the required pressure for the burners in use, it will continue to give a practically uniform supply, however much the pressure in the mains may vary, or whether the whole or only a portion of the burners being supplied through it, may be alight at one time. Wherever the regulator is adopted in the neighbourhood of the heavy pressure, a considerable saving will be the result.

There is a further great advantage attending the use of the regulator. It develops the illuminating power of the gas by ensuring its consumption at a low pressure. It is a clearly established fact that the lower the pressure (provided there is just sufficient) at which gas can be burnt, the better the light. The principal cause of the complaints as to the illuminating power of the Wigan gas throughout the borough is due to the heavy pressure that has had to be maintained by reason of the exigencies of the supply. Instead of being advantageously consumed, the gas has been forced through the burners into the atmosphere, the carbon (the light-giving medium) being oxidized by the excess of air drawn into the flame by the heavy pressure, with the usual unsatisfactory results as regards illumination.

I concur generally in the necessity for the extensions proposed by the manager to be made during the present year. With his estimate of the cost of the same, however, I do not agree; most of the items are, in my opinion, considerably under the mark. The proposed new tank and holder of the size stated, will cost from £2500 to £3000 more than the sum put down for them.

The present prices of the gas supplied by the corporation are—

Inside the mile radius, under 150,000 cubic feet per annum, 8s. 10d. per 1000; outside the mile radius, 4s. 11d., less 10 per cent. discount if the amount is paid within one calendar month from the date of delivery of the bill. Inside the mile radius, 150,000 cubic feet and upwards per annum, 3s. 10d. per 1000; outside the mile radius, 4s. 11d., less 20 per cent. discount if the amount is paid within one calendar month from the date of the delivery of the bill.

Notwithstanding that the capital of the concern is somewhat high, amounting to nearly £800 per million cubic feet of gas produced per annum, with the necessity facing the Gas Committee of still further adding to its amount, I am satisfied that if the judicious management now being pursued is continued, the corporation will soon find themselves in a position to make a handsome reduction in the price per 1000 cubic feet.

From my observations during the investigation, I have come to the conclusion that the gas enterprise has not had fair play during past years of its existence. Without going beyond the present boundary, I feel assured that there is a wide field for gas extension in the district.

I beg to bear my testimony to the facilities for making the inquiry that have been rendered to me by the chairman and members of the Gas Committee; by Mr. Hawkins, the manager of the gas-works; and by Mr. Betley, the borough analyst. I have also to thank the secretaries and members of the committee of gas consumers for the willing assistance they afforded to me in my endeavours to arrive at the facts; and I testify to their frequently-expressed desire that the investigation should be made without prejudice, and reported on in the like spirit.

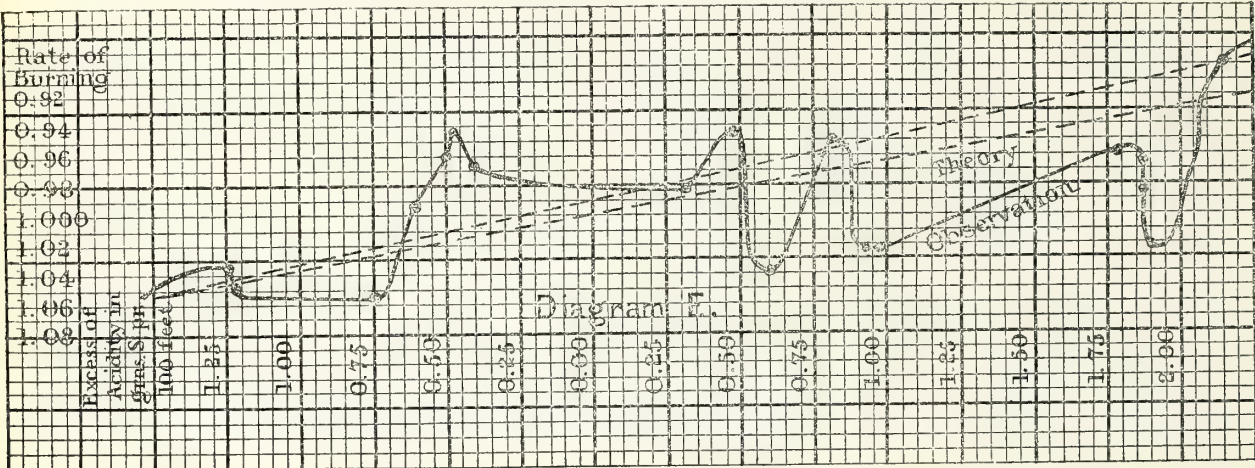
I am, gentlemen, your obedient servant,
5, Norfolk Street, Manchester, March 16, 1877. THOS. NEWBINGG.

ON THE VOLUMETRIC DETERMINATION OF SULPHUR AND AMMONIA IN ILLUMINATING GAS, WITH A DESCRIPTION OF THE APPARATUS EMPLOYED.
By H. E. SADLER and B. SILLIMAN, of New Haven, Conn.
(Concluded from page 424.)

The Formation of Nitrous Acid and other Sources of Error.
In endeavouring further to reduce or eliminate this variation, the drip from the condensation-tube was carefully tested for other acids and bases. Besides the soda and sulphuric acid, nitrous acid, probably mixed with nitric, was detected by silver nitrate, and also on setting free the nitrogen acids with sulphuric by the coloration tests, ferrous sulphate, brucia, &c. No other acids could be found—carbonic, of course, excepted. The absence of sulphurous acid or a soluble sulphite was a surprise. It was demonstrated by precipitating duplicate samples, oxidizing but one of them. The resulting precipitates did not differ sensibly in weight. This fact was further confirmed by adding 10 cubic centimetres of a carefully titrated solution of potassium sulphite to successive equal portions of the drip. On titrating back with standard iodine solution and starch paste, it was found that 5.65 cubic centimetres of the sulphite in each solution had been oxidized. Of the bases a trace of ammonia alone was found. The drip in experiment No. 12 was submitted to Nessler's test, and showed 9-10ths of a grain of ammonia per 100 feet, equal to 84-100ths. of a grain of sulphur. The nitrogen acids were not determined, as no means for the

estimation of so small quantities presented itself, except the somewhat difficult combustion process. It seemed impossible* that more than 100th of a grain of ammonia could be supplied by the 700 feet of air admitted by the apparatus for the combustion of 100 feet of gas, and it followed that the remainder must be produced in the burning. There was no other source for the nitrogen acid.
We are brought here face to face with a curious phenomenon. Nitrogen, forming simultaneously, under the same conditions, an acid and a basic radical with the oxygen and hydrogen directly or indirectly supplied by the air and gas respectively.
This fact has been before noted and more clearly proved.† Two theories present themselves in this connexion to account for the variations noted in the above table between the sulphur and the total free acids produced by the combustion. The first is that where the gas is passing rapidly and the flame is near the smoking point, the nitrogen will find an abundance of hydrogen from the gas and a scanty supply of oxygen. The tendency will then be to form ammonia in excess of nitrous acid. When, on the contrary, the gas is burned slowly and, the supply of air being the same, a surfeit of oxygen awaits the scanty hydrogen, acid will be more freely formed than ammonia. The excess of total acidity will then be a function of the relative supply of gas and air, and column VII. will follow column IX., which gives the rate.

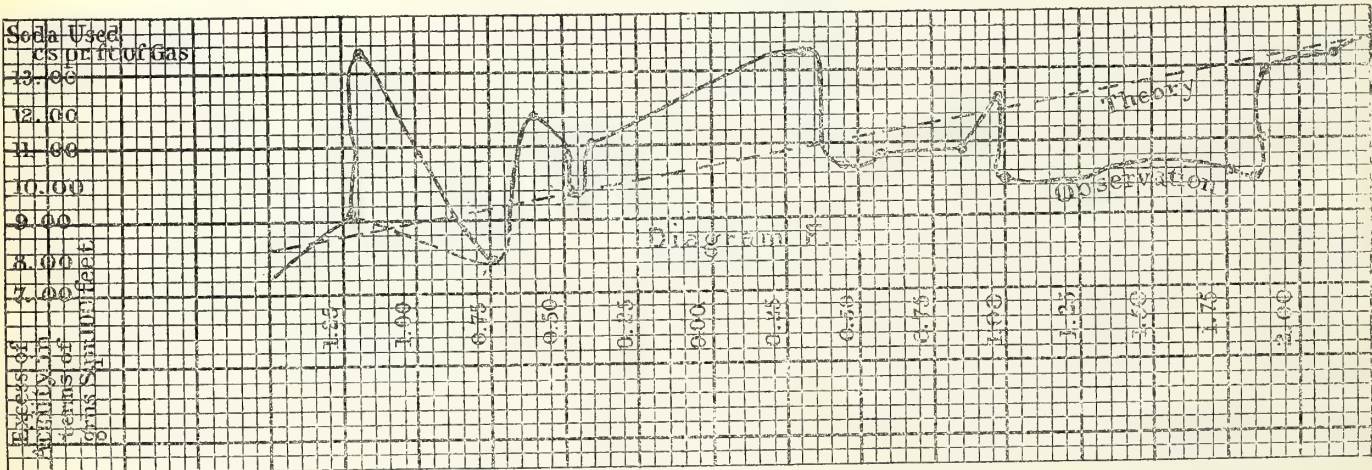
How far our experiments sustain this view will be seen from diagram E :



The second theory plants itself upon the hypothesis of the dual nature of nitrogen gas, one atom of each molecule broken up in nitrification taking to itself hydrogen and the other oxygen. In this case an excess of acid or base from the nitrogen is impossible, the product of nitrification being uniformly ammonium nitrite, a salt. This substance, however, is very unstable, falling readily back to water and nitrogen, and yielding easily to an acid, ammonia, to a base, nitrous acid. Thus, this body, in passing

through the condensing-tube, would surrender its acid to the soda, in amount somewhat proportionate to the quantity of free soda in the tube, while the ammonia, but slightly absorbed by the alkaline solution, would pass off at the escape. Column VII. would then accord in some sort with column VIII., which gives the relative proportion of soda and gas used in each experiment.

Diagram F shows the variations :



To pronounce upon the accuracy or sufficiency of either proposition without further experiments made with especial reference to them would be premature. Probably outside of certain limits which we may call the normal working, both the rate and the alkali used have their influence on the result, as will appear more clearly by comparing the two curves given above with the curve of their average as shown in diagram G :
For the rest, the perturbations must be charged to the inaccuracy of the test as worked, of which there are several sources which, small in themselves, may yet be considerable in the aggregate. First, we assume that, at the end of an experiment, the condensing-tube contains the same quantities of alkali and of sulphur as at the beginning. The difference, when compared with the total quantity, must be small, but a difference there may be. Second, the alkali pipette attached to the apparatus, the acid pipette and burette, and the alkali burette, must be strictly accurate; at least they should accord with themselves and each other. The former of these conditions was not in our apparatus entirely fulfilled. Third, the opportunity for error is considerable in judging the change of colour with cochineal, especially when the determinations are made on different days, and cannot be compared with each other. And, lastly, the "personal error" cannot be entirely disregarded.

Other Products of the Combustion.

Aside from the acids and bases, no substance among the products of combustion was positively identified. Potassium iodide paper, moistened with starch liquor, and suspended above the marbles in the condensing-tube, immediately showed the presence of an oxidant, probably hydrogen dioxide or ozone, since nitrous acid was hardly possible after passing this alkaline solution. Blue litmus paper, however, was here reddened, but rapidly bleached. The reddening was probably due to the carbon dioxide.

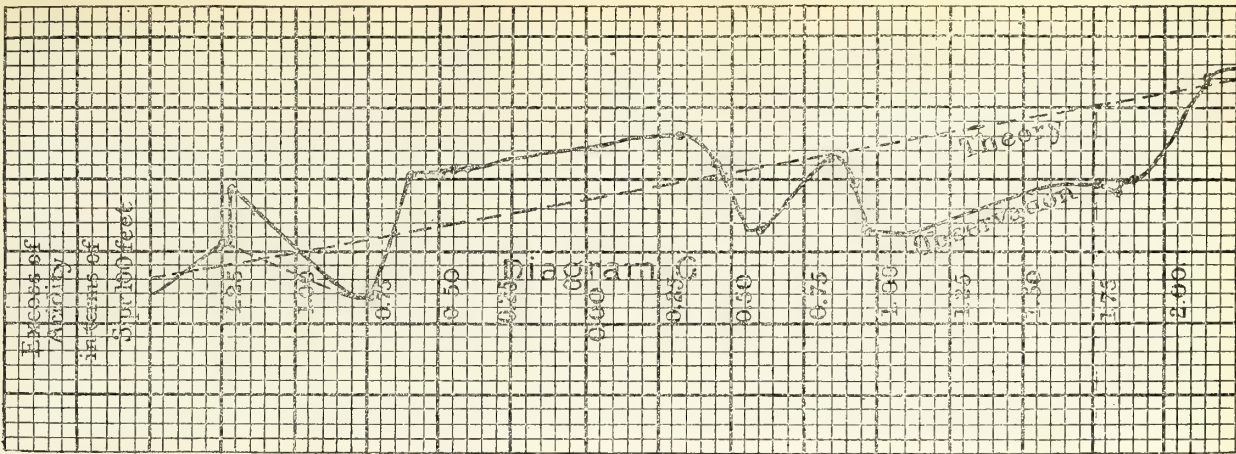
A portion of the drip from each of the last eight experiments was preserved in tightly-stoppered bottles, and at the conclusion of the experiments tested for oxidants with 1-20th normal sodic hyposulphite and iodine solutions. No oxidation of hyposulphite took place in alkaline solution. Upon acidifying with hydrochloric acid, from one to two cubic centimetres were found to be oxidized. After adding excess of hyposulphite, and allowing the solutions to stand—Nos. 12, 13, and 14 over night, and the rest for one hour—the following results were obtained. Since no oxidation took place in the alkaline solution, it was inferred that nitrous acid was the oxidant, and not hydrogen dioxide or ozone, and the results are accordingly expressed in grains of nitrogen oxidized in the combustion of 100 feet of gas :—

TABLE H.

Grains N.	
No. 12.—0.988 equal in saturating power to 0.86 grain of sulphur.	
No. 13.—0.789	0.65
No. 14.—0.706	0.62
No. 15.—0.415	0.36
No. 16.—0.411	0.36
No. 17.—0.354	0.31
No. 18.—0.292	0.26
No. 19.—0.244	0.21

These results seem to indicate so unquestionably that much the greater part of the oxidation was due to the atmospheric air absorbed by the liquid that it is barely worth while to recall in this connexion the Nessler

* See Johnson's "How Crops Feed," p. 55, and especially Vile's determinations Pelouze and Fremy, I., 320.
† Schaeffer *American Journal of Science*, Nov., 1863. T. Sterry Hunt, "Chemical and Geological Essays," Appendix p 446. Schönbein, London and Edinburgh, *Philosophical Magazine*, June, 1862, p. 466.



determination of the ammonia in No. 12, 9-10ths of a grain per 100 feet, equal in saturating power to 0.84 grain of sulphur. The above table shows nitrous acid in No. 12 equal to 0.86 grain of sulphur.

Further Suggestions.
The possibility of avoiding the complication arising from the arrest of varying quantities of nitrogen acids, and of further simplifying the working of the test by substituting pure water for standard alkali in the condensing-tube, is suggested by a consideration of the fact that sulphuric oxide possesses so great affinity for water, and that, when once in solution, especially if the proportion of water is large, only slight traces of acid vapours are given off, even under the most favouring circumstances.
It may be true that, in the combustion of sulphur, sulphurous and not sulphuric oxide is the body immediately produced; but it is rendered probable by several experiments, most of which have been detailed above, that, travelling in company with the powerful oxidants produced by the combustion of hydrocarbons in air, no considerable quantity of sulphur would enter the combustion-tube without being completely oxidized—a view which receives confirmation from the important experiments of M. Vérigo, communicated to the *Académie des Sciences* by M. Berthelot, reported in the *Comptes Rendus* for April 24, 1876.* If this inference prove unfounded, we have still a safeguard in the comparatively ready solubility of sulphurous oxide in water, with which the products of combustion are very thoroughly scrubbed in the condensing-tube; and, as a last resource, the addition to the scrubbing water of a small quantity of standard solution of borax, which is a great solvent for sulphurous oxide.

While still under the impression that sulphurous acid was the chief substance to be met with, some experiments which depended for success upon the power of water to arrest sulphuric oxide, as suggested above, gave the following results:—

TABLE I.

No. 1.—14.93	grains S. per 100 feet.
No. 2.—31.52	" " 100 "
No. 3.—17.51	" " 100 "
No. 4.—10.51	" " 100 "
No. 5.—10.48	" " 100 "
No. 6.—18.60	" " 100 "
No. 7.—18.43	" " 100 "
No. 7.—15.34	" " 100 " (Letheby.)

The products of combustion were bubbled through water, and bromine added continuously by an automatic arrangement to oxidize the sulphurous acid. The exhauster, a Richard's pump, used to draw the gases through the water was insufficient in capacity and uncertain in its action, and, accordingly, only a small quantity of gas, from 2-10ths to 4-10ths of a foot, could be burned for each determination. A volumetric estimation of the sulphuric acid was then obtained by expelling the free bromine with heat, and the hydrobromic acid by digestion with silver oxide, or better with silver carbonate. When this had settled, an aliquot portion of the supernatant liquor was withdrawn for titration, but as it was found to contain dissolved silver salts sufficient to obscure the reaction between hæmatoxylin or cochineal and an alkali, these were removed by precipitation with hydrogen sulphide, the excess of which was in turn expelled by boiling. The remaining free acid was titrated with standard alkali. In dealing with such small quantities the probable error was, of course, very large, and it was thought useless to make comparative experiments with the Letheby test until the apparatus should be put in condition to burn a larger quantity of gas for each determination. Before so amending, the whole process was abandoned in favour of the alkali test, and we have accordingly but one comparative experiment, No. 7. The general results afford some indication, however, of what might, under more favourable conditions, be accomplished with water as a scrubbing liquor.

Résumé.

In reviewing what has been accomplished, an advance in two directions seems possible:

1. An apparatus has been devised for bringing gases into contact with a liquid, which is an improvement on bubbling them through the liquid contained in a Woolfe bottle in three respects. The necessity for an exhauster or blower is avoided, the gas is completely broken up, affording a more intimate contact, and the proportion of the two may be so regulated as not to flood the products. 2. The gas engineer is provided in this apparatus with a complete indicator of the working of all his purifying processes except the removal of the tar.

It is continuous. There is no instant of the day or night when the quantity of ammonia and sulphur passing into the holders or street-mains is not being accurately measured.

It is ever ready, and if the condensers and scrubbers allow an abnormal quantity of ammonia to pass, or the purifying-boxes become over-worked, and there escape traces of hydrogen sulphide, which every engineer now intends to remove, the test papers give immediate notice, and the amount of damage done can be quickly determined.

It is complete. The presence and quantity of ammonia, and of hydrogen sulphide and the other sulphur compounds, are indicated, and the possible presence of carbon dioxide; for, on account of the well-known power of that body to decompose moist calcium sulphide, setting hydrogen sulphide

free, no noticeable quantity of carbon dioxide can pass the purifiers without the previous escape of hydrogen sulphide.

It is rapid. Ten minutes is ample time to determine both the ammonia and sulphur.

It is inexpensive. Fifteen dollars will provide all the glassware for the apparatus. The breakage is small, and the chemicals cost comparatively nothing.

Finally, it is simple in theory and practice. To work it successfully requires no knowledge of chemical theories, and the needful manipulations can be easily acquired by a little care and attention to a few simple directions.

THE CHEMISTRY OF GAS MANUFACTURE.

By A. VERNON HARCOURT, Esq., F.R.S.,

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[A course of Four Cantor Lectures delivered at the Society of Arts, London.]

FIRST LECTURE.—MONDAY, MARCH 5.

I propose, this evening, to give you, in the first place, a short account of the formation and chemical nature of coal, and afterwards to offer a general view of the subject, which I shall deal with more in detail in succeeding lectures—namely, the result of the application of heat to coal, especially in connexion with the manufacture of coal gas.

Coal was formed from the air, by a process, the beginning of which we are all familiar with, through watching the growth of vegetation.

The air consists, as you know, chiefly of oxygen and nitrogen, so that in 100 volumes there are about 78.4 volumes of nitrogen, and 20.6 volumes of oxygen; but it contains also small quantities of two other substances which for vegetation are much more important—namely, water and carbonic acid. Of water it contains ordinarily about 1 per cent., and of carbonic acid no more than .04 per cent. Nevertheless, it is on the presence of these substances in the atmosphere that the growth of vegetation depends.

The plants which grew at the time when our main supplies of coal were formed differed greatly from those which exist on the earth at the present time; so much so that very few of them can now be referred by botanists to any existing genera. I owe to the kindness of Professor Tennant some diagrams which are now upon the walls, giving examples of a reconstruction of those plants. The remnants or impress of them are chiefly found not on the coal, but in the shale which underlies the coal, and which has preserved the record more perfectly than the more alterable, softer matter of the coal itself.

Although the actual genera are different from those which now exist, yet we may compare these plants with various existing genera. For example, this *Lepidodendron*, of which a portion is drawn here, appears to be a plant of the same kind as the small club moss with which we are familiar, but on a gigantic scale.

Again, there are representatives of the tree ferns and of the conifers, of which I have here some drawings. Then there is what seems to have been a large tree, which is called *Sigillaria*, because of the marks, as if impressed by a seal, existing on its stem; and what was formerly supposed to be a separate plant, but has now been proved to be only the root on which this trunk grew. These roots or stools have been preserved more abundantly than the trunks, so that often where the trunk seems to have entirely disappeared, the roots remain, and as they were supposed to be different, they received the distinct name of *Sigmoria*.

Then, again, another variety of plant, which seems to have abounded in the coal measures, corresponds to the *Mares Tails*, which now grow in marshy places or equiseta. It is, however, uncertain whether the predominance of these varieties in the fossils of the coal measures depends on their greater abundance amongst the vegetation of that period, or rather upon the fact that they have better resisted the influences producing change to which this deposited vegetation has been subjected. Some interesting experiments were made several years ago by Professor Lindley on the powers which different plants possess of resisting decomposition, and he found that out of 177 kinds of plants which he left for two or three years under water, there were only 56 which had not wholly disappeared, and among these were the representatives of those varieties which are found in abundance in the coal measures, rendering it thus probable that the preservation of the forms of these plants may be due rather to their being able to resist the protracted action of water than to their greater abundance.

What may have been the nature and appearance of the forests or jungles which overspread a large portion of the earth's surface, for countless generations of vegetable life, must remain but dimly known. In coal itself the very traces of organic structure are almost wholly obliterated. All that we can say confidently is, that coal consists of the mineralized vegetation of a former period.

As to the way in which it has been accumulated, there were amongst geologists, some years ago, two rival theories. One view is that coal consists of the remnants of plants falling where they had stood, and that by a process of gradual decay, such as is now converting the heather of our moors into peat, these great masses of vegetable matter were accumulated, and converted into a more or less homogeneous mass. The interstratification of these deposits with sandstone, limestone, and shale is supposed to have come to pass in the following manner:—After these plants had grown and died for many generations, the portion of the earth where they grew was flooded, the vegetation was destroyed, and, during the time that it was submerged, mineral matters were deposited where the plants had grown. This submergence, also, we must suppose

* Since this paper was read, our attention has been called to the fact that Mr. C. Heisch F.C.S., had already observed the absence of sulphurous acid (London JOURNAL OF GAS LIGHTING, &c., Dec. 29, 1874, p. 856), and in the October number of the *American Chemist* are reported some experiments of Mr. W. C. Young, F.C.S., leading to the same conclusion.—Authors.

to have continued for a very long time; then the sea, or more often, it would seem, the fresh water, retiring, plants were again sown, and vegetation again throve for a long period; and thus the cycle of changes repeated itself. Probably this is the true account of the formation, at any rate of the greater part, of the coal that we have. By this alternating deposition of vegetable and mineral matters, we have the state of things which an examination of the earth's crust reveals, and which is well illustrated by the section of the coal measures of the Forest of Dean, which Mr. Warrington Smith has lent me. Represented by this grey band is the new clay, which seems to have been the soil in which the plants of the coal measures grew. Then there is an accumulation of coal, the vegetable matter stored up; afterwards there was a period of inundation, and of deposition of mineral matter, which went on accumulating for a long time. The thickness of these strata represents in some sort the length of the periods of time which intervened between each change. The breadth of the black line represents, relatively to the rate of deposition of the organic matter, the length of time during which the forest flourished. Then followed the deposit over it of sand, now compacted to sandstone, for a length of time, through a long alternation of periods here recorded in strata and so on. No doubt the tax on the imagination of receiving a view of this kind is very great, especially if we figure to ourselves how long a period is required for the storage of the amount of vegetable matter which a single coal seam represents. The greater part, no doubt, of the carbon of these plants passed away into the air and disappeared, as the plants disappeared in Professor Lindley's experiments. Then we have to suppose those changes happening far inland, and simultaneously over a great portion of the earth's surface.

The other hypothesis to which I referred is, that these deposits have been formed chiefly from vegetable matters carried down by rivers. There are examples of such accumulations at the mouths of the Mississippi, and other large rivers, which best illustrate this hypothesis where there are great floods, and quantities of vegetable matter borne down and deposited in the delta of the rivers. What seems likely is, that both these causes have been in operation. But the extent and continuity, and even thickness of the seams of coal, and the fact that trees are found standing upright with their roots still bedded in the under clay, make it probable that the former hypothesis truly represents the principal mode in which coal has been accumulated. But wherever the storage of vegetable matter and the deposition of great masses of other materials upon it, so that it has become deeply buried in the earth's crust, and subjected to a high temperature and great pressure—wherever this has happened, there has occurred the process by which coal is formed.

Then, besides the deposition of the vegetable matter, we have also to account for the change which it has undergone. The two principal causes which have concurred in producing this change are pressure and a high temperature. We know that now, as we descend through the earth's crust, the temperature rises at the rate of about 1° Fahr. for every 60 feet that we descend. It is to be remembered also, that of the coal which we can now reach, or which comes within the 4000 feet of depth fixed by the Royal Commission as the greatest depth from which we should ever be likely to succeed in winning coal, much, at any rate, has been at another time at a greater depth beneath the earth's surface than we now find it, and that afterwards, by disturbances in the crust of the earth, it has been carried up to its present level.

Bischof has gone into the question of the nature of the changes by which woody fibre may have been converted into coal, and pointed out that there are various chemical changes by which this may have been effected. The abstraction of water, carbonic acid, and carburetted hydrogen, or of any two of these, produces an effect which may generally be described as a removal of a portion of the oxygen and hydrogen from the woody fibre—the carbon remaining behind in larger proportion. That, at any rate, is the nature of the principal difference between wood and coal, that oxygen and hydrogen exist in larger proportion in wood, and that the change by which coal has been produced has consisted in one way or the other in their more or less complete abstraction.

Another change, and one, perhaps, harder to understand, has gone on at the same time. Not only does coal differ from wood in the proportion of its organic constituents, but it differs from it in a remarkable way in its mineral constituents. The ash of coal is a very different thing from the ash of wood. Moreover, the ash of coal is almost the same as the ash of shale, and we must therefore suppose further that the coal, or the material of the coal has been exposed to the action of water carrying mineral matters, either in solution or in suspension, for a sufficient length of time for its own mineral ingredients to be washed out, and those which were borne in solution or suspension by the water to have been substituted for them.

There, on the wall, is a diagram, showing the position of the coal measures in the series of strata down from the surface of the earth, which may serve to illustrate the great depth where all these strata are superimposed of the formation in which the coal lies.

I pass next to the changes which are produced in coal by the application of heat. Such changes occurred independently of man's agency, and at a period long before man appeared upon the earth. We know that in several parts of the earth it has been observed that inflammable gases issue from the ground. At Chat-Moss, in Lancashire, it was observed long ago—that by simply making a hole in the ground, placing a pipe in the hole, and applying a light, a flame could be maintained for a long time; and actually such gas has been applied to the lighting of buildings. Then, again, not only does nature make gas, but in making gas nature makes coke. Anthracite is natural coke—it is coal which has been exposed to a high temperature, and thus has undergone the same changes which we produce in coal by exposing it to artificial heat. When coal is heated, the change it undergoes depends upon the temperature to which it is heated, or the rate at which it is heated. Probably the meaning of this is, not that coal, speaking of it as one substance, undergoes different changes, according as it is heated quickly or slowly, but rather—which, I think, is the true explanation of the matter—that, when it is heated quickly, the products which are first produced by heating it are exposed to the high temperature before they can escape. Probably the effect of heating coal quickly to a high temperature might be perfectly imitated by subjecting the products of its decomposition at a low temperature subsequently to a high temperature. This may be difficult to effect on a manufacturing scale, or may have no economical advantage. I believe something of the kind has been tried, but the true account of the matter is probably this—not that the same substances undergo chemical changes different according as they are exposed at once to a bright red heat, or gradually and gently heated; but that, when coal is treated in the way in which it is treated in a gas-retort, and is suddenly exposed to this strong heat, the substances which would be simply distilled from it, if it were first heated gently, come into contact with strongly heated surfaces, and thus undergo a further change. The difference in the result is, that coal which is gradually heated gives off a much larger proportion of liquid, and a much smaller proportion of gaseous products, than coal which is suddenly heated strongly.

When the process of heating coal for economical purposes was first introduced, I believe the object in view was not the production of gas,

but of the liquid and solid products. "In 1781, Lord Dundonald took out a patent for the distillation of coal, his object being to produce *brown oil*, as it was called, naphtha, ammonia, and coke; but the gas was let go. Works for this purpose were in operation for nearly 50 years at Muirkirk, in Ayrshire. A curious circumstance in connexion with these works is, that among the coal which was thus treated was found some cannel, which was thought to be unsuitable and thrown away.

I have here a miniature gas-works, lent by my friend Mr. Fison, which is now in action, and shows every step in the manufacture of coal gas, the heating of coal in the retorts, condensation of tar, ammoniacal liquor, washing, purifying, storage, and distribution. There are also on the walls a set of diagrams, lent me by Dr. Frankland, illustrating the same operation.

The solid residue, when coal has been heated in the retort, is the well-known substance called coke. The same substance, or very nearly the same substance, is also produced in coking-ovens for use in locomotives, and for other purposes. It contains some three-fourths of the total weight of the coal which is distilled; and when the coal employed is a caking coal—that is, a coal which, when it is heated, is sufficiently bituminous to partially fuse, and so aggregate itself together—the coke remains behind in a solid piece, such as I have here. In many respects coke is superior to coal as a fuel. It has over coal the same advantage, for many purposes, that anthracite or steam coal has over other coal. You know that for use on board ship, and wherever a clean fire is required, the steam coal or smokeless coal is greatly preferred to ordinary bituminous coal. We do not commonly use coke for fires in our sitting-rooms; but I believe that this depends upon the form of grates which we are accustomed to use. A better form of grate has recently been advocated, under the name of Slow Combustion Grates, in which the air is not admitted to the fire from below, but only in the front. The effect of admitting air through an open grating beneath the fire, is to cause the coal to burn quickly away. If air enters from the front, combustion takes place, and each coal glows on the side towards the room. The grate should have a high and wide front, but be shallow from front to back, and have flat bars set edgewise, or rather far apart. The open space above the top bar should be no more than sufficient for putting on coals. In a grate of this kind, as I can testify from my own experience, coke can be burnt with the help of a little coal, just as well as coal, and with a better heating effect. I cannot but think that the consequence of the reform in our grates, which I hope to see, will be that this fuel will be largely substituted in domestic use for coal, to the advantage both of the householder and of the gas manufacturer. At times like the present, when the price of coal is lower than it has been, and the winter is mild, the quantity of coke which accumulates is very large, and the value of it to the maker is often very much below its real value. The reason we now use the bright or blazing coal in our fires is, that the air being admitted through the bars below, the chief part of the combustion goes on there, radiating heat only upon the hearth-stone, and the upper part of the fire, which is what we look upon, would be dull, unless we used a coal yielding a great deal of gas, in order that we may have a blaze at the upper surface, and see something bright.

The gases which pass out from the retort consist partly of what are termed permanent gases, and partly of what are distinguished as vapours; that is, of gases which, under other circumstances, would not be gases but liquids.

This distinction between gases and vapours is more misleading than it is serviceable. When we speak of a substance which is perfectly gaseous as a vapour, we recall by that word a circumstance which is generally quite irrelevant—namely, that under other conditions, if the temperature and pressure were different, this substance would be a liquid. Most probably the same is true of every gas; we know it to be true of all gases except six. It is as though we restricted the word "liquid" to permanent liquids like alcohol, and had another word for liquids which could be frozen. However, at the ordinary temperature a great deal that is gaseous at the high temperature of the gas-retort becomes liquid, and so is collected separately. I have on the wall two long tables, giving the names and the chemical formulæ of the great variety of substances which have been found among the products of the destructive distillation of coal. You will see that in one table all the substances, whose names and formulæ are given, consist of combinations of two only of the elements of coal—hydrogen heading the list, and all the other substances being combinations of it with carbon. Those which stand first on the list—hydrogen and marsh gas—are both permanent gases, which have never been liquefied. The others are substances which exist in the gas, and which are also partially condensed with the tar. They are grouped here according to their chemical classification, not according to their volatility. Those which come lower down are liquids. Paraffin is the name generally given to a solid substance that is obtained from coal, and it is given also by chemists to both liquid and gaseous substances which have the same general formula, $C_n H_{2n+2}$. Acetylene, again, is a gaseous hydrocarbon; then come some of the principal of the liquid bodies that are produced. Naphthalene is sometimes gaseous and sometimes, unfortunately, solid. It is liable to be deposited, and to obstruct gas-pipes at a distance from the works. Anthracene—a substance of which I shall have more to say presently—is also a solid substance. Then there are others into which oxygen, nitrogen, and sulphur enter, in combination with carbon, or hydrogen, or both.

This other table gives the results of a number of analyses of the different kinds of coal. The varieties of coal range, shading one into the other, from that containing the largest proportion of carbon—namely, anthracite—to highly bituminous coals, passing on into cannel coal, and into a substance about which there has been a dispute whether it is coal or not. This is Boghead cannel. This still richer substance of which Mr. Evans has kindly sent me a specimen—Boghead shale, as it has been called, from its resemblance to Boghead cannel—comes from Australia. You will see, from the specimens I have here, how extremely these substances differ in appearance from each other; indeed, different samples of cannel coal differ very much from one another, some being quite devoid of lustre, and some being brilliant like anthracite. The more bituminous coals yield a larger proportion of liquid products. Coals are called bituminous, not because they contain bitumen—for this substance cannot be extracted from them—but because they yield it when they are heated. As to the actual substances existing in coal, very little is known, because the actual constituents of coal are extremely insoluble, and chemists have not succeeded, by the application of solvents, in extracting directly (by processes which will produce no change in the coal) substances which they can isolate and examine. Thus it happens that our knowledge is almost entirely of the substances producible from coal by heat, and not of the substances—equally definite, no doubt—which already exist in it.

I shall have to speak in a subsequent lecture of the substances which enter into ammoniacal liquor, as it is called, but will pass now to the other of the two liquid products of the destructive distillation—namely, tar; and consider, in the time which remains, the nature of some of the products which have been obtained from it.

Tar is a mixture, in varying proportions, of a great number of different substances. When it is heated it is divided into more and less volatile parts. There distils from it first some water—indeed, a principal difficulty with the tar distiller is to get rid of the water with which the tar is

mechanically mixed. After that there comes over a substance which the tar distiller calls "liquid naphtha," which is subjected to a subsequent distillation. Next there comes over a substance of higher boiling point, of a consistency which is almost solid—a buttery substance which is called "creasote;" and, lastly, there comes over a substance which is at first more fluid, but afterwards nearly solidifies, called "anthracene oil," because anthracene is obtained from it. That which first distils over has nothing characteristic in its appearance, being a limpid, colourless liquid. In these bottles are the products of the subsequent distillation.

The crude naphtha is first acted upon by soda. It is brought into contact with something like one-third of its volume of a strong solution of soda. It contains, besides benzol and other similar hydrocarbons, a quantity of another important substance—namely, carbolic acid. This unites with the soda, and the two together form a heavy liquor, on the top of which the lighter naphtha floats. The liquor is drawn off and mixed with sulphuric acid; it separates, as it cools, into two layers, the lower one consisting of a solution of sulphate of soda, and the upper one of the crude carbolic acid. The tar distiller carries the operation no further than to run away the sulphate of soda, of which he makes no further use, and to draw off the carbolic acid. The naphtha is next acted on with sulphuric acid, which combines with the organic bases substances containing nitrogen, as well as carbon and hydrogen, and the purified naphtha, now containing only hydrocarbons, is distilled. In this first distillation the greater part is collected together, and a small quantity remains behind, which is rejected or mixed again with the crude naphtha. It is then what chemists call "fractionally distilled"—that is to say, distilled in a gradual continuous operation; while the runnings of the still are collected separately. The receivers employed are carboys; the order in which they are filled is noted; and, subsequently, an examination of their contents is made, and the liquid products classified accordingly. The examination consists in determining the boiling point of the liquid. According as the manufacturer wishes to have a hydrocarbon of a higher or lower boiling point—which depends on the demand in the market—he mixes with the first portions distilled a larger or smaller proportion of the subsequent distillate, so as to have either a larger quantity of somewhat higher boiling point, or a smaller quantity of lower boiler point. These two are called respectively 90 per cent. benzol and 50 per cent. benzol—meaning a liquid which is judged, from its boiling point, to contain 90 or 50 per cent. of pure benzol.

Benzol is a hydrocarbon, of which the formula is C_6H_6 , and it is associated with other substances—namely, toluol, xylol, cumol, and cymol—substances which are homologous with benzol. These substances form a series proceeding in arithmetical progression by a difference of one atom of the carbon and two atoms of hydrogen, the first having the formula C_6H_6 , the next C_7H_8 , the next C_8H_{10} , and so on. They are all mixed together in the naphtha, and they are, to some extent, separated from one another, in the fractional distillation, by the tar distiller. The purest benzol which is ever collected by the manufacturer contains some admixture of the other substances; but I have been lent, by Mr. John Williams, some samples of these different substances in a pure condition. Here are benzol, toluol, and xylol. Their appearance is absolutely similar; all are mobile, colourless liquids; but we should find, if we were to place them in a flask with a thermometer, and heat them until they distilled freely, and observed the temperature, it would be in the three cases, 84° , 114° , 126° .

The actual distillates collected at the tar distillery consist of mixtures of these substances boiling at temperatures which differ according as the hydrocarbons of lower or higher boiling-point predominate. I have here some samples of the commercial products, which I obtained to-day, through the kindness of Messrs. Blott, from their distillery.

The sample next in volatility to benzol is called "solvent naphtha," the purpose for which it is employed being to dissolve india-rubber.

After a time, as the temperature rises, the liquid which comes over is found to be of too high a specific gravity, and unfitted for this purpose; it is called "burning naphtha," and is sold for burning in such lamps as are used sometimes to light stalls in the open air.

The second product of the original distillation—namely, "creasote"—is a pasty mass, which, on standing, divides itself, to some extent, into an oil and a solid, the solid being naphthalene. The chief use of this substance is for pickling timber; especially, I believe, railway sleepers. The pieces of wood are placed in cylinders from which air is exhausted, and then this substance is let in upon them, and forced into their pores by the atmospheric pressure. The wood is thus rendered more capable of resisting exposure to moisture and the attacks of insects than it otherwise would be.

Some portion of the oil which drains from the semi-solid mass is also used for making lamp-black. It burns with a very luminous, fuliginous flame, and the soot which is formed is collected and called lamp-black.

The third product is "anthracene oil." This divides itself into a liquid and a solid. It is poured upon frames carrying a filtering material, and the oil runs through, while the solid remains upon the filter, and is afterwards transferred to bags, where it is allowed to drain, and is then more completely dried and freed from the adhering oil by pressure.

Here are the three substances: the anthracene oil, which has a solid layer now settling, the "green oil"—so called from its colour—which is used for making grease, and thirdly anthracene.

I have here a pure specimen of the naphthalene, which is the solid substance accompanying the creasote; and also one of anthracene and of carbolic acid.

Besides the three distillates, the tar which is distilled leaves this solid substance called "pitch;" which also is applied to various purposes, the principal, I believe, now being that of making artificial fuel. It is mixed with breeze, and the pitch serves as a sort of cement to compact together other combustible substances, the whole forming a serviceable fuel. It is also used for making artificial asphalt, and in preparing a kind of felt.

It has also been supposed that, by further distillation of this substance, a further quantity of the valuable anthracene might be obtained; but I understand that, although the substance yielded by the destructive distillation of pitch greatly resembles anthracene, there is found to be some difference between them, which renders it not serviceable as anthracene is. The solid residue of the distillation of pitch is that which I have here—pitch coke—a very pure form of carbon, being almost free from ash, since it is formed by the destructive distillation of a substance which itself has been gaseous.

I have only a few words to add about the substances which are formed from these; but it is less necessary to go at length into that part of the subject, though it is very interesting and important, because some seven or eight years ago it formed the subject of a course of lectures given here by Mr. Perkin, who is the principal among those who have developed this important and beautiful industry.

One substance directly produced by the destructive distillation of coal is "aniline;" but this is not produced in large quantity, and is not easily isolated. It was found first that from benzol, a substance of some use in perfumery, it may be obtained by the action of nitric acid, the product being called nitro-benzol; and it was also found that by the reduction of this substance—that is to say, the replacement of its oxygen

by hydrogen—it was converted into aniline. This reduction was first effected by the action of sulphide of ammonium; but it was afterwards discovered that it was effected equally well, and more economically, by the action of acetic acid and iron. So that though coal and coal tar are the great sources of aniline, it is not obtained directly from them, although it exists there, but indirectly from the benzol, the benzol being first transformed by the action of a mixture of sulphuric and nitric acid into nitro-benzol, and then the nitro-benzol being further transformed by the action of reducing agents into aniline.

The first great discovery was that, by the action of oxidizing substances upon aniline, it was transformed into a black powder which was serviceable as a dye. By the action of sulphuric acid and bichromate of potash, aniline was transformed into a substance to which the name of "mauve" was given. Subsequently, in the hands of Mr. Perkin and others, this production of colouring matters from aniline received a very great development, and the consequence was the production of a number of beautiful pigments which are familiar to all of us, and of which I have here some specimens which Mr. Perkin has given me. There is, I think, no more striking or more beautiful result of the application of chemistry than that it should be possible, from such a substance as coal tar, to obtain substances at the very opposite end of the scale of mineral being, these beautiful coloured products.

There is one other point only which I would name. From the anthracene oil, anthracene is obtained; and from anthracene, by a series of processes which it would take me too far to go into, a substance which had long been used and known—viz., "alizarin." The investigation of madder, some 40 years ago, showed that the colouring matter consisted principally of alizarin and purpurin, of which alizarin was the more important. Then followed the great discovery that, by a succession of operations upon anthracene, it can be transformed into the same substance which is the colouring matter of the madder root; so that now actually the use of madder as a dye stuff is, I believe, almost disappearing: its place being taken by what can be produced to greater advantage economically—namely, the very same material produced from coal tar.

This is really the crowning triumph—at least, it is difficult to suppose it can ever be surpassed—viz., the application of chemistry to the arts; and with this I conclude the present lecture.

SOCIETY OF ENGINEERS.

Mr. Thomas Cargill, C.E., the President of the Society of Engineers, delivered his Inaugural Address at the meeting on the 5th ult. In the course of his remarks, referring to the progress of water, sewerage, gas, and other works, he said:

The supply of pure wholesome water to a town is one of the first considerations which should occupy the attention of the local sanitary authorities, and there is probably no professional duty which taxes more the skill and ability of the engineer, than the designing and construction of water-works. Unfortunately but very few of our large towns are provided with this indispensable requisite to the health of the inhabitants, and when our examination extends to our smaller towns and villages, the result is unsatisfactory in the extreme. Not one in a hundred has any water supply in the proper sense of the term, and the unfortunate people have to obtain whatever quantity they can, from wells but too frequently sunk in close contiguity to the cesspool. The facts which have been recounted by the various Royal Commissions appointed to inquire into this matter would not be credited, but for the unimpeachable evidence upon which they rest.

The opening of the Colne Valley Water-Works was successfully performed towards the latter end of last year. The cost was about £80,000, and the establishment of these works will be of the greatest benefit to the district.

Brighton was also provided with a further supply, by a method which I may briefly mention. The system adopted was to sink a number of shafts, and from them to drive a series of tunnels or headings into the chalk, and in this manner tap, or intercept, the water in its progress of downward infiltration to the sea.

During the ensuing year, it is intended to construct a new reservoir and other works at Bradford, at an estimated outlay of nearly a quarter of a million, and similar hydraulic works, upon a minor scale, will be actively commenced in many parts of the country.

Turning our attention to foreign countries, we find the authorities of Rio de Janeiro are prepared to expend over a million in supplying the town with water; and it is satisfactory to note that a very large order for pipes has been taken by a firm in this country. Recently an expenditure of £100,000 has been sanctioned for the construction of water-works at Simla. Irrigation works on a very extensive scale are projected on the Continent and in India.

In the latter country there are four principal descriptions of irrigation works: 1. Inundation canals. Examples of this kind are common in Sind and parts of the Punjab. 2. Irrigation canals, whose waters are taken from rivers. These are principally in use in Northern India. 3. Canals in the deltaic portions of rivers. 4. Tank irrigation. It is only by multiplying these several systems of irrigation throughout a great portion of Hindostan that the severe famines which occur almost annually can be prevented.

The barrage of the Nile, the drainage of Lake Fucino, a work commenced 22 years ago and just completed, together with similar works in progress at Ferrara, are well worth the notice of engineers. At this last-mentioned place, the largest pumping-engines ever constructed are almost continually at work.

A very useful application of hydraulic power has been recently made at Kingston-upon-Hull. A system of main-pipes 6 inches in diameter is laid, for about a mile along the docks, and charged by pumping-engines with a pressure of 600 lbs. to the square inch. Any machinery, such as cranes, winches, or elevators, can be easily and economically worked, by simply connecting with the main-pipe. The power required is close at hand, and a person can pay for the amount he wants and no more. Many advantages result from this arrangement to the users of motive power. First cost is avoided in engines and plant. Less space is needed, and consequently less rent of premises incurred, and the risk from fire is also very much diminished.

It is with regret that I have to observe that we have not yet attained to a satisfactory solution of the sewage problem. There can be very little doubt that, so far as a principle is concerned, that of irrigation has given the only really reliable results. The number of different companies which have tried disinfecting and deodorizing processes, together with the manufacture of so-called artificial manures, is legion, and their numbers are equalled only by their failures. It has been calculated that one company alone squandered a million of money in the vain attempt to accomplish what, to all these processes, is a double impossibility—viz., the purification of the effluent water to the degree prescribed by the standard, and the manufacture of an artificial manure which shall pay the cost of its own production. Irrigation, and irrigation alone, by calling nature to its assistance, effects the double result by a single operation. Unquestionably, the great drawback to the more general adoption of the irrigation system, is the difficulty of procuring land suitable for the purpose. At home, we

are now tolerably familiar with the benefits which sewage irrigation confers upon every description of crop to which it is applied, and to the especial advantages which some particular crops derive from its application. The most recent successful example which has attended the adoption of the principle abroad is at Dantzic, a town, the drainage of which was carried out by one of our past presidents, Mr. Baldwin Latham. The crops which have been produced, both in variety, number, and quality, vie with those grown at the Lodge Farm, and on other well-known sewage farms in England.

The difficulty of obtaining land for irrigation purposes would be greatly lessened, if the powers conferred upon local boards were more vigorously supported and enforced by the higher authorities. That land still can be obtained is evident, if other instances were wanting, by the completion of the sewerage works at Oxford, where 350 acres have been acquired for the disposal and utilization of sewage by irrigation. Towns situated on the sea will doubtless continue to make use of that natural receptacle for their sewage, and it must be acknowledged that, in the matter of wasting so valuable a commodity, the Metropolis sets them an example on a gigantic scale.

The dilemma in which local boards sometimes find themselves, with regard to the disposal of the sewage of their towns, is well illustrated by the case of the sanitary authorities of Kingston. The sewage of this town originally flowed, as was the universal custom in all places similarly situated, into the nearest river, which in this instance was the Thames. The Board of Conservancy gave the Kingston Board notice to discontinue this practice, under penalty of an injunction being obtained against them after the lapse of a certain time. The answer of the Kingston authorities was: "You have closed the only outlet we have for the sewage and drainage of the town. What are we to do with it? Will you tell us where to put it?" The reply of the Conservators of the river was: "That is no business of ours. All we have to do is to see that you do not discharge it into the Thames." In instances of this kind, of which this is not a solitary example, it would sometimes be difficult to draw the line of demarcation between real inability to comply with the legal order, and a plea which might be simply in *contumaciam*, and intended as an excuse for shirking the whole subsequent responsibility and expenditure. In the Kingston case, whatever might have been the validity of the plea for non-compliance, the injunction was obtained, and the penalties actually incurred for neglect gradually reached the sum of £10,000. This modest total being arrived at, another respite was granted to the authorities, to enable them to extricate themselves from their embarrassment. A comprehensive scheme of drainage, which embraces several towns and districts in the valley of the Thames, has since been proposed, and is at present under consideration. It is not, however, very creditable to our sanitary legislation, that injunctions affecting the health of the population should be systematically disregarded, and penalties of a fabulous amount, so far as any chance of their recovery is concerned, incurred with equal carelessness and indifference. In order to ensure the due enforcement of our sanitary rules and regulations, the hands of both the administrative and executive departments require to be strengthened.

The erection of gas-works in towns of any pretensions to size, either at home or abroad, is now so usual a procedure that it fails to excite much notice. New gas-works, or extensions of existing ones, are being carried out in our own, as well as in nearly every foreign country which can lay claim to even partial civilization. The experiences of the last few years will clearly show, so far as the Metropolis is concerned, that the tendency to amalgamation, or centralization, is very much on the increase.

In 1869 there were 13 gas companies supplying London. In 1870 the number had diminished to 11, not by the extinction of the other two, but by the incorporation or absorption of them into the others. This number was again reduced in the following year to ten, subsequently to nine, and ultimately to six, which represents the number of separate and distinct companies supplying gas to the Metropolis. These are The Gaslight and Coke Company, the Phoenix, the London, the Commercial, the South Metropolitan, and the Surrey Consumers. The capital of these six companies in 1875 was over eight millions. One of the advantages attending amalgamation is, that a marked decrease has taken place in the loss of gas from leakage and other causes. The amount of loss has been reduced from 17½ per cent. to less than 7 per cent. But the chief benefit resulting from amalgamation is the diminished price at which the public can be supplied. Companies are empowered now to pay one-quarter per cent. over and above the maximum dividend of 10 per cent. for every penny they take off the price of their gas per 1000 feet. The company supplying the Metropolis with three-quarters of all its gas, now charge 3s. 6d. instead of 3s. 9d. per 1000, which is equivalent to three-quarters per cent. more dividend. The quantity of gas sold by the company who have made the authorized reduction amounts yearly to 14,000 million cubic feet, which, taking the difference of the two prices already mentioned, benefits the consumers to the extent of £175,000 per annum. It is an open question how far the principle of amalgamation will be carried. The companies situated respectively north and south of the river might amalgamate, or the incorporation of the whole say into one, might be accomplished. It is very possible that the principle of incorporation will be carried still farther, but the advisability of its reaching so extreme a point as unity is a fair matter for discussion.

ON THE ESTIMATION OF SULPHUR IN COAL GAS BY MEANS OF STANDARD SOLUTIONS OF ALKALI, Etc.

By W. C. YOUNG, F.C.S., &c.,
City of London and Metropolitan Gas Examiner.

Rather more than two years since I was engaged in some experiments on the products of the combustion of coal gas, the results of the completion of which were published in No. 8 of the *Analyst*, and subsequently in the *JOURNAL OF GAS LIGHTING*.

The absorbents used were caustic soda and carbonate of soda. During the progress of the first part of these experiments, it occurred to me that by using solutions of these substances, of known strength, the sulphur could be estimated by subsequent titration with a standard acid.

The first experiment was made by drawing the products of the flame of a small Bunsen burner over a standard solution of soda contained in a Woolffe's bottle, partly filled with glass balls. The aspirator used was a Bunsen's filter-pump. The results were very satisfactory, but as I was unable in this way to burn the gas at a greater rate than 25 cubic feet per hour, I endeavoured to adapt the Referees apparatus to this purpose. In this case, the standard solution of soda was dropped slowly on to the glass balls contained in the cylinder, from an ordinary separating funnel. No carbonate of ammonia was placed in the apparatus. The results obtained in this way were very concordant, but on the average gave 8 per cent. more sulphur than those obtained by the Referees apparatus upon the same gas.

The standard soda solution was made of such a strength that 100 septems was equal to 4 grains of sulphur.

One hundred septems of the standard acid was equal to one grain of sulphur.

One hundred septems of the standard soda was taken and diluted to

5 ounces with distilled water; this was placed in the separating-funnel, which was fixed by the side of the eduction-tube, in a cork fitted to the neck of the cylinder. The flow of the alkaline liquid was regulated to about one ounce per hour, and the gas burnt at the rate of one cubic foot per hour.

Four cubic feet of gas were burnt, and at the finish the apparatus was washed out, the drippings and washings made up to a known bulk with distilled water.

One-fourth of this liquor, after well mixing, was taken; to it was added 100 septems of the standard acid, and boiled in a long-necked flask for ten minutes, to expel all carbonic acid.

The excess of acid remaining was then ascertained by means of a standard soda solution, of the same strength as the acid, made by diluting one part of the original soda solution with three of distilled water. The number of septems used equal grains of sulphur in 100 cubic feet of gas.

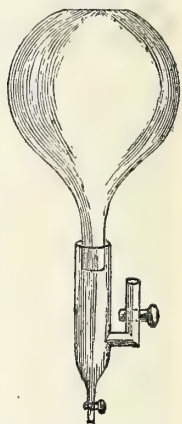
The results obtained in this way were fairly comparable with those obtained by the first method; but, although I was enabled to burn the gas at a much faster rate, there still remained two difficulties in the way to its general adoption.

These were, first, that the stop-cock of the separating funnel had to be adjusted several times during the experiment, to obtain a constant flow of the soda solution; and, secondly, that the solution became eventually so diluted as to render it difficult to any but an experienced eye to determine the point of neutralization to within one or two septems.

In endeavouring to overcome the first objection, I experienced very great difficulty, but, in the end, devised an apparatus that succeeded admirably.

This consisted in a modification of the constant level apparatus used by Dr. Bischof, in his method of water analysis, and described in Sutton's "Handbook of Volumetric Analysis."

It is figured in the accompanying drawing, and consists of a flask, the neck of which is ground into a tube, narrowed towards the end to a fine bore, having at the side another small tube blown on at right angles, and again turned up, so as to be parallel with the neck of the flask. Into the vertical part of this tube is fitted a stopcock, and another is fitted in the narrow part of the other tube, about an inch below the juncture of the two. The flask may be of any capacity, the one I used held 30 ounces. I obtained the same results with this apparatus as with the last mentioned, but the second objection still remained. The method of using this apparatus is as follows:—The quantity of standard alkali to be used is placed in the flask, with enough distilled water to fill it, the cap with stopcocks placed firmly on, the whole inverted and fixed over a Referees cylinder, having a small funnel at the side of the eduction-tube. The lower stopcock is then opened full, and the liquid run through the funnel into the cylinder. The dropping soon ceases, after which the flow can be regulated as required by the upper stopcock, which admits the air, the rate at which it is started being maintained until the flask is almost empty. The apparatus can always be obtained of Mr. Cetti, of Brook Street, Holborn.



Subsequent experiments caused me to abandon the former methods, and resulted in the adoption of the following, which can be fitted up at most gas-testing places at very short notice. The apparatus consists of a double Referees apparatus, the end of the eduction-tube of one fitted to the lower neck of another cylinder.

Into the upper cylinder is slowly run the standard alkali to be used. By inserting the dripping-tube about three-quarters of an inch above the bottom of the interior, so as to form a reservoir, the whole of the standard alkali will be retained, and a constant surface of it presented to the acid vapours entering from the eduction-tube of the lower cylinder, under the trumpet-tube in which the gas is burnt.

In this way fully 95 per cent. of the moisture is condensed before the products of the combustion of the gas reach the alkali, which, being in a more concentrated state, admits of the gas being burnt at a much faster rate than in the other methods, and, what is more important, the point of neutralization in the subsequent titration may be determined with ease.

I prefer, with this apparatus, to use a weighed quantity of dry carbonate of soda, which is obtained sufficiently pure by calcining the commercial bicarbonate. I take about 40 grains, place it on the top of the glass balls in the upper cylinder, and moisten with about one ounce of distilled water. At the completion of the experiment I wash out the upper cylinder with hot water, add an equivalent quantity of standard sulphuric acid to the soda used, boil for ten minutes, then titrate back with standard alkali, one septem of which is equal to the 100th of a grain of sulphur. It is obvious that all excessive acidity must be due to the sulphur in the gas, and that if 10 cubic feet be burnt, each septem of standard alkali used is equal to 1-10th of a grain of sulphur in 100 cubic feet.

The liquor condensed in the lower cylinder is not used, but an addition of 5 grain of sulphur per 100 cubic feet is made to the result—that being the average of a very large number of estimations I have made of the sulphur contained in this liquor, the quantity varying only from '52 to '48.

This method leaves nothing to be desired in point of accuracy or simplicity; those who are not experienced in the manufacture of standard solutions can always purchase them ready made, and, with a little careful practice, an intelligent workman can be entrusted with the estimation.

In most of my experiments I have burnt the gas at the rate of one cubic foot per hour, but I have obtained equally good results at twice that rate; indeed, I have no doubt that, by increasing the size and condensing power of the lower cylinder, the gas may be burnt at a much greater rate with the same result. I should add that the results with this, as with the other methods, were, on the average, 8 per cent. higher than those given by the Gas Referees apparatus.

I am now engaged in experiments, which I hope to publish shortly, by which I trust to be able to determine the sulphur by the difference in weight of the apparatus before and after its use.

ACCIDENT TO A GASHOLDER-TANK AT MIDDLESBROUGH.

Mr. Cail, engineer, of Newcastle-upon-Tyne, having received instructions from the Gas Committee of the Corporation of Middlesbrough, has prepared the following reports upon the collapse of the gasholder-tank, to which reference was made in the *JOURNAL* of the 20th ult. :—

To the Chairman of the Gas Committee of the Borough of Middlesbrough.
Newcastle, March 7, 1877.

Sir,—In compliance with the request of Mr. Bainbridge, the town-clerk, on the 16th ult. I went to Middlesbrough, to inspect the new gasholder-tank which was in course of being formed in the Marsh. I made an examination of the work on the 17th, and also had an interview with the Gas Committee, who requested me to make myself acquainted with all I required, in order that I might make a report to them, what I thought best to be done under all the circumstances of the case, whether to form the gas-

holder-tank in the present site in the Marsh, or abandon it and buy land near the site of the proposed new workhouse at Linthorpe, and build the tank there. I was also requested to give any instructions necessary for retaining the work and buildings near in their then position; the worst thing to enable this to be done was the flow of water from drains which had been dislocated, and caused a large quantity of water to run into the interstices of the part which had subsided into the tank, and to this point Mr. Latham, your surveyor, gave his best and prompt attention, and is doing all in his power to renew the sewers in such a way as to remedy this evil, and he also assisted with the staple. Your gas manager, Mr. Booth, has also given me all the assistance in his power in getting a staple sunk down to a depth of 56 feet 6 inches below the surface, to ascertain the strata below the level of the bottom of the tank.

I was also instructed to make approximate estimates of the work in the two places named to me, being the site near Linthorpe, and in the Marsh where the present one has failed. I have given my best attention to the subject, and with this view I have carefully examined the strata down to 56 feet 6 inches, or 15 feet 6 inches below the bottom of the present tank, and I have come to the conclusion there is no great difficulty in building the tank, as a permanent and lasting work, at the site in the Marsh within the present one, by means which I will describe; and to be more easy to understand, I have made two small sketch plans, one being a half plan of two sizes of the proposed tank, and the other a plan of the cylinders for the foundation, which I propose to be sunk 14 feet in depth below the walls.

To carry out the work, I propose to lay down beams of timber across the tank, radiating to the centre, and to stay the present walls of the tank in their present position, and when this is done the water to be pumped out and all water stopped from flowing into the tank whenever practicable. Then to commence to build brick and cement cylinders of 6 feet diameter inside, and 7 feet 6 inches outside diameter, and about 4 feet high, having a tongue on one side and a groove on the other, thus forming a tie between each cylinder, which tongue and groove projecting 9 inches, makes a total of 8 feet 3 inches, or requiring about 52 cylinders of 134 feet in diameter, and 60 of 150 feet diameter, to form the ring or foundation for the concrete wall forming the tank. The cylinders to be built on a platform in a mould made the exact shape of the outside of the cylinder, and the bricks, being first thoroughly soaked in water, to be walled on edge and bedded in cement and clean sharp sand, with a thin joint of cement at the front inside, to prevent the grout coming out, to fill in pieces of shingle in the tail or back joint, and then to fill in each course with cement grout, so that each course will form a solid ring, and to continue this operation until each cylinder is built to about 4 feet high, so that these cylinders when put together will make the required depth. The bottom cylinder will have a sharp edge, the jointings above will have a bed of cement.

When the cement is sufficiently set, the cylinder to be lifted out of the mould off the platform to be ready for use, and others built in its place in the same manner. The site or place where the cylinders have to be sunk being levelled, it is not necessary that the ground should be at the level intended for the height of the cylinders to finish at, but may be higher, until a number of cylinders should be partially sunk; men would then go in to dig out the material and send it up, cleaning out below the cylinder all round, so that the cylinder would follow down; if the cylinders did not go down freely, they would have to be weighted with pig iron, and as one was sunk to the level of the ground, additional cylinders would be placed on the top until the required depth was obtained, when the bottom would be cleaned out, making a slight hollow (as will be described in the details), and then to fill in the interior of the cylinder to the top with concrete and blocks of sound slag, having been previously well soaked in water. When the cylinders are sunk to the intended depth, then cement grout is to be poured down the joints of the tongue and groove, and the ground cleaned round the top of the cylinders for a depth of 3 feet, and filled in to the line of the outside of the cylinders with concrete and blocks as before named.

On this to form a bed of concrete, 2 feet thick, the full width of the cylinders, and for 6 feet within the line of cylinders to form the rest for the gasholder, also laying a bed of concrete 6 or 8 feet wide inside the cylinders in the same manner as named above, thus forming an arch of from 20 to 22 feet in depth, to resist lateral strain. Upon this base to commence the wall of the tank, which I propose to commence 2 feet above the level of the present tank, and to build this wall 6 feet thick for a height of 8 feet, 5 feet thick for the next 8 feet, the next 7 feet 4 feet thick, the next 7 feet 3 feet 6 inches thick, and 4 feet at the top including the coping 3 feet thick, making the total height of the tank 34 feet from the hollow, 6 feet of which would be above the ground level. The whole of this wall to be built of concrete, having a considerable portion of blocks of solid slag put in (previously well soaked), and the liquid or plastic cement well beaten round them as the work proceeds.

I would also advise a dry well to be formed, which is not provided for at present (shown on plan), for the entrance and exit of pipes, so as not to interfere with the thickness, or make a break in the tank wall in any way, except at the bottom, where the pipes come through the wall by a small, arched opening. The pillar in the centre to be built in a similar manner, gravel or shingle mixed with it. All slag for concrete to be properly broken, and a sufficient quantity of slag, or concrete, gravel, or shingle mixed with it to form a proper matrix, or matrix, to bed the larger stones solidly in it, that vacant spaces may be left. All concrete to be mixed by machinery to be approved of, unless by special authority, and only when the quantity to be used is small. The sloping part of the core in the interior to be cut and beaten into a solid body, any peat being removed, and clay substituted, and formed with a slope of $1\frac{1}{2}$ to 1, to be laid with concrete 2 feet thick at the base and 1 foot at the top, and to continue 1 foot thick on the level part to the pillar in the centre. It is not proposed to use any bricks for lining the tank, but to render it with a coating of cement. The only place where bricks would be used would be in the dry well for the pipes, and the arch through the wall for them to enter the tank. All the parts between the new and old wall, and up to the ground level, to be of puddle and well-punned clay. By following out the plan and work named, in a proper and workmanlike manner, I have not the slightest doubt a most substantial and durable work can be accomplished, and at the least cost possible, as there are no costly materials or workmanship required, and most of what is required are near the works. I think I have made the mode I propose doing the work sufficiently clear to be understood for the present purpose, and I estimate the cost of doing the work at the sum of £6300 and £6900 respectively.

I have also made an estimate to take the main to the site at Linthorpe, which would be £5600, and if one-half was added for a return pipe, it would make the amount £8400, and it is my opinion a tank would cost more at Linthorpe than to rebuild at the Marsh, which, together with the extra cost of mains, is so much against the Linthorpe site, that I could not recommend it for your adoption.

Newcastle-upon-Tyne, March 10, 1877.

Dear Sir,—I have your communication of the 9th, in which you ask me to state the cause of failure of the present work. I was not present when the work gave way, neither did I see the place or state of the ground where

the wall was founded, either where it first gave way or at any other part; but I see quite sufficient reasons, in my opinion, why it should have failed at the time it did, or would have done at a later period, when the earth was levelled up to the top of the wall to its full height, and the earth removed inside as proposed. The immediate cause of the failure was from the pressure of the loose earth behind the wall adjoining the street, assisted greatly by the water flowing from the dislocated sewers, filling all the cracks and openings in the slipping ground, thus causing the greatest possible amount of pressure both down and sideways, extending down to the base of the wall. There being no solid body placed below the base of the wall as a foundation to it, to resist the lateral pressure, and the ground being of such a tender nature that it could not bear the pressure placed upon it without the support indicated, when the counterbalancing earth was removed inside the tank, near the base of the wall, the pressure behind being greater than the tender nature of the earth could bear, forced up the ground inside the wall, and by this means formed a passage below the shallow foundation, for the loose earth and water behind the wall; and as the ground forming the foundation of the wall was carried forward into the tank, the wall failed, and was fractured as is now seen, in several places, and for a great distance from the point at which the first great failure or break took place.

I am also bound to say, after an examination both of parts of the wall which has been fractured, and where such has not been the case, I have come to the conclusion it has not been properly carried out as it should have been, the concrete being very faulty in its combination, from its not having a sufficient quantity of small material in it to form a bed for that of larger size, and from this cause it is very much weakened and liable to fracture from not being perfectly homogeneous. This is highly important when the great radius and lightness of the wall are taken into account.

I may add, in explanation of the proposed mode for building the tank, that I have fully considered the cause of failure of the present work, and provided the means to avoid it in future. The brick cylinders which I propose to use can all be sunk without disturbing the ground in any way, and when completed and filled with concrete will form a solid wall, serving both for a foundation to the wall, and when the concrete is laid around and upon them, this part of the work forms a solid dish of concrete of the great lateral depth of an arch of 24 feet, with a radius (in case the 150 feet diameter tank was adopted, and which I would recommend) of 69 feet to its radius, thus providing for a greater amount of lateral pressure than can come against it. Should you require further explanation, I will be glad to give it on application.

I remain, dear Sir, yours truly.

RICHARD CAUL.

George Bainbridge, Esq., Town-Clerk of Middlesbrough.

GAS AFFAIRS IN AMERICA. REPORT OF THE GAS COMMISSIONERS IN RELATION TO THE SUPPLY OF GAS TO THE CITY OF BOSTON.

(Continued from page 426.)

Relations of Municipalities to Gas Corporations and Works.

This relation is a peculiar one in many respects. A gas company cannot be viewed in the same light as other manufacturing corporations, for many reasons. In the first place, it supplies a commodity which is not merely a luxury, but is almost a necessity. Secondly, the sale of its manufactured product is a very limited one, being confined to the limits of the city or district which it supplies; and a gas company at the present time is expected by the people to lay its pipes, so that all who desire to burn gas within the limits of a city may be accommodated. This, necessarily, in many parts of a city, entails an expenditure in distribution, which is not, perhaps for many years, repaid by the sale of gas in that special locality. And, thirdly, a very large portion of the material used (all of that used in the distribution of gas) is almost valueless for any other purpose; so that, if a company should become bankrupt, that material is not worth what it would bring for old iron, were it above ground. For these reasons, a gas company is entitled to a great deal of consideration, providing it does its duty to its customers, and is honourable in all its transactions.

The relation between municipalities and the gas corporations has been very thoroughly discussed in England, and all of the important points have been settled, to the satisfaction of all parties, by experience; so that we cannot do better than devote a little space to a short sketch of the history of the relations between the London authorities and the London gas companies.

In London, this question was brought up as long ago as 1820, and the matter was referred for investigation to a committee, the chairman of which was Sir William Congreve. This committee, after mature deliberation, recommended strongly that only one company should be allowed to supply the same district in the city, and should have the exclusive right to supply that district. Parliament, however, did not adopt this recommendation, but, on the other hand, favoured competition, by chartering new companies. The Independent Company was chartered in 1829, and competed with the Imperial, which was established in 1821. The Equitable Company was chartered in 1831, and competed with the Chartered, which was established in 1810, and was the oldest company. In 1844 Parliament permitted the establishment of the London Company, to compete with the Imperial, Equitable, and Chartered; the Great Central Company, in 1848, to compete with the two companies supplying the City, and in 1854, the Surrey Consumers Company, to compete with several companies on the south side of the Thames. The Western Company was established in 1850, and competed with the Chartered, London, and Imperial.

This condition of affairs existed from 1830 to 1857, at which time, in some of the streets, there were the mains of three or four companies lying almost in contact with each other. When a leak occurred, it was impossible to tell from which main the gas escaped; and, moreover, it was in some places impossible to state with certainty to which company a certain main belonged, so that it sometimes happened that a consumer used the gas of one company, and paid another one for it. Then, too, the additional outlay of capital in laying three or four mains when one would answer, did not tend to lessen the cost of the gas.

At this time, there were thirteen companies supplying gas to the citizens of London; in some places four or five companies competing with each other. So many difficulties arose, besides the mere price of the gas, that they mutually agreed to abandon competition and district off the City. Five of the thirteen united their interests with some of the others, thus reducing the number of companies to only eight, and recently the three companies supplying London proper—the Chartered, Imperial, and Independent—have consolidated. There was, at this time, no restriction placed by law upon the quality or the price of the gas, or upon the dividends which the companies might pay, so that the citizens of London considered themselves as completely at the mercy of the companies, and called for some legislation in regard to its supply. Consequently the "Metropolis Gas Act, 1860" was passed by Parliament, the principal points of which were—First, the companies were bound under a severe penalty, to furnish an ample supply to every one in the district requiring it, and, practically, to

extend their mains in that district wherever required, either for public or private supply. Second, they were restricted to a maximum price of 4s. 6d. per 1000 cubic feet for 12-candle gas, except in case of any extraordinary emergency, when the Secretary of State for the Home Department had power to authorize an increase of price, not exceeding 5s. 6d. per 1000 cubic feet. Third, they were subject to heavy penalties if their gas was at any time below the standard of illuminating power and purity fixed by the Act. Fourth, they were obliged to supply meters at fixed rentals. Fifth, they were obliged to publish their accounts annually, with such details as the Home Secretary might require, so as to show distinctly the amount of profit they were making. Sixth, their dividends were limited absolutely to 10 per cent., and all surplus profits beyond the amount sufficient to pay a dividend at that rate, and to form a reserve-fund of limited amount wherewith to maintain that dividend, were to be applied to the reduction of the price of gas. Seventh, power was given to the Quarter Sessions, at the instance of any two consumers, to order an investigation of any company's actions at any time, and arbitrarily to reduce the price of gas, if it should appear from such investigation that the company's profits would admit of such a reduction. In 1867 the "Revision Clauses" were proposed, lowering the price and raising the standard of the gas. They consisted of a recommendation to Parliament to empower the local authorities to erect works and supply gas if the companies would not agree to sell gas for 3s. 9d. per 1000 cubic feet of 16-candle gas; and if any company could pay a dividend of 10 per cent. at that price in any year they might do so; if they could not, they might call for the appointment of three commissioners, who were authorized to raise the price for one year if they should think best, so as to allow the companies to pay as nearly as possible 10 per cent., the system of the reserve-fund being abolished. And the local authorities might also call for the appointment of a commission, if they thought that 10 per cent. could be paid with a price of less than 3s. 9d. These conditions were incorporated into the "City of London Gas Act, 1868," to which the three companies supplying the old City of London were compelled to accede by the persistent efforts of the Corporation of the City of London to procure parliamentary authority to erect works and supply gas in the City, in competition with the companies at the expense of the public rates, and they actually called for the appointment of the commission, when, in 1872-73, and a part of 1874, on account of the coal famine, coal went up from 14s. to 32s. per ton. The contest with the London companies is still going on,* and the repeal of the revision clauses is recommended, and a sliding scale is advised in their place. This scale is, that if the price charged is more than 3s. 9d. per 1000 cubic feet, the dividend shall be cut down one-quarter per cent. for every additional penny, and, for every penny less than 3s. 9d. charged, the dividend may be increased one-quarter per cent.

Thus the necessity of having but one company supply any definite district was recognized by Parliament, and, at the same time, it was considered necessary to place some restrictions upon them as to price, quality, and amount of profit. Inspectors were also appointed, with offices supplied, at the expense of the companies, with all apparatus necessary for testing gas at a distance from the gas-works, such inspectors to report regularly upon the quality of the gas, and to have no connexion whatever with the companies.

The London JOURNAL OF GAS LIGHTING, 1876, p. 615, says:—

With respect to the dividends and expenditures of the companies, those which supply the larger part of the Metropolis are under the active inspection of an official auditor, who is appointed by the Board of Trade for the express purpose of examining their accounts and of finding out whether any irregularity occurs. The auditor is a very different person from the ordinary, and often incompetent, shareholders auditor, who readily accepts specious explanations, and is willing to make things pleasant. The Government official takes nothing for granted; he likes his power, and uses it; he holds a continuous examination and makes minute inquiry; he is armed with supreme authority to disallow any item he may consider improper, either in principle or detail, and he is actually authorized to prevent the declaration of any dividend which he considers has not been duly earned, or is not lawfully payable. It is difficult, therefore, to conceive how more stringent precautions could be devised, or a state of things under which it would be more impossible for the companies to delude the public, even if they desired to do so, than under the existing law; and it may be added that the companies referred to, confident in their own integrity, willingly consented to submit themselves to these safeguards and precautions in favour of the consumer, in the hope that thereby they might disarm suspicion and gain confidence.

In giving the above short history of the connexion of the London government with the gas companies, it has been necessary to speak also of the results of competition in that City; that subject will, however, be again referred to.

Thus the fact, which is, at the present time, just being learned in this country, has long been established in England—viz., that the public, who are in a measure forced to use the commodity supplied by gas companies, should not be left entirely at their mercy, but should be protected to a certain extent by law, and should be ensured an article of good quality, and for a price which is not exorbitant. There is no doubt, whatever, that many gas companies in the United States have been, and still are, making very large profits by charging a high price for a poor gas. This is, however, not true of the Boston Gaslight Company, whose gas has been of a superior quality, and whose prices have been much lower as a rule, than those of other companies of nearly the same size.

The question is not merely whether the citizens of Boston are now being fairly treated in regard to price and quality, but whether they are sure of being always so treated; and in order to ensure this result, we consider that they, as well as all other gas companies in the State, should be subjected to inspection, not only in regard to the quality of their gas, but also in regard to their investments, operating expenses and profits, as is the case with the railroads throughout the State. Such an arrangement would be as much for the advantage of the companies themselves, providing that they are making and selling gas economically and honestly, as for the citizens; since it would ensure for them a monopoly, would prevent numerous applications to the authorities for permission to compete, and would do away with most of the complaints by consumers. This view of the matter will be discussed in detail later.

The arguments in favour of the manufacture of gas by the authorities themselves are, that the supply of gas is of necessity a monopoly; that economy may be effected by uniting the districts of the various companies supplying a city into one, as has been done in Philadelphia; and, thirdly, that the streets in which are located the pipes and mains are directly under the control of the city authorities. There are a number of cities in England, where the gas undertakings are in the hands of the municipalities, and among these may be especially mentioned Manchester, as one in which the management has been most efficient and successful. In some of the English towns, however, the management has not been so successful.

The gas-works are under the control of the city government in Philadelphia, Penn.; Alexandria and Richmond,† Va.; and Frankfort, Ky.‡

In Philadelphia, the gas manufacture is entirely in the hands of trustees appointed by the City Council, the works, which are very extensive, being the property of the city. This manner of election is somewhat objectionable, on account of the injurious influence which must naturally result from party politics; and so many complaints have arisen on the part of the citizens, that in 1874 a committee was appointed by them to investigate the affairs of the trust. This committee, however, found it no easy matter, and reported—"That the nature of the gas trust is such as to render a thorough investigation of its affairs impossible. No details can be ascertained, except such as the trustees themselves see fit to communicate to the public, and these are carefully doled out, so as to preclude investigation or analysis." We may, therefore, readily conclude that if this city has been successful in delivering gas to the citizens at cheap rates, while under the influence of political leaders, and the expenses being often unnecessarily increased by the employment of large numbers of voters before elections (so it was stated), it would have been possible, under more conservative management, to have furnished gas for 25 or 30 cents less per 1000 cubic feet. Thus, the price paid for coal per ton in 1875 was greater than was paid for the same coal in New York, and nearly as much as in Boston and vicinity. We should have supposed that the closer proximity to the coal region would secure to these works the material for manufacture at lower rates than those paid in Boston; but owing to some unaccounted-for discrimination on the part of the railroads, in favour of coals delivered at the seaports, we find that the Westmoreland coals at the Philadelphia works cost 6'70 dols. per ton, while 6'75 dols. was the cost in Boston during the same year. Then, too, the labour in manufacturing the gas cost about 10 cents more per 1000 cubic feet than in most other companies, which seems to confirm the statements made, that large numbers of men are employed before elections for political purposes.

Notwithstanding all the disadvantages arising from political influence in the management of these works, we find the profits for the year 1875 to have been 793,244'12 dols.; and, after deducting for interest on bonds, &c.,* the sum of 302,986'21 dols. went towards the increase of the sinking-fund, which, on Dec. 31, 1875, amounted to 2,470,193'93 dols.; while the whole amount of outstanding bonds amounted to 5,400,000 dols., thus leaving only 2,929,806'07 dols. to be provided for, when the whole works, costing nearly 14 million dols., will become the unencumbered property of the city.

The published accounts of the Philadelphia Gas Company are very defective in many respects. Thus we find that the number of public lamps is given as 10,260, and the amount of gas consumed by them as 313,373,748 cubic feet, or 30,543 cubic feet per lamp annually. This, at the rate of five feet per hour, would give as the number of hours burned, 6109 per year for each lamp, or 16 hours per day. This shows either that the city is paying for a much larger amount of gas for the street lights than is actually consumed in them—for they certainly do not burn 16 hours per day—or else that there is a waste of two or three cubic feet per hour in each lamp, since 5 cubic feet per hour of 16½-candle gas for each burner is more than sufficient. In Boston the amount is only 4 cubic feet per hour of 18-candle gas, and each lamp burns 10 or 11 hours per day.

The best argument in favour of municipal management of gas undertakings is, that about 50 cents of the price of each 1000 cubic feet of gas sold must be devoted to the payment of the dividend to the stockholders; when a much smaller amount than this, at the low rate at which money could be hired by the city, would be sufficient to pay interest on the capital, and at the same time allow a sufficient amount to be laid aside, in the form of a sinking-fund, to entirely liquidate the debt in a few years. As a rule a city cannot manufacture gas as cheaply as a private corporation, since it is almost impossible to avoid the influence of politics upon any city undertaking. Yet, notwithstanding this, the amount required to pay the dividends of a private corporation forms so large a proportion of the total price of the gas (one-fifth or one-sixth), that the loss resulting from city management can scarcely equal it. Thus the capital of the Boston Gaslight Company is 2,500,000 dols. and the amount required to pay the 10 per cent. dividend is 250,000 dols. which is 39'6 cents per 1000 cubic feet of gas sold. This does not include the interest on 500,000 dols. bonds issued.† Were this capital in the hands of the city authorities, 150,000 dols. at the most would be required to pay the necessary interest, and the capital might be diminished by 50,000 dols. or 75,000 dols. annually, by placing 2 or 3 per cent. in a sinking-fund for its liquidation. Thus a saving of 15½ cents per 1000 cubic feet would be made, granting that none of the capital were paid off, and that the city manufactured the gas as cheaply as the private corporation. This saving would naturally go on increasing year by year with the diminution of capital. The difference in the cost of manufacture and distribution by the city and that by a private corporation would not probably exceed 10 cents per 1000 cubic feet of gas sold, were the managers of the undertaking properly chosen.

While we think that gas can be made more cheaply by a well-managed private corporation than it probably would be under municipal management, and that the best plan is that adopted in London—to allow the manufacture to be continued by a corporation which shall have a monopoly of the business, under proper regulations and restrictions, in the method we have indicated—still we think there would be little risk in the undertaking by the city of Boston of the gas supply within its limits.

(To be continued.)

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

A quiet week has again to be recorded in connexion with the local iron trade, in which there are, as yet, few reliable symptoms of an improvement. Pig iron has remained fairly steady at late rates, but with a continuance of the previously reported indisposition of smelters to enter into forward engagements at current prices. At the present time North Yorkshire pigs of G. M. B. are held at the following figures:—No. 1 foundry, 47s.; No. 2 foundry, 45s.; No. 3 foundry, 43s. 6d.; No. 4 foundry, 42s. 9d.; No. 4 forge, grey, 42s.; No. 5 forge, mottled, 41s. 6d.; No. 6 forge, white, 41s.; refined metal, 61s. 6d.; Kentledge 48s.; and cinder pig, 40s. per ton, all net cash. Airedale, Leeds, No. 1, is 54s.; No. 2, 52s.; No. 3, 51s.; No. 4, 50s.; forge, 50s.; M, 49s.; and W, 49s.; all free on rails at Leeds or Hunslet. North Lincolnshire prices range from 50s. to 60s., according to brand and quality. Derbyshire pigs are being sold here at 48s. to 57s. 6d. per ton, on one month's cash terms. A special quality of pig for cylinder and other superior castings ranges from 100s. to 107s. 6d. per ton, delivered here. In the foundry departments of the leading works there is a fair amount of work in hand, chiefly in respect of the articles mentioned several times recently in these notes. The coal trade of Yorkshire and Derbyshire is in a comparatively stagnant condition, and I hear of proceed-

* The outstanding bonds, on which interest to the amount of 490,257'91 dols. is paid represent, therefore, but a small portion of the cost of the works.

† At the time this report was prepared the result of the Metropolis Gas Legislation of 1876 was not known.—Ed. J. G. L.

‡ The published accounts of the Richmond Gas Company, which were sent for, have not been received by us.

§ The city of St. Louis is about to purchase the works of the St. Louis Gaslight Company. That company refused to sell to the city in 1870, at which time the city had the right to purchase according to the charter of the company, and action was taken to compel the company to sell. The court has recently decided in favour of the city.

† The total capital of the gas companies supplying the city of Boston, not including the Brookline Company, which supplies Brighton, is 4,333,000 dols., and the total amount of gas sold by these companies in 1875 was 844,300,000 cubic feet. (No return was received from the East Boston Company, so that the amount sold by this company was estimated at 15 million cubic feet, which cannot be far from correct.) To pay 10 per cent. dividend upon this capital the citizens of Boston must expend annually 483,300 dols., or nearly 56 cents. per 1000 cubic feet.

ings on the part of one of the leading coalowners, which lead me to the belief that a further general reduction in wages is contemplated. At the Shireoaks pit the whole of the 700 men employed there have just received notice to leave in a fortnight hence. At Denaby Main, disturbances have arisen, owing to the employment of non-unionist miners, and it is feared that these breaches of the peace may assume a more decided form. In other parts of the district there is much discontent, yet I am informed, on the best authority, that the men are now getting as much coal by steady work, three or four days weekly, as they did two years ago when on full time. Prices remain very easy for all kinds of fuel, except slack coal which is again rather dearer. The coalowners have had an interview with the directors of the Great Northern line, to ask for an early and considerable reduction in the coal carriage rates to London, and their demands have been promised serious consideration. At present the average rate to London from the South Yorkshire district is 8s. 3d. per ton.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The more wintery weather of the last few days has caused a better demand for all classes of fuel in the Manchester market, and the large firms are generally tolerably well supplied with orders for the present, whilst stocks, both at the pits and in the yards, have been considerably reduced. As, however, the improvement is solely dependent upon the weather, it can only be of a temporary character, and, generally throughout Lancashire, the round coal trade is in anything but a healthy condition. In South-West Lancashire many of the pits are still not working more than eight or nine days to the fortnight, whilst the common classes of round coal are a complete drug in the market, and difficult to sell almost at any price. Good Arley coal, at the pit mouth, is quoted at 9s. 6d. to 10s. 6d. per ton; and Pemberton four-feet, 8s. 6d. to 9s.; but, for sales in bulk, somewhat lower prices would, no doubt, be accepted. Common coal ranges from 6s. 6d. to 7s. 6d. per ton at the pit, according to quality. Although common burgy is still difficult to move, the better sorts of engine fuel, and particularly good slack, meet with a ready sale at fully late prices, and the market has a decidedly stiffening tendency. Good burgy is worth about 5s. 6d. per ton at the pit, and slack from 3s. 6d. to 4s. 6d. per ton.

The shipping trade continues quiet, and prices ruling at Liverpool and Garston are still extremely low.

In the iron trade there is no improvement. North country makes of pig continue to be offered in this district at lower prices, but the local brands are without change. Finished iron has a tendency to be weaker, but the current market rates remain at £7 for Staffordshire; and £6 15s. to £6 17s. 6d. per ton for Lancashire, Sheffield, and Middlesbrough bars.

The reduction of miners wages is again being mooted in the Wigan district, and a proposal has also been made to put all the pits on short time.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England was extremely quiet last week. It was duller than the preceding week, and the shipments were fewer. Best gas coals are coming into demand for shipment abroad as the Baltic begins to open; but there is a weaker coasting inquiry. Best gas collieries are the only pits which are kept well employed. The house collieries show a little falling off of business. All kinds of second-class coals seem to be less in demand; and the pits employed in these trades are doing less business. The prices of steam and second-class coals are a trifle lower. There has been a little better demand for manufacturing coals of late; but there is no change in value. The bulk of the miners in the North of England are badly employed. Fully two-thirds of the pits in the Northumberland steam coal-field are working no more than half time.

The coasting freight market is very dull. There is hardly any business worth mentioning transacted at present. Rates are low. A considerable fleet of small sailing vessels are in the Tyne in search of employment. Steamers are active, and as the weather is fine, they do fully two-thirds of the coasting trade, but at a very moderate rate of freight. They do not realize more than from 4s. 3d. to 4s. 6d. per ton for London. The shipping trade continues to open very quietly for the Baltic, and outward business is dull to the Mediterranean.

The iron trade of the North of England gives very little appearance of rallying. The continual depression has dissipated every appearance of prosperity from such towns as Middlesbrough, Stockton, and Darlington. None of the iron-works are doing much profitable business. Possibly from its low price, a good deal of pig iron is being shipped abroad.

Attention is being paid to the manufacture of Bessemer steel, and numerous cargoes of the finer kinds of Spanish hematite ore are imported into the Tyne to be used for that purpose.

The chemical market was quiet last week. Any little symptoms of speculation which were indicated in the business of the previous week had disappeared. A fair amount of fire-bricks and retorts have been shipped lately; but fire-brick manufacturers complain that there is not much business astir beyond meeting immediate wants.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

It is stated that there is a probability that, at the next meeting of the Berwick Gas Company, a reduction in price of 5d., if not 10d., per 1000 feet of gas, to date from the 25th of May, will be announced. The reduction in the price of coal has already been so great that consumers are of opinion the reduction ought to be retrospective, and date from the 25th of January.

The directors of the Coldstream New Gaslight Company, considering that nothing has transpired to prevent the resolution adopted at the meeting held on the 8th of December last—"That in the event of no unforeseen contingency occurring to prevent it, the price of gas be reduced to 6s. 8d. per 1000 cubic feet, to come into operation on the 17th of February," being carried into effect, they have agreed that the price of gas be reduced accordingly.

On Monday, the 19th inst., at the monthly meeting of the Police Commissioners of Huntley, Mr. Anderson, one of the members of that body, remarked that, as the board now possessed the power, he might make a motion at a future meeting, that the gas-works be taken over by the board. Several of the members seemed to doubt whether their power extended so far as to compel the gas company to hand over the gas-works. It may be considered, however, that Mr. Anderson has given notice of motion on the subject.

The Alloa Burgh Police Commissioners met last Tuesday evening, when, after some conversation regarding the bad quality of the gas which was being meted out to the consumers, it was unanimously resolved—"That the Burghs Gas Supply (Scotland) Act be adopted in, and applied to, the Burgh of Alloa."

By the bursting of an iron plate in the tank of a large gasholder at the Nairn Gas-Works last Wednesday, a large volume of gas escaped, causing considerable alarm, but no serious consequences.

At the monthly meeting of the Forfar Corporation Gas Commissioners, held on the evening of Monday, the 19th inst., the manager submitted a

report upon meters and fittings, which pointed out that complaints against the quality of the gas supplied to the town were too often founded on imperfect internal fittings. The report was referred to a committee for consideration. It was also remitted to the committee to open and dispose of the offers received for supplying higher class coal. The report upon the gas manufactured during the preceding month showed a decrease of 67,500 cubic feet, as compared with the amount manufactured in the corresponding week of last year.

Some time ago the municipal authorities of Peterhead remitted to their Lighting Committee to consider and report upon the propriety of adopting the Burghs Gas Supply (Scotland) Act, and acquiring the works and plant of the gas company. The report of the committee was submitted to a meeting of the Town Council in the early part of the past week. It was as follows:—"The committee found that the Act empowered them to supply gas in two ways—first, by terms to be mutually agreed on, or to be fixed by arbitration for the acquisition of the existing gas company's works; or, second, if the gas company refused to sell the same, by the erection of new works under the powers of the Act. The latter mode might, in the meantime, be dismissed from consideration; and, with regard to the first, it appeared desirable in the outset to ascertain whether the plant of the gas company could be acquired at such a price as would enable the Town Council to supply gas to the community at a considerably reduced rate. The committee, therefore, thought that, before passing a resolution to adopt the Act, an understanding should be come to with the present gas company as to the terms on which their property could be acquired; and should the council concur in this view, it was recommended that negotiations should be forthwith initiated, and that the directors might lay before the council confidential statistics as to the present financial position of the company, so as to enable the council to arrive at an intelligent decision on the subject. It further appeared desirable that a skilled professional person should also be consulted, which would no doubt be expensive, but the committee thought the magnitude of the transfer imperatively called for the employment of such a person before the council committed themselves. Some discussion took place upon the report, after which it was agreed to remit it back to the committee, with power to do the things suggested in it.

While speaking of the movement with regard to the adoption of Sir Windham Anstruther's Gas Supply Act, it is proper I should put myself right with regard to Dumfries v. Johnstone. Last week I unwittingly gave the last-named town credit for having been the first to adopt the Act in all its completeness, whereas Dumfries really deserves that credit. On the 22nd of September last a special meeting of the Town Council was held for the purpose of considering the Act, when, upon the motion of Bailie Wood, it was unanimously resolved to adopt and apply the Act. This resolution was reconsidered and confirmed in the beginning of the present year.

During the week ending the 17th of March, Dr. Wallace failed to find the illuminating power of the Glasgow gas under the standard at any of the four testing-stations. In one instance the average was as high as 28.12 candles. I may here mention that at a late meeting of the Corporation Gas Committee it was resolved to instruct Dr. Wallace, when he finds the gas below the standard illuminating power at any of the testing-stations, to proceed at once to the works where the gas is made, and examine it there.

It has been resolved by the Police Commissioners of Alloa to increase the water supply throughout the town by the laying of a 12-inch main, an estimate of £1598 13s. 4d. being accepted for the same.

The Forfar Police Commissioners have now been so thoroughly "schooled" by the Board of Supervision, and frightened by the Court of Session, that they have just resolved to carry out Mr. Bateman's water supply scheme in all its entirety, at an estimated cost of £37,000.

The local authority of Aberdour have resolved to free themselves if possible from the Dour Water Scheme promoted by the Town Council of Buntisland, and to take steps to join with Inverkeithing and North Queensferry in getting a supply of water from the Devon.

On the 24th of February the water in store for Greenock amounted to 482,047,473 cubic feet, or 138 days supply for all purposes. The average consumption in the town is 53 gallons per head per day.

Last week's pig iron market closed on Friday with the price 7½d. per ton under the closing quotation on the previous Friday. The market was firm.

There is no appearance of improvement in the coal trade. Miners wages are being reduced in all directions.

REDUCTION IN THE PRICE OF GAS.—A committee of the directors of the Sheffield Gas Company have decided to recommend the board to reduce the price of gas by 2d. per 1000 feet to all classes of consumers from July 1 next. The price will then be for small consumers 2s. 11d., and large consumers 2s. 8d. per 1000 feet.

PONTEFRAC T GAS COMPANY.—The half-yearly meeting of shareholders was held on the 21st ult. The directors report showed that the amount divisible was £1234 2s., out of which they recommended the payment of a dividend for the half year ending the 31st of December last, at the rate of 10 per cent. per annum. The directors also reported a considerable increase in the sale of gas during the past half year, and that the works and plant were in perfect working order and condition.

QUALITY OF THE DUMFRIES GAS.—Mr. A. Malam reports that the illuminating power of gas as tested on the works, for the week ending the 23rd inst., was as follows:—

March 17	27-20 Candles
" 18	28-23 "
" 19	27-75 "
" 20	27-19 "
" 21	28-70 "
" 22	27-77 "
" 23	29-52 "

Average illuminating power, 28.05 candles.

COST OF LOCAL GOVERNMENT.—At the fifth ordinary meeting of the Statistical Society for the present session, on Tuesday, the 20th inst., the President, James Heywood, Esq., F.R.S., in the chair, Captain Craigie read a paper "On the Cost of English Local Government." After pointing out the deficiencies in the returns of local finance, the recent improvements, and the points on which information was still wanting, he showed that while the cost of local government in 1868 stood at £30,237,000, of which pauperism cost £7,419,000, or 24½ per cent., it had risen in 1874-75 to £41,977,000. The cost of pauperism alone showed a decrease since 1868 of £738,000, or nearly 10 per cent., every other head of expenditure had risen to a net increase of total outlay of £11,640,000, or 38½ per cent. The largest share of this increase was due to the "so-called" sanitary expenditure of provincial towns, who now spend £7,646,000 more than they did seven years ago. The local debt was £94,000,000 at the present time. The great diversity in the objects of local governments precluded reliable comparisons between districts. In Birmingham only £1 14s. 5d. seemed to be spent, against £5 4s. in Manchester. Five great towns—viz., the Metropolis, Liverpool, Manchester, Birmingham, and Leeds—containing one-fifth of the population of England, account for about one-third of the local

expenditure of the country and owe one-half of the debt. He also dealt with the complex organization and vast number of local authorities, showing that 12,336 such bodies existed. He noticed the large number of paid officials required by these varied governments, annually receiving £2,400,000 in salaries. In conclusion, he urged the need for more uniform and complete statistics, a better system of local finance, and a regular official audit in all cases, and enforced the advantages which might be derived by consolidating local governments, concentrating local functions, and establishing powerful provincial authorities in county areas, which should strengthen local institutions, and introduce greater economy, efficiency, and uniformity into our local system.

GLASGOW CORPORATION WATER SUPPLY—ESTIMATES FOR 1877-78.—At the meeting of the Glasgow Water Committee, on the 20th inst., the Finance Sub-Committee reported that a statement of the probable revenue and expenditure for the current year showed an estimated surplus of £2847, which was recommended to be carried to the sinking-fund. The estimate of revenue and expenditure for 1877-78 was submitted, the revenue being stated as under:—Domestic water-rate within compulsory limits, at 8d. per pound (as at present), £39,244; less abatements, £2940—£36,304; domestic water-rate, beyond compulsory limits, at 11d. per pound (as at present), £25,672; less abatements, £1170—£24,502; public water-rate, at 1d. per pound (as at present), £11,958; trade charges (as at present), £24,300; meter-rates (as at present), £41,857; new buildings (as at present), £2000; arrears, £600; costs, £250; ground annuals, &c., £720—£142,491. Less deficiency in revenue account of river supply works *ut infra*, £2198: total, £140,293. The estimated expenditure was £119,864, and that sum, with £13,720 to the sinking-fund at 1 per cent., being deducted from the revenue, £119,864, a surplus was left of £6709. The river supply account was as follows:—Revenue from water supplied for nine months, £3309; excess of expenditure over revenue, £2198—total, £5507. The cost of pumping and management for the period was stated at £1237, the interest was given as £3392, and £978 was set down for the sinking-fund—total, £5507. The Sub-Committee recommended the Water Committee to report to the commissioners that they were of opinion the sum to be set apart as a sinking-fund for 1877-78 should be £14,598—*i.e.*, £13,720 for the "Glasgow water account," and £878 for the "River supply account"—being at the rate of one per cent. on the amount of money borrowed; that the amount of the domestic water-rate to be assessed and levied within the limits of compulsory supply for the said year, should be continued at 8d. in the pound; that the amount of the water-rate to be levied beyond the limits of compulsory supply, but included within the limits of the Glasgow Corporation Water-Works Act, 1855, should be continued at 11d. in the pound; that the public water-rate should be continued at 1d. in the pound; and that the present table of rates and charges for supplies of water for other than domestic purposes should not be altered, except in the following particulars:—That the charge for supplies by meter be reduced from £1 17s. 6d. per 100,000 gallons to £1 13s. 4d.; that the charges for bottlers, &c., be reduced from 10s. and 7s. 6d. per 50 gross bottles, to 7s. 6d. and 5s. 6d.; that the charge for pasture fields be reduced from 5s. to 3s. per acre;

that the minimum charge for licensed grocers be reduced from £1 to 10s.; that the charge per stall for livery stables be reduced from 4s. to 3s.; that the charge for first-class schools and seminaries be reduced from £1 to 10s. for each pipe, closet, or urinal; and that it be optional for builders to take a supply through meter at a minimum charge of £10.

DRAINAGE OF LONDON.—At the meeting of the Sanitary Institute of Great Britain on the 14th inst., Sir Joseph W. Bazalgette (vice-president) said the conditions essential to the health of cities and towns were pure air and a pure and abundant supply of water. The means, however, of removing from towns rapidly, and without contamination, the rainfall, and drying the subsoil, and removing all decomposition in the most efficient manner, was a subject upon which there was a great variety of opinions. He regarded the report of the committee appointed by the President of the Local Government Board rather as a record of failures than successes; but it was useful, inasmuch as failures taught one what to avoid. He quoted the various conclusions of the committee, and gave a number of instances to show that the value of sewage for manuring land was greatly exaggerated. Some 30 or more years ago London sewage was thrown into cesspools, and that was a horrible state of affairs, the ground being saturated with sewage. It was then wisely decided that cesspools should be destroyed, and that the sewage should be turned into sewers, the result of which was that the Thames became polluted, and that gave rise to an Act resulting in the carrying out of the main intercepting system, and the diversion of the sewage from the river. In London was seen the best example of the disposal of sewage on the principle of carrying it all away by the water carriage system, and putting it into the tidal outfall. The expenditure in London, inclusive of interest on capital borrowed for the construction of the main sewers, and inclusive of the annual cost of pumping 136 million gallons daily in dry weather 35 feet high, and all cleansing and maintaining, had been at the rate of 1s. per head per annum. But had London adopted one of the processes of purification, and obtained 60 square miles of land for a sewage farm (which was the extent which would be necessary), it would have led to a large failure and costly delay. Comparing London with Paris, he said that the latter had adopted a system of removing sewage by pails; the cost of constructing their main sewers had been £4,000,000 (the same as that of London); and the cost of cleansing and repairs in Paris, where there was no pumping, had been £59,000 per annum, or 6d. per head of the population. In London, where the sewage was lifted an average height of 35 feet, the cost was only £58,000, or 3½d. per head of the population, although we had the additional work of pumping. In Paris they removed the soil by carts, and in 1869 they removed 600,000 cubic metres by their process, which cost them 2s. 3½d. per head. If their process were applied to London, it would mean that in London an additional £487,000 per annum would have to be expended. The conclusion at which he had arrived was, that no one system for dealing with town sewage could be advocated as suitable for all places. He believed that cesspools, middens, and dry earth systems were objectionable for towns, and that purification by chemical means was costly and unsatisfactory, and should only be adopted in exceptional instances.

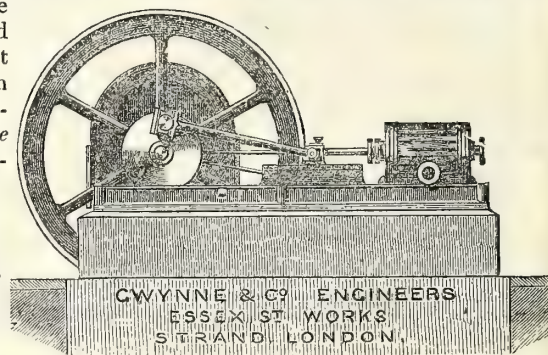
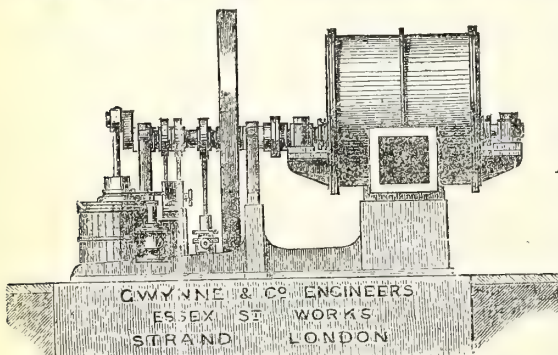
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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

MANAGER OF A SMALL COUNTRY WORKS.—You will waste all your ammonia without effecting any beneficial result by slaking your purifying lime with weak ammoniacal liquor instead of water.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 3, 1877.

Circular to Gas Companies.

MR. RAIKES did not, last Monday week, move the adoption of the additional Standing Order, the object of which is to compel the sale of all new gas shares by public auction. Our "Parliamentary Intelligence" shows that the consideration of the matter has been deferred until Friday, April 6. In the meantime, as will be seen by an able letter from Mr. W. Livesey, printed in another column, the Association of Gas and Water Companies have become alive to the gravity of the question. Mr. Raikes, it seems, has been prompted by that strangely misnamed body, the Board of Trade. We are well aware that some of the permanent officials of this remarkable institution have a sort of craze respecting auction clauses. They would, if they could, include in their operation all sorts of Joint-Stock Companies; but Gas and Water Companies are the most accessible game. We have repeatedly urged that the right of existing shareholders to allotments of new shares at par, when original shares are at a premium, has been established by the Legislature, and we cannot see why the privilege should be abolished at the bidding of the officials of a Government department.

We have to call the attention of our readers to a return ordered by the House of Commons, on the motion of Mr. Chadwick, on the 27th ultimo, which, we fear, is of importance to very many Gas Companies. The order is for a list, "alphabetically arranged, of all Joint-Stock Companies which have "at any time during the last seven years ending on the 31st day of December, 1875, failed to make the annual return re-

"quired by the 26th section of the Companies Act, 1862, "showing how often each Company has so failed during those "seven years."

The section of the Companies Act referred to is as follows :—

Every company under this Act, and having a capital divided into shares, shall make once at least in every year a list of all persons who, on the fourteenth day succeeding the day on which the ordinary general meeting, or if there is more than one ordinary meeting in each year, the first of such ordinary general meetings, is held, are members of the company; and such list shall state the names, addresses, and occupations of all the members therein mentioned and the number of shares held by each of them, and shall contain a summary specifying the following particulars :—

- (1) The amount of the capital of the company, and the number of shares into which it is divided :
- (2) The number of shares taken from the commencement of the company up to the date of the summary :
- (3) The amount of calls made on each share :
- (4) The total amount of calls received :
- (5) The total amount of calls unpaid :
- (6) The total amount of shares forfeited :
- (7) The names, addresses, and occupations of the persons who have ceased to be members since the last list was made, and the number of shares held by each of them.

The above list and summary shall be contained in a separate part of the register, and shall be completed within seven days after such fourteenth day as is mentioned in this section, and a copy shall forthwith be forwarded to the Registrar of Joint-Stock Companies.

What Mr. Chadwick intends to propose when he learns what Companies have not complied with the law we do not know.

The great sulphur battle has still to come off, and the issue is, of course, uncertain. In the meantime, some important correspondence between the Board of Trade and the Metropolitan Gas Referees, on the Sulphur Question has been published, which we hope to lay before our readers *in extenso* next week. It is sufficient to say now that the present Referees do not retreat from the position taken up by their predecessors. To have done so would have been virtually to confess their inability to fulfil the functions imposed on them by the Metropolitan Gas Acts since 1868. This, naturally, they are not disposed to do, and we must confess to some sympathy with them in their difficulties. With, however, a parliamentary inquiry of great importance impending, we hesitate to enter upon a discussion of the serious questions raised in the correspondence to which we have alluded. Our readers will, we hope, see it for themselves next week, and they will form their own judgment. Broadly speaking, the question raised by the Bill of the Chartered Company is, "Referees or no Referees," for matters in connexion with the sulphur question are all that they have to decide. The tests for illuminating power and the arrangements of the testing-stations have now been settled. The ammonia question, we might almost say, has settled itself, and if a Parliamentary Committee affirm that, with our present knowledge of the methods of purifying gas, it is impossible, with fairness to the Gas Companies, to fix a sulphur maximum, it will be unjust to leave the Companies saddled with the expense of officers who are no longer of any use. It must be understood that we here express no opinion on the matter, which is of too much consequence to be disposed of without mature consideration.

It is, perhaps, impossible to overrate the importance of the decision of the Commons Committee on the Ramsgate Bills. It will give a check to the filibustering propensities of Local Authorities, which were stimulated by the decision in the Middlesbrough case last session. Efforts at confiscation, it will be seen, are not always successful; and local authorities, if they are wise, will think twice before they incur heavy expenses in a doubtful parliamentary contest. The ratepayers of Ramsgate will presently wince at the rate which must inevitably be imposed upon them to defray the costs inflicted by a narrow majority, beguiled by promises which in no case could have been fulfilled. We may pity the Rev. E. G. Banks's dupes, while rejoicing over his defeat. What alterations may be made in the Bills of the Companies when the clauses come before the consideration of the Committee next week we, of course, do not know; but we do hope the Companies will not relinquish their claim to capitalize expended profits. The right to do this has been firmly established by parliamentary precedent—we say nothing of the moral right—and the only question hitherto has been the rate of interest to which "Improvement Stock," as it is called in the Ramsgate Bills, shall be entitled. This, it appears to us, will be the point for the Companies and their advisers to consider; and when we see who the advisers are, we feel certain that as much consideration will be given to the public as to the private interests of the shareholders. Mr. Banks affects a pity for the "poor shareholders," whose pockets he professes to think will suffer from this year's legislation so much that they will soon force the Directors to sell their undertaking. We think that the Companies will continue to prosper, and that the shareholders will repose perfect confidence in the directorate, which is more, we strongly suspect, than the ratepayers will do in the

members of the Local Board. To get votes in support of the prosecution of their Bill, the Board promised an immediate reduction of 10d. in the rates. The result, however, is that an additional shilling at least, if not more, will be necessary this year. When the provisions of the Companies Bills have been definitely arranged, we shall have more to say on the general principles involved, as well as the circumstances peculiar to these cases.

With regard to the case of the Blackburn Gas Company, reported in our last, we have a fear that some people will imagine that a compulsory purchase has been effected by the Corporation. We can assure them that nothing of the sort has taken place, though, no doubt, Sir Edmund Beckett will, next session, declare that it has been made. The Company have agreed with the Corporation to sell the undertaking on their own terms. It is one of the best managed in the kingdom, as will be seen when we publish a working statement, for which we have not space this week. We only now allude to the terms of transfer, to remove an impression that may have been upon some minds, that a compulsory purchase has been effected. Nothing of the sort has taken place. The Company, the shareholders in which, we believe, are interested in the borough and neighbourhood, have elected to sell—that is all.

The Exeter Town Council, in accordance with advice given, are about to make an attempt to purchase, by agreement, the undertaking of the Exeter Gas Company, who, also acting under advice, will, we presume, decline to sell. Thus there is a prospect of another parliamentary contest next year, which will, in some of its features, resemble the Ramsgate case recently decided. The agitation at Exeter is kept alive by continual accusations of a nuisance from the works, the cause of which no one seems to be able to satisfactorily explain. An allegation of nuisance cannot, however, be accepted as sufficient reason for the confiscation of a Gas Company. If the occasional escape of vapours from a gas-work, which some people may deem unpleasant, be a valid excuse for confiscating an undertaking, we know of no Company who can be considered safe. Nor, indeed, do we know of any Corporation works against which complaints might not occasionally be made. We fear that this must be regarded as a "squeamish" age. But gas smells are not the only offenders. Medical works tell us that the odour of violets has produced epileptic attacks; the smell of musk, we have been personally assured, has occasioned violent fits of hysterics. What wonder, then, that the smell of tar and liquor should, in some subjects, induce disagreeable symptoms.

The Leicester Gas Company, as our readers know, are promoting a Bill in Parliament, one object of which is to acquire land on which to erect new works. The site they have chosen is admitted to be the best the neighbourhood affords; but, unfortunately, a portion of the land selected is part of the "Freemen's Estate," and the "Freemen" vehemently protest against the erection of gas-works thereon, and are about to petition Parliament against the Company's Bill. We may confess that we do not know sufficient of the locality to enable us to form any opinion as to the prospective value of the land which the Company have selected; but we must protest against the notion that the existence of gas-works invariably depreciates the value of property in their neighbourhood. Then, again, a danger to health is asserted, when it is a well-known fact that the locality surrounding a gas-work is always, *ceteris paribus*, exceptionally healthy. Gas-works may be admitted to be unsightly, and then you have said the worst of them.

We have received the report of the Directors, and the accounts for the past half year, of the Commercial Gas Company. It need hardly be said that, with gas at 3s. 9d., the Company have realized a large profit on the half year's working. Large as it is, however, it falls some £2000 short of the sum required to pay full dividends; but there is an unappropriated balance much more than enough to meet the deficiency. The reason the profit is not greater is to be found in the fact, that the Directors have erected "exceptional and abnormal" purifying plant, the cost of which they have defrayed out of revenue, while the greater part might have been fairly charged to capital. The result is that the East-enders will not get that reduction of price they so earnestly desire.

We do not like verbal criticism, but we feel bound to call attention to the use of the word "abnormal." We do not believe that the works are "abnormal." We have no doubt that they have been excellently planned and well constructed, and are eminently calculated to effect their purpose, when they are used with skill. But, supposing the works to be really "abnormal," who but the Directors are to blame? And why should the consumers—for it comes to that—be made to

pay for "abnormal" works, which certainly cannot be required in any gas undertaking?

The Surrey Consumers Company, with gas of not less than twelve-candle power, at 4s. per 1000 cubic feet, have necessarily done better. They can pay full dividends, and then, after paying interest on bonds, will have £2446 to carry to a balance of an already respectable amount. We hope that the Directors may soon find it possible to make some reduction in the price of gas, and relinquish their pre-eminence as the highest-priced Metropolitan Gas Company.

Water and Sanitary Notes.

WHATEVER sentimentalists may say to the contrary, it cannot be denied, we believe, that the most important information we have obtained with regard to the physiology of the human being has been derived from experiments made on the lower animals. It is not, however, our purpose, now to defend the practice of vivisection. We only wish to point out the opportunities that the presence of Rinderpest in the Metropolis offers for a study of the mode in which contagious diseases are propagated. The disease makes a sudden leap from Whitechapel to Shepherd's Bush. There is a suggestion that the contagion may have been carried from the cattle-shed at the East to that in the West, by an individual who goes about inoculating for pleuro-pneumonia; but, so far as we have seen, the man's wanderings have not been traced.

Cholera, also, has made extraordinary leaps, no satisfactory explanation of which has ever been offered. Animals, however, and particularly cows confined in dairymen's sheds, afford special advantages for a study of the means by which contagion is spread. They never go out to meet the virus; it must be brought to them. We hope, then, that the origin of every outbreak will be diligently investigated. There seems to be no suspicion in this case, that water has anything to do with the extension of the disease, which, considering the fertility of the imagination of the enemies of the Water Companies, appears to us very remarkable. It may, perhaps, be accounted for by the fact, that veterinary surgeons are men of common sense, wedded to the old-world theory, that personal contact is the one essential to the spread of contagious disease, and not given to dogmatizing on matters respecting which they possess but limited information. We look, therefore, to the Veterinary Department of the Privy Council for a most careful investigation into the origin of every outbreak of cattle plague, certain that it will throw valuable light on the causes of the spread of all epidemic diseases.

We publish to-day our abstract of the accounts of the Metropolitan Water Companies for the year 1875-6. At present we have no space for comment on some interesting features revealed, but may, perhaps, call attention to them next week.

The woes of the Town-Clerk of Sheffield have greatly excited a portion of the population, and much dirt is being thrown in all directions. Nobody, however, appears to offer to pay the money the Clerk is out of pocket. On one side it is attempted to be shown that the Councillors, who in Sheffield resolved to withdraw the Water Bill of the Corporation, ought to be made responsible. Counsel in London, it is said, were certain of success; but we believe that the Councillors in Sheffield were much better informed, and knew that the Bill had not a ghost of a chance, and that they saved the Town-Clerk a good deal of money by not prolonging an inquiry which could have had but one end. We have often regretted the introduction of party politics into municipal affairs. Sheffield is a shocking example, and we notice that all the blame is thrown upon the "Liberal" party in the Council. Some in Sheffield affect to consider that the profession of Free Trade principles is inconsistent with the holding of shares in what is denominated a "monopolist" Water Company!!

We have not hitherto noticed an inquiry which has proceeded for some weeks before the Water Committee of the Corporation of Liverpool, in relation to an accusation brought by Mr. Alderman Bennet against Mr. Deacon, the water engineer, that he had appropriated or plagiarized some plans sent to the Water Committee by Messrs. Mather and Platt. When two gentlemen have to prepare plans for works to be erected on the same spot, for a common object, it is hardly possible that the designs should not have some features in common. The Water Committee, after a full investigation, have completely exonerated Mr. Deacon from the charges brought against him. His reputation in his profession is too high to need any defence from us; but we may express an opinion that he is perfectly incapable of appropriating another man's ideas in the way alleged.

Communicated Article.

CONTRIBUTIONS TO THE THEORY OF LUMINOUS FLAMES.

By Dr. KARL HEUMANN.

[Translated from the *Journal für Gasbeleuchtung*.]

PART I.

(Continued from page 14.)

In order to prove that the same phenomena will occur in luminiferous vapours, provided they are not oxidized into a feebly luminous gas by an excess of oxygen, hydrogen was passed through a vessel containing common salt and zinc turnings, on which dilute hydrochloric acid was poured. The gas issued from a fine luting-tube, and burnt with an intense yellow light, owing to the particles of salt carried along with it. When this flame was passed into a vessel containing pure oxygen, no disillumination ensued, but, on the contrary, a far more brilliant light was emitted.

If, therefore, the disillumination of a narrow gas-flame in pure oxygen is a result of the admission of an excess of this latter gas, while disillumination does not take place so conspicuously in atmospheric air, it is because of the presence of the inert nitrogen which dilutes the oxygen and diminishes its oxidizing energy.

To prove the correctness of this explanation, the nitrogen of the atmosphere was replaced by carbonic acid—that is to say, a glass cylinder was filled, over water, with one volume of oxygen and four volumes of carbonic acid, and after due mixture of the two gases a gas-flame issuing from the fine point of a brass tube was introduced.

The flame remained just as luminous as if it were burning in atmospheric air; from which it follows that the nature of the inert gas mixed is immaterial, and that the dilution of the oxygen alone regulates the result.

Every neutral gas must act in this way, and therefore the products of combustion of the flame itself will form no exception. If the flame is allowed to issue from a fine brass tube into a flask (with the neck downwards) filled with oxygen, and to burn there, at first the disillumination above described takes place, but presently, when the carbonic acid and aqueous vapours produced by the combustion have sufficiently diluted the oxygen, the flame will begin to regain its luminosity. The light cone that was reduced to a bright point gradually enlarges, and finally the flame, continually increasing in volume, exhibits the same appearance as if it were burning in air; this will occur at the moment when the oxygen remaining in the flask is diluted by the gases of combustion in exactly the same proportion in which, in the air, the oxygen is diluted by the nitrogen.

If the re-illuminated gas-flame continues to burn inside the flask, disillumination presently again takes place; but not, as at first, from the outside by excessive diminution of the luminiferous envelope, but by gradual reduction of the light until the flame is entirely disilluminated. The whole flame continues to increase in size, and is finally extinguished. This method of disillumination is quite similar to the disillumination of a flame by neutral gas, such as carbonic acid or nitrogen, being mixed with the gas burned, and, in fact, the cause of disillumination is identical in both cases. As every ordinary flame* requires two combustibles for its production, their chemical combination causing the gases to glow and emit light, it must be a matter of indifference which of the gases is diluted by neutral gas—whether the illuminating gas, as in Knapp's experiment, or the oxygen of the air.

And, in fact, a gas-flame, burning with a bright flame in the air, at once becomes blue if it be introduced into a mixture of five volumes of air and two volumes of carbonic acid contained in a larger vessel. This experiment is, to a certain degree, the reverse of Knapp's, yet it equally causes disillumination, as a consequence of dilution and reduction of the temperature of the flame.

Instead of mixing carbonic acid with the air before commencing the experiment, the mixture may be allowed to take place through the combustion of the flame itself, when it will be found that a luminous gas-flame burning in a flask filled with air, and with its mouth turned downwards, will, after a short time, become fainter, and finally quite blue, at the same time increasing considerably in size. The flame will continue in this non-luminous, almost invisible state, for some time (according to the size of the flask), and burn bright again immediately, if brought back into the open air in sufficient time, otherwise it will go out. This case of disillumination is, therefore, quite analogous to the second disillumination which takes place when a gas-flame burns in a closed reservoir of oxygen; only, in this latter case, there is no nitrogen present, and the products of the combustion of the flame alone dilute the oxygen.

When, therefore, a narrow luminous gas-flame is introduced into an atmosphere of oxygen, confined in a close vessel, we observe first—

Disillumination of the flame, during which the diminution of the luminiferous envelope takes place from the exterior inwards, and in favour of the faintly luminous surface which increases in size.

Then, after a short time, increased development of light takes place, till the flame recovers the shape and luminosity belonging to it in atmospheric air, because the energetic oxidizing power of the pure oxygen on the burning gas becomes moderated through dilution with the gases produced by combustion.

And lastly, in a short time after, disillumination again takes place, but this time chiefly through diminution of the illuminating power of the whole luminiferous envelope, occasioned by increasing dilution of the oxygen still present with the inert gases of combustion, combined

with a lowering of the flame temperature. Both these agencies operate with increasing effect, till the flame, after becoming blue, then almost invisible, while still increasing in size, is at length cooled below the temperature necessary for combustion of the gas, and is finally extinguished.

From the above it results that disillumination may be produced, not only by refrigeration and dilution of a carbon-containing flame, but also by a third course—namely, *rapid decomposition of the luminous material*—i.e., immediate oxidation of the carbon to a faintly luminous gas (carbonic oxide and carbonic acid).

If we recapitulate the means—as shown during this investigation—by which disilluminated flames may be restored to brilliancy, we arrive at these results:—

That hydrocarbon flames, deprived of their light by withdrawal of heat, are revived by an *increase of heat*.

That flames disilluminated by dilution with air or neutral gas, are restored by *raising the temperature of the flame*.

And that flames disilluminated by excess of oxygen causing a too rapid oxidation of the carbon, will recover their luminosity by *dilution of the oxygen with neutral gases*.

It would be interesting to know whether flames disilluminated by a mixture of neutral gas, besides being restored by heating the burner, would also become brilliant again if burned under such a pressure that the molecules of the combustible gas were, notwithstanding the admixture of nitrogen or carbonic acid, forced as closely together as they were originally. Unfortunately, I do not possess the apparatus necessary for such experiments, and I should like to draw the attention of those talented chemists, who have investigated the phenomena of combustion under increased pressure, to the action of various flames when disilluminated by admixture of air or neutral gas, or by refrigeration. It also remains to be proved whether the disillumination which a narrow gas-flame undergoes in pure oxygen ceases if the oxygen atmosphere is rarefied to one-fifth, or less, of its original density.

The essential difference which existed between the views of previous experimenters—namely, on the question as to whether refrigeration or dilution was the cause of the disillumination of carbon-containing flames, when air or neutral gas was mixed with the gas burned—seems to me to be now definitively settled, and the fact ascertained that, at least, three different causes may, any one of them, effect disillumination—namely, *refrigeration, dilution, and oxidation of the combustible material*.

In most cases two, or even all three of these causes will come into operation; thus, in disillumination by nitrogen or carbonic acid, dilution and refrigeration are chiefly concerned; in enlarging the flame by a cold body, refrigeration and the more rapid oxidation of the carbon come into play; while in disillumination by air, all three causes are combined; moreover, in this latter instance, the presence of the oxygen added occasions an increase of the flame temperature, and a diminution of the flame itself—effects quite opposed to the action of refrigeration and rarefaction.

From this reasoning it follows that the much-canvassed flame of the Bunsen burner is really the ultimate result of a whole series of forces acting, some in the same, some in opposite directions; and it is not surprising that views should differ so widely respecting the constitution of luminous flames, when this very flame of the Bunsen burner is usually selected as the most fitting example of disillumination, thus unconsciously choosing the most complicated instance, and the least fitted of any for introductory study.

NORTH CAMP AND FARNBOROUGH DISTRICT GAS COMPANY, LIMITED.—At a meeting of the directors of this company, held on the 25th ult., the tenders of Messrs. Willey and Co., of Exeter, were accepted for the iron apparatus, the cast-iron mains and the laying of the main-pipes; and of Mr. Robinson, of the Rockingham Works, New Kent Road, London, for the buildings, gasholder-tank, &c. The tenders accepted in each case were the lowest. The plans were prepared by Mr. Hedley, consulting engineer of the War Department Gas-Works, Aldershot Camp, and the quantities were supplied by Messrs. Franklin and Andrews, of Adelaide Place, London Bridge.

WESTON-SUPER-MARE WATER-WORKS COMPANY.—The annual meeting of this company was held on Saturday, March 24—the chairman, Mr. Alfred Hill, presiding. The report of the directors was as follows:—"The net earnings of the year, after deducting the interest on the mortgage debt, £178 3s. 6d., the £100 set aside to depreciation-fund, and £653 2s. paid as directors and auditors' back fees, in accordance with the resolution of the meeting of shareholders held on May 20, 1876, amount to £1295 15s. 3d., and the balance to the credit of revenue account is £1444 4s. 7d. It will be in the recollection of the proprietors that, during the first ten years of its existence, the depressed state of the company's affairs precluded the payment of any dividend whatever, and it was not until the year 1864 that the first dividend was paid. This first dividend did not exceed 2½ per cent. From that date, however, the rate of dividend has progressively increased, until the increased profits in 1874 enabled the company to reach its maximum dividend of 7½ per cent. While by the Act of Incorporation the dividend is limited to 7½ per cent. for any one year, a power is reserved to the company to make up to the proprietors, out of surplus profits, the deficiency of dividends of the years in which less than 7½ per cent. was paid. In November last an interim dividend of 4 per cent. was paid on the original shares, and also an interim dividend of 3½ on the paid-up capital (£5) of the new shares of 1874. There remains, therefore, but 3½ per cent. on the former, and 4 per cent. on the latter, payable to the proprietors to make up the maximum dividend of 7½ per cent. for the year 1876. But the directors are happy to state that the affairs of the company now admit of its availing itself of the powers above referred to, and of paying out of surplus profits 1 per cent. towards making up the deficiencies in dividend in the years prior to 1874. It will be proposed, therefore, that the dividend to be now paid on the original shares shall be 4½ per cent. instead of 3½ per cent.; making, with the interim dividend already paid, a total of 8½ per cent." The report was adopted, and a dividend declared in accordance with the recommendation in the report. It was also resolved that an interim dividend of 4 per cent. for the half year on all the capital of the company be paid in November next.

* Except the flame of exploding materials.

Correspondence.

AUCTION CLAUSES IN GAS BILLS.

SIR,—In your paper of last week you state that the Chairman of Ways and Means had given notice to move in the House of Commons, on Monday, March 26, a new Standing Order, to the following effect:—"In every Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender, at the best price which can be obtained." And you add that, "We write this with a conviction that, before these lines meet the reader's eye, the Standing Order will have been adopted; but, nevertheless, we think it right to put a protest upon paper." Fortunately, however, this was not the case, although it must be admitted that there was just ground for assuming that it would be so; for if it had been brought on at such a short notice, and in the manner proposed, under the auspices of the Chairman of Ways and Means, it would, no doubt, have been passed.

The notice of this motion appeared first in the Votes that were delivered to members on Thursday morning, the 22nd inst., when it merely said that it would be moved for "on an early day," which, as it was then within two or three sitting-days of the recess, all parties interested concluded would be some day after the recess. But in the Votes delivered to members on the following day—that is, Friday, the 23rd inst.—this "on an early day" was exchanged for "Monday, the 26th of March." There was thus no time to call the companies together and ascertain their views, so the solicitors and agents who have been accustomed to act for the provincial companies (without waiting for specific instructions) took the matter up in the interests of their respective clients, and having ascertained, with the kind assistance of some members, that the motion had been made at the instance of the Board of Trade, they formed a deputation, and, with the secretary of this Association, waited upon the Board.

The deputation stated that they did not attend the Board to discuss the merits of the proposal, but to point out the great injustice of pressing forward a motion of such importance, affecting property amounting probably to 100 millions of money, in such haste that the parties whose interests would be so largely affected by it could not, in the ordinary course of events, have any knowledge of what was being done, and so urge its being put off until after the recess.

The President of the Board thereupon said that he thought the request was but reasonable, and he would write to the Chairman of Ways and Means to that effect; and shortly after information was sent to the parties that the motion would be adjourned until Friday, the 6th of April.

In plain terms, this proposal is nothing more nor less than to provide, by a Standing Order, that no gas company shall in future be allowed to derive any benefit from the extension of their operations.

The object of the Standing Orders of the House of Commons, so far as the public are concerned, is simply to regulate the proceedings before the House. Adopting that view, the question forces itself upon the minds of all persons interested—Is it right to deal with such an important provision as this as a mere question of proceeding?

The principle involved is not confined to gas companies, it affects all commercial undertakings in the United Kingdom acting under parliamentary powers. If it is sanctioned, it will give to the House the power of overriding, by its own Standing Orders, every public Act that may be passed for the regulation of those companies; and it is obvious that there could be no limit to such a power, or to the injustice that might be done by it.

There are public Acts for the regulation of railways, telegraphs, piers and harbours, water-works, gas-works, &c. If these Acts are defective, or insufficient for their purpose, the proper course is to introduce a Bill for their amendment, and then all parties interested will have—what every individual, be his position what it may, is entitled to—the opportunity of being heard when his property is sought to be interfered with. Whereas the passing of a Standing Order for such a purpose would destroy all those rights, and would, in effect, be making a law that would greatly depreciate private property, without allowing the owners thereof to be heard against it.

The utmost that can with propriety be done in this direction by a Standing Order, consistently with the object and intent of Standing Orders, is to provide that every Select Committee on a Gas Bill shall consider the expediency of inserting a provision in the Bill for all new shares being sold by auction.

It has been said again and again that, notwithstanding the fact that the Gas-Works Clauses Act prohibits the payment of higher dividends than 10 per cent., the companies do contrive, by some means or other, to pay higher dividends than 10 per cent., and cases are frequently referred to in illustration of this. But all this arises from a misapprehension of the facts.

The members of the House of Commons and the public both seem to suppose that all gas companies are under statutory regulations, whereas of the 1600 gas companies in the United Kingdom there are only about 400 under regulations, and the objectionable proceedings on the part of some companies, which so frequently come before parliamentary committees, and cause so much dissatisfaction, do not originate with these 400 companies, but with the others.

When a company are under compulsory regulations, they are compelled to supply gas of a certain standard of illuminating power. They are limited in price, in the amount of capital, and in the rate of dividend, which of late years has been reduced to 7 per cent. upon all new capital, and now it is proposed that all new capital shall be sold by auction.

When a company are not under statutory regulations they can increase or reduce the illuminating power as they think fit, charge any price they may think reasonable, raise any amount of capital required, and pay any dividend they can earn upon old and new capital alike.

The limitation of the dividend upon new capital to 7 per cent. has done more harm to the public than it ever did good, inasmuch as it has deterred many companies from coming under statutory regulations.

If the 10 per cent. had never been interfered with, the majority of the companies would by this time have applied for an Act or a Provisional Order; but while they know the law is such that if they were to

obtain an Act they would be limited to 7 per cent. on all their new capital, but that if they carry on their operations without one they may get 10 per cent. or even more, they are unwilling to apply for an Act until they are obliged.

This new regulation, if passed either as a Standing Order or an Act, would only aggravate the end, and make matters worse, for if the companies are unwilling to apply for parliamentary powers now, they would be still more unwilling with this new regulation, and no company would do so who could possibly avoid it, and the companies already under parliamentary powers would exercise all their existing powers to the utmost before they would apply for further powers and be subjected to such unjust regulations.

It ought to be the policy of the authorities to encourage extensions in every possible way. Outside of every large town, there are many places too small to have gas-works of their own, and whose only chance of getting a supply is from some adjoining company; but what company would extend their mains for such a purpose while prohibited by law from making any profit out of the transaction, and might thereby even lessen the profit they were previously earning?

When the auction clauses were imposed upon the Metropolitan Companies, the limitation of the dividend to 10 per cent. was repealed, and the companies were allowed to regulate their future dividends by a sliding scale—that is, if they raised the price beyond a certain standard, their dividend was to be reduced; or if they lowered their price below that standard, their dividend might be increased.

The effect of this is, that as the premiums received on the sales of shares are expended on the works without dividend, the companies are enabled to extend their operations at a cheaper rate than otherwise, and thereby make a larger profit, and consequently pay a higher dividend on the existing capital.

This proposal emanated from the Board of Trade; but the present proposal, which also emanates from the Board of Trade, is to so impose the auction clauses, and not allow the sliding scale. If this regulation were passed, it could only apply to the 400 companies under statutory powers, the other 800 companies would still be entirely independent of it, as they are now. It would, therefore, unavoidably be utterly valueless for the purposes for which it was designed. But even if it were otherwise, it would be an act of great injustice to impose such regulations upon all the companies for the defaults of two or three only, or to make those companies who have voluntarily placed themselves under regulations suffer for the irregularities and defaults of the other companies who have refused to do so.

In whatever way the proposal is to be viewed, it is wholly indefensible. Its operation would be to injure many companies that have honourably fulfilled all their obligations, while it would be unable to reach those who had failed to do so, and it would tend to prevent extensions, to the discomfort of many persons in the outlying districts.

W. LIVESEY.

*Gas and Water Companies Association, 6, Victoria Street,
Westminster, March 31, 1877.*

SIR,—By way of exchanging ideas, I send you a copy of a letter I have just posted to the M.P.'s for this city and the North and East Ridings.

CHAS. SELLERS.

York United Gas Company, April 2, 1877.

[COPY.]

Dear Sir,—I am requested by my directors to invite your attention to the following notice which has just been put upon the Votes of the House of Commons—viz., that it will be moved, on the 6th inst., to adopt the undermentioned as one of the Standing Orders of the House:—

"In every Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender at the best price which can be obtained."

My directors think you will agree with them that the application of such a principle to gas companies would not only be prejudicial to gas enterprise, but specially harsh and coercive, and therefore they respectfully hope that you will use your influence to induce Mr. Raikes, the Chairman of Ways and Means, not to press the motion.

Of course, if the principle were adopted, every gas company having a Bill either in this or any future session would have to insert a clause, and put up all their new shares to auction. Now, apart from the fact that the introduction of this special legislation upon gas companies, whereby shareholders interests are made unduly subservient to the interests of the public, is harsh, my directors cannot but regard the principle as peculiarly dangerous to commercial enterprise generally; for if the compulsory sale of the privileges which shareholders have hitherto enjoyed, and regarded as their right, be applied to gas companies, it must be seen that it ought to apply equally to railway companies, and all companies of a similar character. Besides, if even the principle were sound, my directors are of opinion that its compulsory application to all gas companies alike, without any examination before committees into the history and peculiarities of a company's capital, or, in other words, into the history of its shareholders, to see whether or not they have even been rewarded at all for their risk and enterprise, would be manifestly unjust.

With these comments, my directors hope that you will oblige them by using your influence against the motion.

(Signed) CHARLES SELLERS, Secretary.

THE CONSTRUCTION OF GAS-GLOBES.

SIR,—There has been much agitation for some time past regarding the improper use of gas for illuminating purposes, but this has been chiefly directed to gas-burners. We wish to draw attention, through the medium of your JOURNAL, if you will kindly allow us, to another important branch of this question that has been all but neglected—viz., the globe and its surroundings, these being as great sinners, where they are used, as the burner itself. We shall only touch incidentally on the globe's surroundings, as the main object we have in view in writing this letter is to draw attention to, and suggest a remedy for, an objectionable feature in the globe itself.

We suppose the globe was originally introduced as an ornament, and this idea has evidently been the one that globe-designers have followed to the present day, leaving utility out in the cold. How the globe would look must have been the leading idea, not how it could be made to conform to the requirements of the flame it had to cover, or how it would affect it. Every one familiar with gas lighting and the use of globes must be aware how a gas-flame is spoiled in appearance, and made un-

steady, by having placed over it a globe of the ordinary kind, such as our gas-fitters shops are filled with. Utility has also been neglected by manufacturers of other *etceteras* connected with gas lighting. Our chandelier makers have designed the parts connected with the globe that they have to do with, regardless of the effect they would have in obstructing the downward passage of the light. For a globe-holder nothing is required but the three forks projecting from the centre, with the necessary screws, and as light as possible for the purpose; but, in addition to this, they have added outside the forks a thick ring of metal, and underneath this is frequently found a saucer-shaped piece of metal, the whole being an area of something like 3 inches of metal, through which the light can scarcely find a crevice to pass. Then going upwards, we find the designer again at work, the results being that the whole combination is crowned by placing on the top of the globe a thing called a coronet, which, though having a very fine name, is always composed of very ordinary material, which becomes discoloured and an eyesore with a few weeks of use. The light being now pretty well guarded from coming out at the top and bottom of the globes, various devices are had recourse to in order to "modify the glare" of the light that comes out at the sides thereof. For this purpose we are favoured with various shapes and thicknesses of ground and opal globes, and thus matters go on, until the whole combination of the designer's art is found obstructing the light to the extent of from 60 to 80 per cent. of that yielded by the naked flame. When people have succeeded in beautifying their gas-lighting apparatus up to this point, they then find out that "they want more light," that "the gas is poor," &c.; and no wonder that this is so. If our architects were to display as much ingenuity in keeping daylight out of our rooms as is here displayed in keeping gaslight out, what would be thought of them?

Though we have thought fit to make these general remarks about the parts connected with the globe, it is not our intention to make a crusade against all the objectionable features here pointed out, but will leave them to be remedied or dealt with by each person in accordance with his own fancy, and content ourselves by taking in hand one feature that is well deserving attention, and which is the main object of our letter—we allude to the 2-inch hole to be found at the bottom of all our 7-inch globes, with the exception of a few opal ones.

We have no idea to whom the honour belongs of fixing the diameter of this part at 2 inches and under, but it is utterly inadequate for its purpose. The column of air it admits is so confined, that in its upward rush it too rapidly oxidizes the centre of the flame, curls up its edges, and produces smoking points, with great unsteadiness that rises sometimes into a roar when the pine-apple shaped globes are used. Why this objectionable feature should have existed so long might have been capable of easier explanation, had there been any difficulty in the way of its removal; but there is none. A remedy is at hand which is simple, effective, and costless, and therefore only requires some one to take it in hand and keep pressing the matter forward until a complete change is effected. This office we have taken upon ourselves to fill.

The remedy we propose is a 3-inch opening at the bottom, instead of the 2-inch hitherto used. This alteration allows the flame to spread itself properly and develop its illuminating power, and imparts to it steadiness; also giving much more downward light than with the 2-inch hole. The difference in effect between two globes of precisely the same pattern—with the exception of the holes—when placed over two similar gas-flames, is so striking that we are perfectly satisfied the earnest attention of the profession and the gas-fitting trade only requires enlisting in the cause in order to have the change rapidly effected.

We know there are 8 and 9 inch opal globes with 4-inch openings at the bottom, but these are not suited, nor are they intended for general use, and they are not the sizes we are writing of. There are also 7-inch opal globes, with 2½-inch openings; but 2½ inches is not worth altering for, as that does not accomplish the end sought. Though not enough, it is a step in the right direction, and it is strange that this alteration has not been made in the ordinary globes as well as in the opal ones. The explanation is probably to be found in the fact that the opal globes have generally been pushed in connexion with some particular kind of burner; but we want the alteration made for every kind of burner, and for every kind of 7-inch globe, no matter whether it is opal or the kind more commonly used. For this purpose nothing short of 3-inch openings will answer effectively, and this size of hole may be used without interfering with any form of 7-inch globe or pattern on same. The feeling that prompts us to move in this matter is a strong desire to remove one of the greatest defects connected with our gas lighting apparatus, and a feeling somewhat akin to shame, that in the leading gas-consuming country in the world such a defect should continue to exist when it can be so easily removed.

Leeds, March 24, 1877.

GEO. BRAY AND CO.

CLITHEROE WATER-WORKS COMPANY.—The annual meeting was held on the 23rd ult.—Mr. W. B. Dewhurst in the chair—when a dividend of 10 per cent. for the past year was declared, and 3 per cent. paid in addition on account of back dividends. The sale of the undertaking to the Urban Sanitary Authority, on the terms already agreed upon by the directors, was confirmed. Sixty guineas were voted for a testimonial to the chairman, who has so long and ably presided over the company, and brought it to so successful an issue. Forty guineas were also voted to Mr. Wheeler for a testimonial for past services, his connexion with the company as secretary and law-clerk extending over a period of 20 years.

CROOKES'S FORCE.—During the last twelve months, Mr. G. T. Stoney, F.R.S., and Mr. R. J. Moss have conjointly been investigating the behaviour of that force manifested in radiometers known as Crookes's force, and they have laid before the Royal Society some of the results so far obtained. If, as has been asserted, the pressure which is exerted on the blackened pith surfaces re-acts on the side of the glass envelope, then in like way a transparent disc delicately suspended close to a stationary disc of blackened pith ought to move away from the pith, and, therefore, towards the light when the pith is illuminated. An arrangement, described in their paper, was devised to test this. As soon as the vacuum commenced to be formed, the glass disc was repelled from the pith, and the repulsion was more violent as the vacuum became more perfect. The establishment of this fact with regard to this mysterious force, the authors put forward without any expression of doubt. With regard to the influence of variations in the tension of the residual gas, and the variations in distance between the reacting surfaces, the authors state some results, but reserve discussion till further observations have been made.—*The Times*.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MARCH 26, 1877.

The Examiners certificate of non-compliance with the Standing Orders in the case of the Dublin Improvement Acts Amendment Bill, was referred to the Standing Orders Committee.

The following Bills, brought from the Commons, were read the first time, and referred to the Examiners:—Edinburgh and District Water; Falmouth Water; London Corporation; Longton Corporation.

HOUSE OF COMMONS.

MONDAY, MARCH 26, 1877.

The following Bills were read the third time, and passed:—Edinburgh and District Water; Falmouth Water; London Corporation; Longton Corporation.

The Dundee Gas and the West Surrey Water Bills, as amended, were considered.

The Colne Gas Bill was read a second time, and committed.

The Leeds Improvement Bill was reported.

The Ramsgate Local Board Bill was reported, preamble not proved.

The Lowestoft Water, Gas, and Market Bill (Lords) was read the first time, and referred to the Examiners.

Mr. RAIKES deferred his motion in reference to the alteration of the Standing Orders till Friday, April 6.

Mr. WHALLEY deferred his motion for a Bill in regard to Reservoirs till Thursday, April 5.

TUESDAY, MARCH 27.

The Newport (Monmouthshire) Gas and the Waterford Gas Bills were read a second time, and committed.

On the motion of Mr. CHADWICK, a return was ordered, alphabetically arranged, of all joint-stock companies which have, at any time during the last seven years ending on Dec. 31, 1875, failed to make the annual return required by the 26th section of the Companies Act, 1862, showing how often each company had so failed during those seven years.

HOUSE OF COMMONS COMMITTEE.

WEDNESDAY, MARCH 14.

(Before Mr. ASSHETON, Chairman; Messrs. SMITH, BELL, and DUNDAS; Mr. BONHAM-CARTER, Referee.)

RAMSGATE LOCAL BOARD BILL.

Sir EDMUND BECKETT, Q.C., Mr. VENABLES, Q.C., Mr. BIDDER, Q.C., and Mr. O'HARA appeared for the promoters; Mr. POPE, Q.C., Mr. MICHAEL, and Mr. CHANDOS LEIGH for the Ramsgate Water-Works Company and the Isle of Thanet Gaslight and Coke Company; Mr. SMITH for the Corporation of Margate; and Mr. BALFOUR BROWNE for the owners and occupiers of St. Lawrence, petitioners against the Bill.

Sir EDMUND BECKETT, in opening the case for the promoters, said the Bill was for the purpose of enabling the Ramsgate Local Board to purchase the undertakings of the Ramsgate Gas and Water Companies (as he would call them for shortness), which measure was opposed by those companies, who had also introduced Bills of their own, seeking for further powers. The general issue, therefore, to be tried was whether the two companies who had been supplying gas and water for a very considerable time under very antiquated Acts of Parliament—and, as the local board said, very badly—were to be allowed to continue to do so, or whether the undertakings were, in conformity with more modern views, to be transferred to the local board, who were willing to purchase them at any reasonable price an arbitrator might give. Ramsgate had been governed by commissioners from the year 1787 until 1866, but in the latter year a body of 24 commissioners were authorized by Parliament, who had jurisdiction over the whole of Ramsgate, excepting the parish of St. Lawrence. If the Bill of the local board passed, they would be authorized to supply gas and water outside their own district, but there was nothing unusual in that. The population of Ramsgate was of a very fluctuating kind; in winter it was about 15,000 in Ramsgate itself, and in St. Lawrence 6000 additional; but in summer the numbers rose to 50,000 or 60,000. The rateable value of Ramsgate proper was £75,000, and of St. Lawrence £25,000, although the rateable value of the lighted area in the latter district was only about £15,000. The Ramsgate Gas Company were incorporated so long ago as 1824, and they had had no legislation since, and all they could be said to have done under that Act had been breaking up the streets, charging what they liked, giving gas of what quality they liked, and defying their own Act of Parliament as to capital. They had also power to light Margate, but there they had separate works. On a former occasion, when a scheme similar to the present one had been proposed, the company complained very much of their works being separated, and the local board therefore proposed to purchase their whole undertaking, binding themselves to secure to Margate that portion which belonged to them, a proposition in which Margate was very anxious to concur. They had also power to light Broadstairs, but had not done so, probably because there was another company there. With regard to the proposal to buy the whole of the works, and transfer the Margate portion to that town, there was a distinct precedent for it in the case of the Birmingham Corporation two years ago, when a clause was put into the Act compelling the Birmingham people to sell to the outsiders when they demanded it. One of the restrictions the Ramsgate Gas Company were under by their Act of 1824 was that they were not to supply worse light by means of gas than the town could get from oil, and that gave an idea of the antiquated state of their legislation; but they even ran that test so close that not long ago the local board did actually start oil lamps against them, on account of a quarrel about price. That did not go on for very long, for there was a compromise, but during that time the oil lamps were as good as the gas. With regard to the water company, they were established in 1855, and were practically under no restrictions—that was, such as companies were now subject to. To show the kind of legislative idea prevailing in those days, he (Sir E. Beckett) would state that the shareholders of the company were to have a preference over every one else in having water. Next to the shareholders, certain streets had a preference; and the rates which they were authorized to levy were as high as 10 per cent. They were not bound to supply any water excepting for the strictest domestic purposes. They had two different works—one at a place called Southwood, which was so near the sea that the water was sometimes brackish; and the other at Whitehall, where they pumped water, which had no fault to be found with it, excepting that it was very hard. There were times when the supply from Whitehall was deficient, and they were obliged to resort to Southwood, which was the case last year, and then the water was so bad that it went by the name of the "Ramsgate Mixture," not quite equal to Epsom salts, but something approximating to it. The principle involved in Bills like the present was, that where there was no strong intervening reason to the contrary, gas and water works were better in the hands of the local authority. That principle was taken from the Public Health Act, which recited that, where there

was a gas or water company in existence, the local board or the corporation should not be allowed to set up competing works of their own until they had satisfied some public authority that those companies could not do their work properly. That legislation was devised by some benevolent party who was anxious to save the legal expenses incurred; but it had proved to be unworkable, and there was not a single instance in which it had been practically and effectually put in force. That Act was mentioned merely as pointing out the general principle, the leading feature of the Act being that there should be a company in existence capable of doing the right thing; but when that was not the case, Parliament had invariably applied the only remedy it could apply—viz., placing the works in the hands of the local authority, who would, of course, be anxious to do what was right. The question to be determined was, had the companies been doing their work properly; but upon that there might always be some difference of opinion. [The learned counsel cited the cases of Rotherham, Stockton and Middlesbrough, Dundee, Glasgow, Leeds, and Neath, in all of which cases Parliament had acted upon that principle.] With regard to the Ramsgate Gas Company, when he stated that they were under no restrictions at all in their original Act—except about giving gas equal to oil—he thought he had said enough to satisfy the committee that they ought to be under parliamentary regulation as to that matter. As to price—not merely as regarded domestic lights, but also the public lights—there had been grievous complaints. The answer would doubtless be, “That is all very true, but here we are with a Bill.” They were before Parliament with a Bill last year, because they found at the end of 1875, if they did not do so they would have no answer whatever to the Bill brought forward in 1875-76 by the local board to buy them. They, therefore, brought in a Bill of their own to oppose the Bill of the local board; but, under advice, they withdrew their Bill just before going into committee. His learned friend, Mr. Pope, knew what the result would have been—viz., that if the committee found that the companies had been conducting themselves as the companies knew perfectly well they had been doing, their Bills would be rejected, and the Purchase Bill would pass, and, therefore, as a matter of tactics, they withdrew their Bills. By introducing those Bills in 1875-76, the companies admitted they ought to be brought under parliamentary control, and they were only withdrawn in order to carry out their selfish policy of protecting their large dividends from either being bought up at a fair price by the local board, or restricted by Parliament. If they were *bona fide* anxious or willing to be under parliamentary control, why did they refuse last year to be put under such control? That alone justified the local board in asking the committee to sweep them out of existence; but it would be sweeping them out with a golden broom, because they would be paid the last farthing an arbitrator would give. The preamble of the gas company's Bill of the present year stated the conditions upon which they were kind enough to allow the committee to put some control upon them—“Provided the capital of the company be declared and readjusted as hereinafter mentioned.” Then they were willing that they “should be subject to the powers, regulations, and restrictions of the several statutes incorporated in and by this Act.” That was to say, “If you will give us the bonus for which we ask, we will submit to be regulated.” What was that bonus? By their original Act they were authorized to raise £24,000, by shares in the ordinary way, and no more; but of that amount they only issued £16,000 in a straightforward way. What they proposed by the present Bill was to convert that £16,000 into £16,000 *plus* £48,000. They did not want legislation about the £16,000, or rather the £24,000. By clause 5 they proposed that “within a period of six calendar months after the passing of this Act the company shall create stock, to be called improvement stock, to the amount of £48,000, and shall issue and distribute the same as soon as created, as fully paid-up stock, to and among the shareholders of the company in proportion to the shares in the company held by each shareholder.” They proposed to justify that by stating that they had expended out of profits, from time to time, a sum equal to £48,000, and, not only that, but another £8000, the difference between £16,000 and £24,000, because they had never raised by a regular issue of shares more than the original £16,000. In other words, having issued by shares £16,000 only, they proposed to make that capital £72,000, thus inventing a purely fictitious capital of no less than £56,000. It was quite true that they limited the dividend on that imaginary capital to 6 per cent., but they kept to 10 per cent. on the original capital of £16,000, and that could not be complained against; but they also asked for 10 per cent. on the £8000 which had not been raised by shares; and, besides that, they asked for power to raise a further sum of £32,000, on which they asked for 7 per cent. With regard to the negotiations which had taken place, he (Sir E. Beckett) found that the local board had offered a sum which almost looked as if they had been improvident, as it amounted to something like £140 a share for their nominal £25 shares, on which they had only paid up £20, and he sincerely believed no arbitrator would have given so much. The company, however, had not accepted it, and he only mentioned it to show that his clients had been desirous of dealing with the gas company on the most extravagantly liberal terms; but they had refused all the offers which had been made, and, finally, intimated to the promoters that, if they were audacious enough to think of coming before Parliament again, they should ask the committee to give them their costs. [The learned counsel then referred to the agitation in the town, to the meetings at which resolutions in favour of the Bill had been carried by large majorities, and subsequently to the results of the poll, under the provisions of the Borough Funds Act, which was very largely in favour of the local board.] The dividends which the gas company had been paying since 1862 were £2400 a year—that was to say, 15 per cent. upon their properly called-up capital of £16,000. It was perfectly well known that the chairman last year called it £24,000, but, if he had chosen, he might have called it £72,000; but, if they had been before Parliament, everybody knew they would not have been allowed to divide more than 10 per cent. Treating the water company in the same way, they were authorized to issue originally £15,000, which they had done with the exception of £1000 (but it was not worth while to dwell upon that distinction), and they had been dividing for the last seven years 10 per cent. upon the £15,000, so that the water company had not been in a very bad condition. It had been mentioned in a general way that the quality of the gas had often been very bad, although latterly, of course, as might be easily imagined, it had been a great deal better. On one particular day it had been extremely good, and the inhabitants could not tell what had happened to it; but it appeared the gas company knew some one was going to examine the gas, and on that day it was beautiful, although it very soon relapsed into its former condition; but water was not so easily brought up to a given mark in five minutes as gas was, because, in order to bring up water to the requisite supply, there must be proper water-works, and it did not suit the company to have proper water-works. As far as quantity went, the statement made last year by the witnesses, and only to a certain extent qualified by the other side, was that when the town was full they gave the extravagant supply of about six or eight gallons per head per day, and no comment need be made upon that. Of course, when the town was empty, they could give a great deal more; but, unfortunately, people must drink when the town was full as well as when it was empty. Some person talked about averages, but stomachs were not capable

of dealing with averages. Where there was a gravitation scheme involving a large reservoir, if an extraordinary demand came upon the company, they could not meet it, because making reservoirs was expensive; but where it was only necessary to draw more adits, or to put down more pumps, it was simply audacious not to do it. The water company had, however, been pursuing that course for several years. The committee would not be surprised to hear that the medical officers had complained over and over again; and by violent efforts the company at last, having refused at first, actually consented to break the Sabbath. No doubt the company would take credit to themselves for having done so, but it had only been lately, and they were not enabled to plead their late concession as an answer to the complaints which had been going on for 30 or 40 years against both these companies. They had also the unusual power of putting in the fittings and connexions themselves, but they had not attended to that matter as they ought to have done. If it had been for the inhabitants to do so, of course the company would have had a ready answer to the complaints—viz., that it was their own fault—but as they had the unusual power of putting in the connexions themselves, if anything was wrong it was their fault, and not the consumers. There was also a grievous want of water in case of fire, and that was another reason for transferring the works to the corporation. Another thing complained of was that the mains were laid too high in the streets, so that they were constantly getting broken by the heavy traffic, and that involved breaking up the streets to relay them. Further, he (Sir E. Beckett) understood the company had no map of their mains, and consequently they had to go pricking about to find them. The water company also proposed by their Bill to raise more money, but they did not want to capitalize so much as the other company did, and therefore they had not the same strange provision in their Bill. They did, however, ask for power to capitalize £15,000. For many years past Parliament had refused altogether to recognize the capitalization of profits, and that was especially the case with regard to the Chartered Company in 1867. Turning to the petitions, the learned counsel said the first was from certain inhabitants in the district of St. Lawrence, who said that “the supply of both gas and water had been, and still continues to be, satisfactory as to quantity, quality, and price.” He would not suggest that there might be reasons why they were not particularly anxious about the quantity of the water—perhaps they did not use it much for baths, and the quality of gas they probably did not care much about. “The object of the promoters of the above Bill is to obtain, by agreement or compulsory sale, the undertaking of both companies, and your petitioners object to the transfer, which they believe will injuriously affect them, more particularly as the local board openly profess that by means of it they may be able, out of the profits of the undertaking, to provide, to a large extent, funds for the improvement of the district.” He (Sir E. Beckett) did not know that his clients did profess that, but he would tell the committee what they really did profess, and what every corporation professed in those matters. Where there was a gas and water company, and still more in an increasing place like Ramsgate, they went on continually increasing their capital, and either legally or illegally they took upon their capital something considerably more than the amount at which a local board or a corporation could borrow money. A corporation in most cases could borrow money at 4 per cent., and sometimes at something less, but no company thought of taking for their new capital less than 7 per cent. The difference, therefore, between the 4 and the 7 per cent. continually went, as fast as the capital was expended, into the pockets of the shareholders of the company, instead of into the pockets of the community at large. It was not the wish of the promoters to interfere at all with the past profits of the company, because it was certain that any arbitrator would take care of them on that point; but as to the future, they respectfully submitted that the profits ought to go into their pockets, and not into those of the company, and that could only be done by introducing a novel form of legislation—viz., reducing the dividends upon their new capital to 4 per cent., to which the company would immediately answer, “We cannot raise new capital at 4 per cent.” The promoters were also introducing a novel—and certainly unusual—proviso at the end of clause 89: “Provided always that if such undertaking has been transferred to the board subject to any mortgage debts, the interest on the same, according to their several priorities, shall be paid out of the revenue of the board from such undertaking, immediately after payment of the establishment charges, and in priority to all the other purposes in this enactment specified, and the balance (if any) of any moneys received on behalf of such undertakings respectively shall be applied in equal moieties in reducing to the consumer the cost of the water and gas respectively supplied under the authority of this Act, and in increasing the district fund.” He (Sir E. Beckett) did not know of a single precedent for that clause; the invariable practice had been that whatever profits the corporation were able to make, went to the district fund, and nobody had any right to inquire and go behind that.

Mr. MICHAEL said there was one case—that of Stockton and Middlesbrough.

Sir E. BECKETT had no doubt his friend was correct; but in the previous year the Birmingham Corporation resisted it most strenuously and successfully. They said, “We are answerable to our ratepayers; if they choose to let us go on making profits upon the gas and water works, they are quite competent to do so.” In the present case they actually made a present of one-half of the profits, whatever they might be. The petition then stated that “it must be obvious that if the charges of the local board for water and gas in Ramsgate and St. Lawrence should be uniform, the effect of the Bill will be that the consumers of gas and water in St. Lawrence will be required to contribute largely to the costs of the general improvement of the district of Ramsgate without deriving any corresponding benefit from such improvement; and if, as is possible, and the Bill allows, the local board charges for gas and water consumed in St. Lawrence should be greater than the charges for gas and water supplied in Ramsgate, inasmuch as both companies now make the same charges within both parishes, a great injustice would be inflicted upon your petitioners.” That was a mere question of clauses, and there was no principle involved in it, and no preference had been given in the Bill to Ramsgate over St. Lawrence. Then the petitioners said they were of opinion “that the affairs of both companies would be better and more economically managed by a board of directors, who, as shareholders, would have a large pecuniary interest in the companies, than by a committee of the local board, who would only be affected to the extent of a very small amount which they might contribute as ratepayers or consumers.” In other words, they were of opinion that it was more economical for the public at large to have a company going on raising money at 7 per cent. than to have a corporation raising it at 4 per cent., and they might establish that proposition if they could. Against the petition might be paired off one from the Margate Corporation, who said, “Your petitioners are of opinion that it is most desirable that the supply of gas within their district, and the neighbourhood thereof, should no longer remain under the control of the company, and that the speediest means of effecting a transfer of the undertaking to your petitioners, as the representatives of the interests of the public, would be by the passing of the Bill, with suitable clauses properly devised, providing means for the transfer of the Margate portion of the undertaking to your petitioners upon equitable terms; but your petitioners

object to the clause for that purpose inserted by the promoters." Of course, that clause was quite open to discussion afterwards. The St. Lawrence people might say, "You are going to transfer the works in Margate to Margate, but you are not going to transfer the works in St. Lawrence to St. Lawrence." True, they were not; but he said again, "Your remedy for that is to join the Ramsgate Local Board, instead of keeping up your miserable independent existence. Why cannot you have one government representing both of you, and then you will have the same control over gas and water." But there was another petition of inhabitants of St. Lawrence, and they said that they complained greatly "of the supply of gas by the company within the parish of St. Lawrence, and to them individually; and that the price charged is unnecessarily high, and that the gas is bad in quality, and very deficient in quantity." One of the constant complaints which had been made against the gas was the deficiency of pressure, which had been sometimes so great as to cause people to light candles in addition to the gas. They also said, "Many of your petitioners have experienced great difficulty in obtaining a supply, and others of them have been unable to do so for various purposes. The public lamps within the said parish are very badly supplied, and are greatly neglected, and in many instances the company refuse to put up and supply new lamps when required to do so, while at the same time the price is too high." The petitioners then stated several other things, concluding with the hope that the Bill promoted by the local board would pass. Proceeding to the petitions of the companies themselves, the water company complained that £60,000 which the local board proposed to borrow was not enough for the purposes of the undertaking, but if it were not, the purchase could not be carried out till the money was paid, and the local board must apply to the Local Government Board for more; but that would not influence at all what the arbitrator might do. They also said that they had always given a good and sufficient supply of water—that was the six or eight gallons a head—and they denied the statements contained in the preamble of the Bill. In the petition of the gas company, they stated: "By the Bill the local board seek to borrow, on security, to an amount not exceeding £150,000 for your petitioners undertaking, which sum is altogether insufficient," for the purchase of an undertaking representing £16,000 worth of shares. In another part of the petition they again raised the question of the separation of the works, and they called attention to the fact that the promoters were not only seeking to supply their own district with gas, but were proposing to include Margate and a large area outside, "and that therefore a great injustice would be done by allowing the Bill to pass, and great confusion would arise thereby." He (Sir E. Beckett) would like to know what injustice and what confusion. Last year the local board did propose to separate them. The companies were as difficult to please as the man who was flogged either too high or too low. In last year's petition they said: "As the Bill is proposing only to acquire a portion of the works of your petitioners, great injustice will be done, and great confusion arise thereby." Last year they said great confusion would arise because they only proposed to purchase half, and this year they also said confusion arose because they proposed to purchase all.

The following evidence was then called:—

Mr. W. A. Hubbard, examined by Mr. O'HARA.

I have been clerk to the Ramsgate Local Board since 1868. When I first entered the service of the board the question of the public lighting was frequently discussed by the Watch Committee, on complaints being made that the public lamps were not properly attended to. In 1869 two letters were sent to the gas company from the Watch Committee, on the subject of the neglect in the public lighting. To the first of those letters we received a reply, and some of the lamps were altered, but not all of them; in fact, I think the greater number of the lamps in Ramsgate still have large apertures, which allow the lights to be blown out. In 1870 the local board made a proposition with respect to the lighting of the West Cliff promenade—which was then unlighted—to the effect that the board should erect six lamps there, and that they should have the power of putting them out when they wished, but the gas company declined to allow that. In 1871 we made further application, and we then agreed that the promenade should be lighted on the same terms as the other lamps in the town, but the gas company insisted upon our paying half the cost of the main. Up to the middle of 1873 the charge made by the gas company was £3 12s. for what were termed permanent lamps, and £3 1s. for non-permanent lamps—viz., those that were extinguished during moonlight nights. [Witness read a lengthened correspondence which had taken place between the local board and the gas company, the substance of which was as follows:—On June 3, 1873, the directors gave notice that after the 30th of that month the charge would be £5 per annum for the permanent lamps, and £4 15s. for the non-permanent lamps. The directors, however, stated that they had no objection to charge by average meter indication, all expenses being borne by the local board, when the cost would be 6d. less than the amount charged to the public, and 13s. additional each lamp for lighting, putting out, and repairing, if done by the company. In their reply, the local board stated that they could not admit that the company were in any way justified in making such an extraordinary demand, but they would not object to all the lamps being lighted as permanent lamps, at a charge of £4 4s., including lighting, putting out, cleaning, and repairing. The directors, however, declined to alter their proposed charges, which they said were arrived at after much inquiry and consideration. In August, 1873, the local board made an offer to pay £4 5s. 6d. for the permanent lamps, and 12s. less for the non-permanent lamps, which was declined by the gas company, who expressed their willingness to accept £4 15s. per lamp, provided all the lamps were made permanent, and the accounts settled quarterly. In October, 1873, the local board applied for an abstract of the accounts of the gas company for the preceding three years, as the board felt a little sore at the high charge proposed, but the company refused to supply those accounts. For the quarter ending Sept. 30 the gas company sent in a claim for £296 16s. 3d., which was at the rate of £5 per annum for each permanent lamp, and £4 15s. for each non-permanent lamp; upon which the Watch Committee called the attention of the gas company to their letter of Sept. 8, offering to accept £4 15s., provided all the lamps were made permanent, and stated they would recommend the local board to agree to those terms, provided the charge of £5 was withdrawn, but this offer was refused by the gas company, and an immediate settlement of the account was pressed for, or the lighting would be discontinued. After some further correspondence on the subject, which led to no result, the local board, on June 24, 1874, forwarded to the gas company a resolution which had been arrived at—that half the public lamps should be discontinued. That arrangement, however, was found to be most inconvenient, and after about three months another resolution was passed, ordering the lamps to be relighted; and the gas company subsequently sent a letter to the local board, in which they expressed a hope that in a short time they would be enabled to make a reduction in the price of gas. Several letters afterwards passed between the parties, on the subject of bad and deficient lighting, in the course of which the gas company contended that, owing to the exposed situation of the lamps, the number was very small, being less than 1 per cent. With reference to the parliamentary proceedings, negotiations were opened by the local board in October, 1875, to effect the purchase of the gas and water works, but those negotiations failed. Since that date renewed correspondence had taken place with the gas

company, and on Jan. 3, 1877, a copy of a resolution was forwarded to them, offering to purchase the whole of the undertaking upon the terms of perpetual annuities of £5 each on the 800 shares issued, together with a payment in money of £15 per share, and in addition £5000 to be paid as compensation to the chairman and directors. In reply to that communication the directors refused to entertain any such proposal, and expressed their intention, should the local board persist in their attempt to acquire the property of the company, to ask Parliament to recoup the company any expense to which they had been put by the proceedings of the local board. On Jan. 26 another letter was sent to the gas company from the local board, stating that a poll of the town had been taken, which was largely in favour of the board, and asking whether the company were inclined to reconsider their decision. To that letter an answer was received on the 5th of February, stating that the directors did not consider it necessary to reconsider the question, and that closed the correspondence with regard to gas. With regard to the water supply, several letters were read, complaining of the absence of water at fires, and also asking that a constant supply should be given to the town-hall, to which latter request the company declined to accede. Another letter enclosed a report from the Medical Officer of Health, suggesting the desirability of a supply being given on Sundays as on other days, and to that proposition the company acceded by turning the water on for a short time every Sunday. A complaint from the local board of the limited time during which the water was turned on, and asking for an additional hour, was met by a reply that the water was laid on for a period sufficient to fill all the cisterns with which every house taking the water ought, by a clause in their Act, to be provided; that the time averaged two hours, and that no complaint had been made to the company of a deficient supply. Some further correspondence ensued as to the advisability of giving a constant supply, which the directors stated they were compelled to defer; but as they were desirous that such a supply should be afforded, they were quite prepared, if supported by the local board, to promote a Bill in Parliament with that object. The correspondence closed with an offer of purchase by the local board similar to that forwarded to the gas company, and its rejection by the water-works company, on the ground that the directors believed that it was contrary to all parliamentary precedent, as it appeared to them to be inconsistent with good faith that a public company should be deprived of their property and privileges against their consent, and only because others had a wish to possess them.]

The Rev. E. G. Banks, examined by Mr. VENABLES.

I am head master at the Chatham and Rock House School, at Ramsgate, and chairman of the Finance and General Business Committee of the Ramsgate Local Board. I have lived in Ramsgate for more than four years, and I think I am the largest ratepayer, except the Granville Hotel. The population of Ramsgate, according to the census of 1871, was 15,600 odd. The census is taken in March, which is the lowest time for the population of Ramsgate, because, when we get the March winds, it drives all the visitors away. The population of Margate is a little less, but not much. The minimum population of St. Lawrence is about 5000, in round numbers. At the height of the season, I should think the population of Ramsgate, including St. Lawrence, is between 50,000 and 60,000. The rateable value of Ramsgate is between £73,000 and £74,000, and that of the lighting area of St. Lawrence about £15,000. In the two places there are about 4000 inhabited houses. The Isle of Thanet Gas Company have power, under their Act, to supply Ramsgate, St. Lawrence, Margate, and Broadstairs, but they have never supplied Broadstairs. Ramsgate and Margate are supplied by different works, but under the same management. During my residence in Ramsgate there has been dissatisfaction from one end of the place to the other. I hardly go into a single house or shop where I do not hear dissatisfaction expressed; but it has not been so much lately, as the company have been upon their best behaviour since their application to Parliament last year. The principal evil complained of has been the high charges—by which I mean that, inasmuch as the company have been paying such high dividends, they ought to have lowered the price. With regard to the public lamps, whenever they have had a chance they have endeavoured to raise the price; and, moreover, they charge us at Ramsgate, though we are the most paying part of their undertaking, more for the public lamps than they do at Margate. The present charge for gas is 4s. per 1000 feet; but there are other expenses to the consumers besides the gas-rental. I have made inquiries, and I find that our company are almost unequalled in the kingdom for the way in which they charge the consumer for laying services, and so on. If a man is living in a £10 house, and wants to have the gas laid on, he has to pay 6s. in advance for a 3-light meter—that is 22 per cent. upon the net cost, which is £1 6s.—and then he has to pay for his own service from the main. Taking a three-quarter inch pipe at 6d. a foot, and an average of 20 feet, there is another 10s. he has to pay, whereas the actual cost would be only 2d. a foot to the company. Then they charge him for the labour of putting this on, and they make him fetch his own meter from the gas-works, and then make him pay for his own main-tap and inlet; so that altogether, if a poor man wishes to have the gas laid on, he has, first of all, to pay from 40s. to 50s. So prohibitory is it, that out of our 4000 houses, only about 1400 are supplied with gas, and nearly all those that are supplied voted for the transfer to the local board. There is also a complaint about the way in which coke is dealt with, because the company charge 12s. per chaldron on the spot, while they send it away in large quantities out of the town at 5s. a chaldron. They have never tried what a good reduction in the price in Ramsgate would do. At the fall of last year they raised the price 1s., and then, when they found they had got such mountains of it that they did not know what to do with it, they lowered it 1s. this year. If the local board had the works, they would probably open a room with stoves, to teach people how to use coke. At Margate the price is the same as at Ramsgate; but it ought to be more, because to get a ton of coal to Margate the dues and freights, and so on, cost at least 2s. per ton more than to get it to Ramsgate, and, therefore, if they make 8000 feet per ton of coal, the price should be 3d. less at Ramsgate than at Margate. Our arrangement is to part with the whole of the Margate works to the corporation there; we do not propose to make a profit, but to hand them over for what they cost. The price of gas in Ramsgate was 4s. in 1870 and 1871; 4s. and 4s. 6d. in 1872; 4s. 6d. and 5s. in 1873; 5s. in 1874; 4s. 6d. and 4s. in 1875. What we object to is not the 4s. in the abstract for 1000 cubic feet, but with all their profits 2s. 6d. would have been a fair price to have charged in Ramsgate. When we tried the oil we found it quite as good as the gas, but it was too much nuisance and bother. The charge for each public lamp, burning 4 feet an hour, is £3 7s. 10½d. We commenced the average meter system on Jan. 1, 1875; that was because the company proposed to charge us £5 per annum each lamp. They allow 10 per cent. discount on the public lamps; but they allow 6d. in the 4s. at Margate, which is more, of course, but I do not know how the difference arises. The charge for cleaning is 17s. 6d., and I think they charge Margate something about the same. New lamps are constantly being required; but I know that St. Lawrence has had great difficulty in getting them put up. We had some put up upon the West Cliff promenade, and they charged us about £70, while the prime cost to them was about £42, and we had to supply the labour. In 1875 we had an interview with the directors of the gas company, and asked them to show us the state of their

capital account; but they could not tell us anything, and there were no documents published by which we could learn for ourselves. We did, however, ascertain the state of their accounts from the cross-examination of their witnesses. Mr. Curling said the original cost was divided between the two places, and that gave £7705 for Ramsgate. Then from 1835 to 1847, £3024 were spent on works; from 1847 to 1862, £5899; and from 1862 to 1875, £22,955; making a total spent on Ramsgate of £39,583. The original cost of the works in Margate was £7705, the same as for Ramsgate; then from 1835 to 1847, there were £2256 expended on works; from 1847 to 1862, £5624; and from 1862 to 1875, £24,804; making a total for Margate of £40,389. The two together made the total sum spent on capital, £79,972. The amount of capital paid up was £16,000; therefore they have got out of the consumers, £63,972, which they have put to their works. During that period they have also paid in dividends £67,320, so that the whole amount the consumers have paid has been £131,292, which works out for 51 years to an annual average profit of £2574 6s. 8d., or equivalent to an annual average dividend, on the £16,000 invested, of over 16 per cent. Mr. Curling made out the annual average dividend to be £1 16s. 5d., taking a capital of £72,000. The company began to pay what they called a 10 per cent. dividend in 1862, and they have paid it uninterruptedly since. They paid that dividend upon the £24,000, which was 15 per cent. upon the capital subscribed; and besides that, they took out of the consumers pockets £48,000, which, if worked out over the 14 years, would give a profit of 36 per cent. The £24,000 was arrived at by two resolutions of the directors, adding £4000 each time. Under their Act it was expressly stated that they were not to subscribe the extra £4000 unless the £20,000 was found insufficient for the carrying on of the works; but as they subscribed no more than £16,000, I say they could not legally take that extra £4000.

Mr. VENABLES: Do you know, as a matter of fact, whether their extensions have been principally of late years, or whether the larger proportion of them were in the earlier period of their existence?

Witness: I am certain that if Mr. Curling had not, last year, given us the average of the previous 14 years, from 1862 to 1875, but had given us the average from 1870 to 1875, he would have found that most of the profit was made in those years, because that is when the principal extensions took place. Regarding the disturbance of the streets, they never tell us beforehand when they are going to do it, nor do they tell us afterwards until some time has elapsed, so that we have to find out for ourselves. We have no power over them under their Act, and if we do complain they treated us with great discourtesy. The feeling of the town is very strongly in favour of the lighting being taken over by the local board. There was a meeting of ratepayers, at which a resolution was proposed in favour of our Bill, and then speeches were made against it, and a poll demanded. It was opposed really by the gas company, only they were clever enough not to appear, but set up other people to do it. That was proved in this way. A list of questions was asked by the gentleman who demanded a poll. I do not think he knew he was being made a tool of by the gas company; but I asked him to hand me up the paper, and said I would answer him in detail, and it turned out that those questions were written for him by one of the firm of solicitors, so that they were evidently acting in league together.

Mr. MICHAEL: I am sorry to hear this gentleman make this loose and wild statement. I am instructed it was never written by one of the solicitors to the gas company.

Witness: It is in the handwriting of Mr. Arthur Daniel, and he acknowledged to me that he wrote it.

Examination resumed: The meeting at which the show of hands was decided in favour of the resolution to promote the local board Bill was crammed; I should say there never was such a meeting in Ramsgate. Since that meeting two long letters have been written to the Local Government Board by the opponents of the Bill, asking them to withhold their consent to the payment of the costs out of the district rate; but the Local Government Board have not complied with their request. Since this matter was first started, there have been two elections on the local board—one in 1875 and the other in 1876—and the question of the local board taking over the gas and water companies was made a material test at these elections. The result was that, out of the twelve members elected in 1876, eleven were in favour of the transfer.

By Mr. MICHAEL: A gas director was at the head of the poll; but as all his friends plumped for him, I do not think there was anything very wonderful about that. I myself gave him all my votes to show there was no ill feeling, and he was a man very well known in Ramsgate.

Examination resumed: That result was obtained under the cumulative voting system. Of the present local board every individual member has approved of the purchase with three exceptions. During the last two or three years we have made two or three offers to purchase, and we are still willing to agree to the terms we proposed. There are very few shareholders who live in Ramsgate or Margate. The shares in the gas company were sold in the market at £75 since last session. They have been lower, but agitation of this kind always sends the shares up in the market. Of course, I object very strongly to the Bill introduced by the gas company. If we purchased the property of the gas company we would give for payment the security both of the gas property and of the district rate, although the gas property would be quite enough to secure it.

Mr. VENABLES: The proposal of the company is first of all to take their capital at £24,000, whereas you have said there is only £16,000 paid up, and upon the £24,000 to have 10 per cent.—that is to say, to have 15 per cent. in perpetuity upon their capital. Then they ask for £48,000, which they have taken from their revenue and applied to capital account at 6 per cent., and then they ask for £32,000 additional capital at 7 per cent., which would mean a very heavy tax upon the gas consumers?

Witness: Yes; and then there is the money they propose to borrow upon mortgage—viz., £26,000 at 5 per cent., so that the total entailed upon the town if their Bill were passed would be £8820, whereas if the local board Bill passed the charge upon the town would be only £4495, so that we should save £4000 a year to the two towns—£2000 to Ramsgate and £2000 to Margate. The maximum charge in the gas company's Bill is 6s. 6d., which, of course, is much too high, but it does not matter about that so much if we can only tie them down according to the terms of their maximum dividend.

THURSDAY, MARCH 15.

Rev. E. G. Banks recalled, and further examined by Mr. VENABLES.

The limits of the water company's supply are, practically, now Ramsgate and St. Lawrence. They originally had power to supply Minster, but they were not to supply that place unless they did it within a certain time, which they allowed to lapse, and the local board now propose to take that power. There are two works—one at Southwood and the other at Whitehall. Southwood is on the higher level, and according to Mr. Easton's evidence last year they do not pump often there, because they have had the salt water in. We maintain that another reason why they do not pump is because they are afraid of the cesspools round. We also say that in the summer there is not sufficient water at Whitehall, and therefore the two waters must be mixed. The Whitehall water is tolerably good, but it is too hard and too full of nitrate of lime. It is not submitted

to any softening process. Mr. Easton said that the greatest number of gallons which they pumped in the summer was 427,000, but we maintain that they want at least a million gallons a day in the summer, when our population is at its maximum. Mr. Stride said that the Chatham and Dover Railway took, speaking roughly, 4½ million gallons of water during the year. We also know that the South-Eastern Company take rather more than that, so that there are 10 millions to be provided for. Then there is the water for flushing, and for the streets, and if you take 50,000 inhabitants at 20 gallons there alone is one million; so that if we say we want about one million, we are within the mark—I mean for Ramsgate and St. Lawrence. The maximum rate chargeable by the company, which they do not propose to alter by their present Bill is £7 10s. per cent., either upon the assessable value or upon the actual rental, at their option. The present charges are as follows:—At or below £50 rating, 13½d. in the pound; between £50 and £60, 12½d.; between £60 and £70, 11½d.; between £70 and £80, 10½d.; above that it is by special agreement with the directors. For washing carriages the charge is 1s. per 1000 gallons, and the same used to be the charge for flushing purposes in the town; but since the last parliamentary session they have agreed to lower it to 9d. per 1000 gallons, provided we take three million gallons in the year. I think those charges are excessively high, especially considering the amount of profit they have been making. Mr. Curling stated last year that the capital contributed was £14,000, and that the works cost £34,000—that is to say, that the consumers have found £20,000—and since the formation of the company dividends have been paid of £34,373, so that the total is £54,373 profit which they have made, giving a yearly average over the 40 years of £1359, equaling an average dividend on the average invested capital—viz., £11,350—during those 40 years of over 11½ per cent.

Mr. VENABLES: What do you mean exactly by the average invested capital?

Witness: I am taking the table of dividends and of the capital which Mr. Curling gave in last year. Since 1849, which is one of the divisions given by Mr. Curling, it appears that £27,821 was paid in dividends and £19,000 added to capital account, which amounts to £46,821, or equivalent to an annual average dividend on the average capital employed for those 27 years (that is to say, the average capital coming to £12,815) of £1734, or 13½ per cent. But if we take the abstract of accounts for 1873-5, we find that the average profit for those last three years has been £2620, so that the dividend upon the £14,000 really invested is over 18½ per cent. for the last three years. The offer we made to the water company was as follows:—There are 1500 shares at present receiving 10 per cent., or £1 dividend in a year, and we offered them perpetual annuities of 30s. on each share, and a money payment of £3 on each share, together with £2000 for the directors. We think these are high terms, but we are still willing to give them if the committee think fit.

Mr. VENABLES: Do you think that you have generally reason to complain of the supply, independently of the capital and of the price?

Witness: Yes; principally upon the score of quantity; we do not get anything like the amount we ought to have. The quantity of water is very important for a place like Ramsgate, which depends entirely upon its health. It is a sanatorium for London, in a great measure, and if the sanitary condition of Ramsgate is bad, many inhabitants suffer, because the whole of their trade is gone. There are cisterns in the place, but there is not a constant supply, and that is one of the reasons why we come to Parliament—viz., to get a constant supply. The time of the day at which the water is turned on varies in different places. In some parts it is only on for perhaps an hour and a half early in the morning, and so inconvenient is that, that the poor people, if they are not up in time in the morning when the water is on, cannot get any all day, through not having cisterns, and we have no power to compel them to have cisterns. They fill every pail they can get hold of when the water is on, and it has to be kept standing all day. Then as to watering the streets, and as to water for the sewers, we continually want water for this purpose, but we are prevented from taking as much as we want, because of the high charges. Then, again, they will not always give it to us when we want it for flushing, simply because they have not got it. Once when we wanted to flush, they said we could not have the water until they had supplied the shipping, although their Act expressly says they are not to supply the shipping until they have supplied their other customers, and I suppose the local board may be considered as one of their customers. I know that a constant supply requires constant inspection of fittings, and the company have practically had no inspection whatever. I believe that the collector of water-rents is supposed to be the inspector; but when it was mentioned last year that he inspected the fittings, everybody laughed. We have no power to supply that defect, because if we have power to compel the owner to supply a cistern for his water-closet, there our power ends, because it is for the water company to put on the water, and if they do not leave it on long enough we have no power in the matter. Another reason why the supply should be in the hands of the local board at Ramsgate is, because we have been lately closing up all the wells in the town, because we had a report that they were unfit for drinking purposes, and thus we compel people to pay water-rates who never paid them before. We therefore think that if we compel people to shut up their wells, and thus swell the income of the water company by compelling them to take their water from the company, we ought also to have water to give them as cheap and pure as possible. I should say it is perfectly impossible, according to modern notions of sanitary science, to be a proper sanitary authority, unless you have the water under your control. The local board are so anxious to get the water, that they are desirous that the committee should direct the principle on which the compensation is to be assessed for the purchase of the original works. I may also remark that we shall never rest in Ramsgate until we do get it, at one time or another, into our hands.

Mr. VENABLES: Of course, the water company can have no interest in the whole concern, excepting as regards the income which they derive?

Witness: That is all. I do not use the term offensively, but their policy must be a selfish policy for their shareholders, whereas ours is simply for the good of the public. If they obtain their Bill and we do not, I do not know when we can get hold of the water-works afterwards, because we can only catch them when they are in Parliament. Last year both companies had Bills in Parliament, and they withdrew them, and the inference is that if they do not obtain what they want they will again withdraw their Bills, unless the local board Bill remains before the committee.

Mr. VENABLES: I see there is, in clause 89 of your Bill, a provision that "the balance (if any) of any moneys received on behalf of such undertakings respectively" (that is, in short, the profits) "shall be applied in equal moieties in reducing to the consumer the cost of the water and gas respectively supplied under the authority of this Act, and in increasing the district fund?"

Witness: Yes; we wish to act fairly to both parties. I do not think it matters at all as regards the water, because we intend, if we get it, that every ratepayer shall be a consumer of water; most of them are so now. As to gas, we thought it was fairer, as the consumers had had to pay so much to make that division of profits—inasmuch as they had, out of their pockets, contributed large sums for the maintenance of the works of the company—that they should have some return.

Cross-examined by Mr. BROWNE: We are anxious to get rid of the existing state of things, by which one side of the street is in Ramsgate and the other side in St. Lawrence; and to accomplish that we are desirous of extending our district, but we have no proposal at present before Parliament with that object. After paying the large sum we have offered for the gas and water works, I do not say there would be a considerable profit from the water, because we might pay a certain amount in extensions and in laying on the constant supply system. There would be, as we think, more profit from the gas than from the water, but we cannot say how much until we know the terms.

Mr. BROWNE: I understand from your counsel mentioning the clause with regard to profits, that there will be profits to be distributed—how will that benefit the consumers in St. Lawrence?

Witness: They will get the same reduction that we do in Ramsgate.

Mr. BROWNE: In what way? Do not half the profits go to the district rate; and so far as that half of the profits are concerned the consumers of St. Lawrence will have no benefit whatever?

Witness: They will have this benefit—if we supply the gas, they will then get their public lamps cheaper, and we shall manage all these affairs.

Mr. BROWNE: I am not speaking of the concerns of the company, but only of the profits. With regard to that half of the profits which goes to the district rate, I take it that the consumers in St. Lawrence will have no benefit whatever.

Witness: Excuse me; that is just where I differ from you, because it depends upon how you conduct the concern as to what profits you get out of it. The district rate at present only applies to Ramsgate, but we are going to incorporate St. Lawrence; but, even if it is not incorporated, we shall manage more economically than the company, by making gas cheaper, and shall make them a present of the directors fees and other things. There is another point with regard to the way in which St. Lawrence is benefited—viz., that if there is a profit the first year, we are bound to give half of it to the district rate, and half to the reduction in price; and the next year there will not be so much profit. If our Bill passes, there is a clause by which we must lower the price to the consumers. The most expensive part of the whole district, so far as regards the gas, will be in St. Lawrence; we shall lay new mains there by which, again, they will be benefited. The principal complaint of want of lighting comes from St. Lawrence. Regarding the quality of the water, I do not accept its being so good as the analysis given last year showed. It is a great deal too hard, and there ought to be some softening process; and I think that sooner or later it will be a very objectionable source of supply. I believe the company have lately been extending their adits in order to obtain more water; but that will never do for the town, because they do not propose to go anywhere else. If we required a million gallons a day, it does not necessarily follow that we must make a new reservoir, but that is a question for the engineers. If a constant supply is to be given, the fittings must be altered, whether it is done by the company or the local board.

Mr. O'HARA said he did not see where all those points were raised in his friend's petition.

Mr. BROWNE said he was attempting to show that many burdens would be thrown upon the ratepayers of St. Lawrence, which would not be the case if the works remained in the hands of the company. (To witness:) Have you looked at section 52 of the Public Health Act?

Mr. O'HARA objected to the question.

The REFEREE said there was no allusion in the petition to the power given to the local board under the Public Health Act, and, therefore, it would be as well to avoid any examination on that point.

Cross-examined by Mr. MICHAEL: I think the existing debt of Ramsgate is about £30,000, for which we have issued mortgages on the rates, some at 4½, some at 4, and some at 5 per cent. I do not know what the debentures now sell at, nor am I aware that one for £1000 has been put up to auction several times. We always pay the interest every time it is due. If the companies do not like the securities we offer, they can have 25 years purchase down in cash instead, which would amount to £117,000, but a great many of the (especially lady) shareholders, and so on, would rather have the security of the local board. By our Bill we propose to obtain the works either by agreement or by arbitration. We made a certain offer, which was declined, and I pledged myself to say before the committee that if they did not think the terms proper, we would accept any terms they chose to put upon us; or if they did not take the matter into their own hands, and if our Bill was passed, not for agreement but for arbitration, then it would go to arbitration. I have no doubt that an intimation from the committee would make the companies agree with us. I have never informed the people of Ramsgate that in case of an arbitration, if the result were not satisfactory, we should repudiate the award. At a meeting on Dec. 2, 1876, I said the terms of arbitration differed, but that which would be binding upon one party to the arbitration would be binding upon the other. If, however, the result of the arbitration was not binding upon the directors, then it would not be binding upon the local board, whereas if it was binding upon the directors it would be binding upon the local board. I should say we could borrow the sum of £117,000 at 4 per cent. without any difficulty. Before we offered that amount, we took more trouble to find out what we thought would be accepted, than to find out the actual value of the works.

Mr. MICHAEL: Do you believe that the money which is alleged to have been expended by the company upon the works has really been expended?

Witness: I believe that the company have expended a certain amount upon their works—of course, more than the £16,000, because it would be absurd to think that gas-works could be built for £8000 in Ramsgate, and £8000 in Margate.

Mr. MICHAEL: Have you any reason to doubt that Mr. Curling's figures last year were correct?

Witness: I do not doubt that the money was expended, but I say that it was expended within the last few years, and I should be more satisfied if an accountant examined those figures.

Mr. MICHAEL: You shall be gratified. Do you wish the committee to understand that it is the original capital invested by the company which has been earning the profits?

Witness: No; it is that *plus* what they have taken from the consumers pockets.

Mr. MICHAEL: Will you point out what is the difference between the shareholders taking the whole profit as a dividend, if they had chosen to do so, and putting the money they had earned as profit into the concern as capital to carry it on, and then doing as they have done?

Witness: There is this difference, that they were doing an illegal act; they ought to have applied to Parliament to borrow more money.

Mr. MICHAEL: Does it make any difference to the consumer whether the company first put the profits into their pocket, and then find more capital, or whether they take the profits and invest them?

Witness: It makes this difference, that in the one case they have actually first asked us to give the money out of our pockets for the capital to carry on the necessary extension of the works, and then they calmly come and ask us to pay interest thereon.

Mr. MICHAEL: Supposing that in ten years the company earned £25,000,

and had no great exigency for increased works, I suppose you will admit that they might have divided the whole amount of those profits?

Witness: I say advisedly that they dared not do so, because they would have called forth indignation against them for dividing so large a profit, and we should have forced them to Parliament earlier. They, however, took care to let it go abroad that they were only dividing 10 per cent.; but that was to deceive the public.

Mr. MICHAEL: Supposing that they had earned £25,000, and, instead of dividing the whole, they had chosen only to divide £5000, and put £20,000 into the works instead of calling up more capital, what difference does it make to you as a consumer?

Witness: It makes this difference, that if they had taken it in the shape of dividends, they would then have been forced to Parliament sooner, and so we should have had restrictions placed upon them. I object to the companies Bills before the committee, because, judging from the previous action of the companies in withdrawing their Bills last year, I hold that they would certainly do the same again this year, unless we had a Bill to force them on. Our strongest ground this year is one of finance. Last year we did not have that before us; and, moreover, one of the great objections of that Bill was that we were dividing the two halves of the Isle of Thanet—leaving Margate, and taking Ramsgate.

Mr. MICHAEL: You say your Bill is founded principally on finance; I want you to show the committee if there is a grievance, and I ask you whether these works could have been conducted without a large amount of capital being invested?

Witness: Yes; but the difference is that we have provided the capital instead of the shareholders providing it.

Mr. MICHAEL: What difference can it make, if you keep under the maximum of 10 per cent., whether it comes out of one pocket or out of the other?

Witness: I might go on that principle and steal a leg of mutton, and then, when I am caught, say, "I will pay you the money; it does not matter."

Mr. MICHAEL: I am sorry you apply "stealing" to the gas company.

Witness: Well, in a certain sense.

The COMMITTEE: The consumers were injured before the time the £8000 were taken from the profits and added to the £16,000.

Witness: Just because, at that period, Parliament said they were to provide works of a certain monetary value, and if that capital were insufficient, they were to provide other; but they did not provide the works as contemplated by Parliament.

Mr. MICHAEL: How much money ought to be expended in order to produce gas? What is the amount you say would be the total cost per annum?

Witness: According to the present Bill £8820. I make that up as follows:—Original capital, £24,000, at 10 per cent., £2400; capitalized profits, £48,000, 6 per cent., £2880. That makes £5280; and I add besides what the company asked for, £32,000 at 7 per cent.

Mr. MICHAEL: Suppose £32,000 were granted, that is to be expended in the future?

Witness: Companies do not care how it is spent, because the sooner it is expended the sooner they get their dividends, and that is one of the reasons why we object to the company. I should think the profits of the two towns together are very nearly sufficient to pay the 7 per cent. on the £32,000, or they very soon will be.

Mr. MICHAEL: Your supposition is based on the idea that £32,000 will be spent by the company contrary to law, on works that are not required?

Witness: I do not say that, but I say it is to the advantage of companies to spend their capital because they get their returns in the shape of dividends. The company have asked for £32,000, but I should say in the hands of the local board £20,000 would go as far, on account of economical management. If the company spend £5000 on a Bill in Parliament, that, of course, is not remunerative to them, but they will apply to raise capital for that, and get 7 per cent. on it.

Mr. MICHAEL: Your experience of companies has been rather unfortunate as to their morality. With respect to the water, and the charges that are made, are you going to charge extra for every water-closet and every bath?

Witness: As our maximum charge we may do so, and so may you. I am aware that you propose to give a constant supply, but I suppose you mean if you obtain your Bill with the money clauses. The company would never have offered to give a constant supply unless they had been forced.

Mr. MICHAEL: Never mind that; if we come under parliamentary obligations we must fulfil them?

Witness: You have not fulfilled them in former times, and therefore we say if it will suit your purpose you will do so again.

Re-examined by Mr. O'HARA: I am aware that, supposing the Gas-Works Clauses Act, 1847, had been in force in Ramsgate, the profits above 10 per cent. would have been applied to the purpose of cheapening the gas to the consumers.

Mr. O'HARA: Then, as a matter of fact, instead of allowing the profits to go to cheapen the cost to the consumer, they added to the capital, and then they earned a dividend upon that money which ought to have gone into the pockets of the consumer?

Witness: That is our great ground of complaint. They were dividing 15 per cent., and the capital they subscribed they put by! They were making 36 per cent. upon the money they had invested. In the district of St. Lawrence there are a large number of persons besides those who have petitioned against the Bill. We are proposing to borrow money on the security of the Ramsgate rates, and if the concern does not turn out a success, Ramsgate will bear the loss, and St. Lawrence will not.

Mr. O'HARA: Therefore you think it fair, when they enter into this partnership with you, and you find the money and bear the liability to loss, that they should have half the profits with you?

Witness: Quite so.

By the COMMITTEE: I tested the gas in a rough way last November, and found it bad; there was a great deal of ammonia. I tested it for sulphuretted hydrogen, but did not discover it to any great extent, even though I got the headache, and had to put out the gas.

Mr. E. J. Hobbs, examined by Mr. O'HARA.

I have been a draper and agent in King Street, Ramsgate, for over 20 years. I have had a general cause to complain of the gas supply, and have written letters on the subject. It is better now than it was. In 1874 a meeting was held at which a resolution was proposed expressing an opinion that gas ought to be supplied at 3s. instead of 5s., which resolution was forwarded to the directors of the gas company, asking whether they would be willing to sell the works to the local authorities, and upon what terms. In reply, the directors stated that they had no power to sell without the consent of the shareholders of the company. Another meeting was then held, and a resolution passed asking the directors to convene a meeting of the gas shareholders, in order to ascertain from them whether they would sell the gas-works to the local authorities. The answer of the gas company was that "they decline to call a meeting of the shareholders at the request of a few consumers who are desirous that the gas-works should be transferred to the local board, which body, so far as the directors know,

have neither the power nor the will to purchase." Another meeting was subsequently held, at which it was resolved to endeavour to send to the local board, at the next election, men favourable to the cheapening and improvement of the gas supply. At the next election, eleven commissioners, I believe, were returned, all, with one exception, being in favour of the scheme.

Cross-examined by Mr. POPE: I had an interview with the mayor of Margate on the subject, and there is a very strong opinion in that town in favour of the proposal.

Mr. J. H. Hodgson, examined by Mr. O'HARA.

I am postmaster at Ramsgate, and have been a resident there for 35 years. I am a large consumer of gas, which, in my opinion, is not so good as it ought to be, especially after eleven at night. I had to complain last year of the pressure at four o'clock in the afternoon. I have a gas-stove in my establishment, and have found during the summer months that early in the morning there was not a sufficient pressure of gas, and I had to discontinue it in consequence. For many years I have been of opinion that the price has been excessive, and that opinion is generally shared in by my townsmen. I consider it desirable that the works should be in the hands of the local board, and have advocated the transfer for some time. So far as my experience goes, the water supply is not deficient at the present time, but in years past I have found very great difficulties. I think a constant supply very desirable, but I have never applied to the company on the subject. I am a director of the Isle of Thanet Steam Flour-Mills Company, who used to take water from the water company; but it had to be discontinued because there was not a sufficient supply, and we were compelled to sink a well. I consider the rates of the water company excessive; since last year, my own rate has been increased 12s. a year.

Cross-examined by Mr. POPE: I expect the local board will manage the gas-works better than the gas company. The stove I used was an ordinary gas cooking-stove, and it was wanted about seven or eight o'clock in the morning. I believe gas might be made and sold in Ramsgate for 3s. per 1000 cubic feet, and the very fact of the large profits the company have made proves this. My complaint about the water is, that it is not on for a sufficient time, and that the price is excessive. I think the local board will derive great advantage from having control of the water in a sanitary point of view, for the purpose of flushing sewers, and so on. I also think the mode of levying the rate at present is bad.

Mr. POPE: You heard me last year pledge the companies to apply to Parliament this year, in order to put themselves under parliamentary control, and allow the local board to suggest any amendments they might desire, and, notwithstanding that, you have again proceeded with your Bill for compulsory purchase. Tell me what new facts have arisen, since the decision of the committee last year, to justify you in coming?

Witness: I am not aware that there are any new circumstances; but I have a strong conviction that the management of the gas and water ought to be in the hands of the local authorities.

Captain T. Paris, examined by Mr. O'HARA.

I reside in Cambridge Terrace, West Cliff, Ramsgate, and have about 30 burners in my house, and also a gas-stove. I find that the pressure is not enough, especially after the town is lighted up. We cannot get a sufficiently bold light. I am decidedly in favour of a transfer to the local board.

Cross-examined by Mr. POPE: Being a private individual, I did not think it any use to complain about the gas. I have complained to the water company, but I never find much use in writing letters. I think the local board would supply the town with gas much better, because they would appoint a proper person to look after it, and, if he did not do it, there would very soon be a town meeting. With regard to my water complaints, there is not a house in Ramsgate, of the same sort, so good as my own, as regards cisterns. On one occasion, when I was not at home, the inspector called, and reported that the ball-valve had stuck, but it was not true. The inspector sent me a notice that it was the fault of the company, and that it should be removed. That was in September, 1876.

Mr. L. Brice, examined by Sir E. BECKETT.

I have lived at Ramsgate for a long time, and have 26 burners in my house. Since the agitation began the gas has been pretty good, but before that it was so decidedly bad that I discontinued the use of it for about six months, to the considerable annoyance of the household. I judged of the impurity by the effect upon the pictures and the gilding of the frames, the darkening of the ceilings, and altogether the very different effect produced from what I had been accustomed to in London. At a *conversazione* of the Ramsgate Scientific Association, I was struck with the foul appearance of the flame, and I put a colza lamp on the table, a piece of paper was held up, the gas-flame being here [pointing to its position on the table] and the colza lamp on the other side, and the entire shadow and form of that gas-flame, to the great surprise of every person present, was thrown upon the paper palpably and visibly. That was about two years since. I now only use two burners—one in the kitchen and one in the hall—at considerable inconvenience. With regard to the water supply, a person of my class does not suffer from insufficient cistern storage, but the poorer classes, where the landlord does not put sufficient accommodation, must necessarily suffer.

Captain Flower, examined by Mr. BIDDER.

I reside at Ramsgate, and am the sanitary engineer of the Lea Conservancy Board. As far as my house is concerned, I do not find the water supply insufficient, but I have to depend upon cistern power. I have two cisterns, but I do not get the upper one filled, except very occasionally. Two years ago I complained to the water company, and they allowed the water to remain on longer, and then my upper cistern was filled, but that was only a temporary alleviation.

Cross-examined by Mr. MICHAEL: I live at the very highest part of the town, and I do not know that the water company have established a forcing apparatus for the purpose of supplying my house. I am aware that the company have a Bill before Parliament to give a supply over the whole system, and if it provides me with sufficient water I should not object to it.

Mr. S. Woodman, examined by Mr. BIDDER.

I am a surgeon, residing at West Cliff, which is in the parish of Ramsgate. I have been in practice there for 13 years, and am well acquainted with its sanitary condition. In my opinion, Ramsgate has not an adequate supply of water at the present time, nor has it ever had since I have known it. I have studied the evidence given by the water company last session, which showed that they pumped an amount of water in the month of August totally inadequate for the efficient supply of the population. The supply was only about 8½ gallons per head per day, including no allowance for animals, shipping, railway supply, flushing the sewers, watering the streets, or for use at fires, and so on. It is almost impossible to have a perfect sanitary system under such conditions. The consequence of an insufficiency of supply falls chiefly upon the poorer classes, and next to them upon the larger lodging-houses, in the season. The requirements of the town cannot be secured unless there is a constant supply, and we also want the power to see that that supply is properly carried out. Last year there was an epidemic of scarlet fever, and many complaints were made of the inadequate water supply. In a

place called Ratcliff Square there are 19 houses and only two cisterns, one of which was empty. When I visited the place, I found that in two of the houses the taps could not be turned off, and therefore as long as the water was on it was running to waste, and yet there was none for any useful purpose. Recently, a stand-pipe has been put up in the square, because it was found the poor people could not drink the water. In the summer time it was full of red worms and other abominations, the cisterns being exposed to the air and the sun. Many houses in the town are in an unhealthy condition, because the water supply is not sufficient. Not many days ago, I attended a woman in her confinement, and at seven in the evening there was not a drop of cold water in the house, and they were obliged to send to the neighbours to fetch it. In Queen Square, about a fortnight ago, I found a foul closet, and on asking the reason I was told that if they used water frequently the cistern would be empty, and therefore they were instructed to use it only once a day, when the water was on. The water company have been asked over and over again to give a better supply, but I do not know that they have been asked to give a constant supply till this year. I certainly think the supply ought not to be less than 20 gallons per head, which is not at all an exaggerated estimate.

Mr. BIDDER: Does it occur to you that if at the present time they are not able to keep on the supply for more than an hour a day, a Bill in Parliament cannot enable them to supply for 24 hours without getting further means of obtaining water?

Witness: Certainly. It is obvious, from experience, that the present establishment is not adequate for a constant supply, and no provision is made in the Bill for increasing the means of supply. There is very little rainfall in the summer, and the roads get very dry, and require a large quantity of water. The water is extremely hard, and analysis shows it to contain a great deal of nitrate of lime. That portion which comes from Southwood is very brackish, especially when the demands on the company are the greatest. Apart from the sanitary question, I consider there are financial reasons sufficient to justify the application for the water supply to be in the hands of the local board. I find that the average capital of the water company has been £11,350, and the average profit £1359, being a dividend of more than 11 per cent. In order to give a constant supply, they desire to increase their capital from £14,000, which is all that has been really paid, to the large amount of £50,000, and their income from £1500 to £4325, with a possible addition of £670 on mortgage income. I believe the local board could secure greater benefit at a much cheaper cost.

Cross-examined by Mr. MICHAEL: Ramsgate is one of the healthiest towns in the kingdom, and very free from epidemic diseases. I think people suffer from the badness of the water a great deal, but more from its contamination in cisterns. The condition they are in is almost inevitable from the intermittent supply. One of the primary objects of the constant supply system is to keep the water-closet cistern distinct from that for domestic supply. The nitrate of lime contained in the water is an injurious element, as it produces diarrhoea.

Mr. MICHAEL: Is it not your duty to see there is a proper supply to all the poor houses?

Witness: We wish to see it, but we have not all the powers we ought to have.

Mr. MICHAEL: How many inspectors do you think would be necessary to visit the fittings of the whole of the consumers of Ramsgate?

Witness: We wish to have one inspector, and if he was not enough, then two, three, or four. They would not be required to visit each house every day to see that the fittings were kept properly. If the water were kept on constantly, people would not be able to stand a constant dripping, and any defects would soon be remedied.

Mr. MICHAEL: Are you aware that the very fittings of which you complain were put up by the local board themselves?

Witness: I do not complain of the cisterns, but of their being empty, and that is not for the local board. The 20 gallons per head a day I mentioned is calculated upon the largest amount required in August.

Mr. MICHAEL: They must then increase their works?

Witness: That is an engineer's question. We should increase them if necessary. We think a great deal more can be obtained from the present source of supply; but if that is not the case, we could go outside our district, to Minster, where there is a good supply. I am not aware that the company are extending their supply by driving adits.

Re-examined by Sir E. BECKETT: If we had a constant supply, I have no doubt that the death-rate would be even lower than it is. We should not have so much illness, which is of great importance, even compared with the death-rate.

Mr. MICHAEL: The mortality among the inhabitants was 13·7 per 1000. Is not that the lowest in the United Kingdom?

Witness: That does not include visitors, and it is visitors who suffer most from impure water.

By the COMMITTEE: I do not know anything about the source of the nitrate of lime, but one is always afraid lest the neighbouring cesspools should manage to empty their contents into the water. The adits are only about 104 feet deep. The supply of water should, more or less, meet the wants of the maximum of the population. Minster is within the water limits of the board. The supply from there would be from the same chalk rock from which it is obtained now, but further in the country.

(To be continued.)

Legal Intelligence.

YORKSHIRE (WEST RIDING) SPRING ASSIZES.

LEEDS, TUESDAY, MARCH 20.

(Before Lord Chief Justice COLERIDGE.)

REGINA v. THE COLNE VALLEY GAS COMPANY.

This was an indictment against the defendants, an unincorporated gas company, for breaking up the highways at Longwood, near Huddersfield, for the purpose of laying down mains.

Mr. DIGBY SEYMOUR, Q.C., Mr. CAVE, Q.C., and Mr. SHAW, appeared for the plaintiffs, the Longwood Gas Company; Mr. WILLS, Q.C., Mr. WADDY, Q.C., and Mr. FORBES for the defendants.

Mr. SEYMOUR, in stating the case, said it was an indictment preferred by the Longwood Gas Company, who had been formed under the Joint-Stock Companies Act, and incorporated by a special Act of Parliament, against the defendants, who were the Colne Valley Gas Company, who were also incorporated under the Joint-Stock Companies Act, but had not obtained any special Act of Parliament. The plaintiffs charged the defendants with breaking, at various times, certain public highways and streets in the valley of the Colne, and interfering with them in such a way as made them guilty of nuisance in illegally interfering and obstructing a highway. The Longwood Gas Company were formed for the purpose of supplying gas to the mills and private houses in the valley of the Colne, Longwood, Golcar, and other places in the neighbourhood of Huddersfield. The company were established in the first instance under the Joint-Stock Companies Act, but in order to acquire the powers given by the Gas-Works

Clauses Consolidation Act, of opening up streets and laying down mains, an Act of Parliament was applied for in 1874. The maximum price of gas was fixed at 6s., and this was objected to at the time by an association of mill-owners. The chairman of the committee in the House of Lords suggested a compromise should be effected. The company agreed to reduce their maximum to 5s., but this was not acquiesced in, and the opposition continued. Notwithstanding this opposition, the preamble was proved, and the Longwood Gas Act came into force. In 1876 the price of gas was reduced from 4s. 6d. to 4s. generally, but in the district of Lindley-cum-Quarmby it was reduced to 3s., owing to the fact that the company there came into competition with the Huddersfield Corporation. Many of the millowners of the outlying district wished the rate to be made uniform, but to supply the outlying and widely-scattered districts upon the same terms as the thickly-populated Quarmby would be utterly hopeless. Owing to the various oppositions, the Millowners Association formed the Colne Valley Gas Company, under the Joint-Stock Companies Act, and in 1876 they gave notice of their intention of applying for an Act of Parliament, in order to obtain the same powers as the Longwood Gas Company possessed, under the Gas-Works Clauses Act. Their Bill, however, was thrown out in the House of Commons; but still, in spite of that, the company had proceeded to lay down their mains, as if they possessed powers under the Gas-Works Clauses Act. The first time that a formal decision was given in a court of law upon the question whether the powers under the Joint-Stock Act enabled a gas company to interfere with the highway for the purpose of laying down mains, was in a case where proceedings were taken against a private gas company in Sheffield, at York Assizes, in 1853. Justice Cresswell then laid it down most distinctly that a company, without the express powers or authority of Parliament, had no right to interfere with the highways; and that by so doing a nuisance was committed, for which the company were liable to indictment. This decision was upheld on appeal.

The following evidence was then called:—

William Rodgers, examined by Mr. CAVE, said he was a police-constable at Linthwaite. On June 22, 1876, he was on duty in Birks Lane, near the Grove Mill. He saw Wilson Townsend and another man digging a trench; Mr. Midgley, manager of the Colne Valley Gas Company, was directing them. The trench was about three yards long, and about half a yard deep. He first saw them about half-past seven at night, and when he returned at three o'clock in the morning they were filling up the trench.

Mr. WILLS said in this case the defendants had the authority of the local board to do what they had done, and it was done by permission and agreement. His learned friend had been arguing that they could not possibly do this without committing an indictable offence.

His LORDSHIP: And you say they can.

Mr. WILLS: It is a question for the jury. We had in each case the permission of the local board to do what we have done.

Examination continued: Witness said, on June 30 he was on duty in Grove Street, when he saw Charles Winterbottom, Wilson Townsend, and two other men digging in the highway near Grove Mill. They made a trench from Mr. Shaw's country house to the Colne Valley Gas Company's mains. That trench was about three yards long, but was not quite so deep as the other. When he came back about two o'clock in the morning he saw the same men laying a pipe from Mr. Shaw's country house to the main. The road was about 8 yards wide at that point. On Friday, Oct. 6, he received a message to go to Milnsbridge, and got there about half-past six in the morning. He found some one digging a trench in the highway, nearly opposite Mr. E. T. Sykes's mill. He saw Charles Winterbottom, Wilson Townsend, and Henry Holmes there. Mr. Midgley was working in the trench at the time. A number of workpeople from the mill were formed in a ring round the trench. The earth which was taken out of the trench was put on one side. The crowd increased, and ultimately there were about 2000 people there. They were stood in a ring in order to prevent the men in the employ of the Longwood Gas Company interfering. Mr. Garside, on behalf of the prosecutors, was going to fill up the trench. He saw Mr. Heaton, one of the defendants, there.

His LORDSHIP: How are these 2000 people connected with it?

Mr. CAVE: They are not indicted, my lord. These men were the directors men.

Witness said Mr. Richard Heaton was pushing among the crowd, and he heard him say to the crowd, "Keep the Longwood men back." He saw Mr. E. T. Sykes there. This ended about twelve or one o'clock, when the people went away.

Sergeant *Ramsden*, examined by Mr. SEYMOUR, said he went to the place about a quarter past five in the morning of Oct. 6. He noticed that the earth was thrown out of the trench. The road was blocked, with the exception of about 7 feet. The trench would be about 6 feet broad, and was about 6 feet long, a large quantity of earth being placed at the end. It was sufficient to obstruct the traffic.

Cross-examined by Mr. WILLS: The greatest obstruction would be about ten o'clock in the morning. At seven o'clock he had to clear the people away. It was something like clearing a racecourse. At five o'clock there were two sets of people—the Longwood and the Colne Valley people. One was shovelling out and the other shovelling in, and they continued to do this very good humouredly until about six o'clock. They threw the earth out as far as they could, to prevent the other people from throwing it back again, so that the whole of the road was covered.

Re-examined: I do not think Garside was there at eleven o'clock.

His LORDSHIP: Did it last very long?

Witness: I arrived at five a.m., and the trench was completed about half-past twelve. I believe it commenced at four o'clock.

Mr. SEYMOUR: We can give many instances if necessary.

His LORDSHIP: It is proved abundantly, but I suppose the public are coming in large numbers to say they were inconvenienced.

Mr. SEYMOUR: All I can say is, I can prove they began at Grove Mill on June 23, 1876, and continued down to Sept. 11, opening trenches in the public highway.

His LORDSHIP: I suppose your 2000 people are the best obstruction you have got. You will not strengthen that case; that is a good obstruction.

Mr. SEYMOUR: I do not think my case requires that.

His LORDSHIP: I do not say whether it does or does not; but there it is. The first witness gave enough evidence to go to a jury—that the manager of the Colne Valley Gas Company was there directing.

Mr. WILLS: There is no evidence against Shaw.

His LORDSHIP: We have got Heaton, Midgley—

Mr. WILLS: Heaton will say he was only keeping the people back.

His LORDSHIP: He was acting.

Mr. WILLS: He may have been on the other side.

His LORDSHIP: I do not think he was helping the Longwood people.

Mr. WILLS: There is no evidence against Dyson or Shaw.

His LORDSHIP: Midgley, Winterbottom, Heaton, and Holmes are certainly all proved to have been acting.

Mr. WADDY: Holmes is dead, my lord.

This being the case for the prosecution,

Mr. WILLS addressed the jury for the defendants, complaining that the action of the plaintiffs was iniquitous and unprincipled in bringing criminal proceedings against the defendants for doing exactly what they them-

selves had done for fourteen years. He hoped that the jury would show their appreciation of the conduct of the plaintiffs by saying that there had been no substantial obstruction, or at any rate sufficient to cause a nuisance. The learned counsel quoted the cases of *The Edgware Highway Board v. The Harrow Gas Company*, *Reg. v. Russell*, *Reg. v. Tindall*, &c.

His LORDSHIP remarked that the learned counsel had not got rid of the case, *Reg. v. Longton Gas Company*.

Mr. WILLS: The essential difference between that case and this is, that there the verdict was subject to the opinion of the Court on the case.

His LORDSHIP: If I am to choose between two judgments, I must take the written judgment, as in the Longton case. Do you wish to add any facts?

Mr. WILLS: I shall add that this was done by the permission of the local board.

His LORDSHIP: I shall direct the jury on a point of law to find your people guilty, and I will give you every means I can to question that verdict; but I do not think it would be respectful in me to run counter to the written judgment of a Court to which I am bound to defer.

Mr. WILLS put in a letter from Mr. Thomas Sykes, clerk to the Golgar Local Board, giving the defendants permission to break into the roads in question.

His LORDSHIP: As a local board they have no right to legalize a nuisance.

Mr. SEYMOUR: I do not object to that letter being put in.

Mr. WILLS: I must either have it admitted or prove it.

Mr. SEYMOUR: If Mr. Wills says he has others, I will admit them also.

His LORDSHIP said he would take note of the letter.

Mr. WILLS, continuing his address, said the prosecutors asked the jury to say that what the defendants had done was a nuisance, a crime, and a violation of the criminal law. He could not speak of the prosecutors in any but strong terms. They had tried to bring the defendants to their terms, and when they found they did not succeed in doing that, they brought this prosecution against the defendants for doing exactly the same thing that they themselves had done ten years ago. If anybody deserved to stand in the dock it was the prosecutors. There was not one out of the 2000 people spoken of brought to say that they had suffered to the smallest extent, and it rested with the jury to say whether this wrong should be effectually perpetrated or not. Referring to the Longton case, he said there were other cases bearing upon this question, in which it was decided by eminent judges that the proper question for the jury to decide was whether the interference which had taken place with the right of passage of the public was so rare, slight, and uncertain that the defendants ought not to be made criminally responsible for it.

His LORDSHIP said he should put a question of fact to the jury, and if they answered it in the affirmative, he should then ask them to find the defendants guilty. He should ask them whether there was, in their opinion, a sensible and appreciable obstruction to the respective highways, which were, in fact, obstructed by the defendants.

Mr. SEYMOUR addressed the jury, and denied that this prosecution was brought for the purpose of crushing a rival company. The prosecutors commenced when there was no rival in the field, and expended thousands of pounds in laying down mains. They conformed to the law, and applied for an Act of Parliament, asking the law to clothe them with power to lay down their mains, and they obtained an Act of Parliament, which the defendants did not succeed in doing. If the jury found that the act of the defendants in the digging out of the trench was not a nuisance, fifty companies might come in, and there would be no end to their obstructions. Lord Bacon had laid it down that it was clearly a nuisance to dig a ditch on any highway, and generally to do any act which would make it less commodious. This was an axiom that had never been controverted to this day.

His LORDSHIP, in summing up the case to the jury, said that nobody had a right to cut up a road or street without the sanction and authority of Parliament. The present case was exactly on all fours with that of *Regina v. The Longton Gas Company*, and he asked them whether there had been any sensible and appreciable obstruction to the use of the highways by the defendants, who had no authority from Parliament to lay mains thereunder. On the other hand, he pointed out that the prosecutors had parliamentary authority to lay down their mains. There could be no doubt of two things, both of which were essential, before they could find the defendants guilty. He did not like, in a case of this kind, to make any question of what he was sure none of them made any question about. The first was that there was evidence that those things were done by the authority of the defendant company. It was proved that their manager was present, at least on one occasion, and was directing the proceedings. There was clear evidence against him, but there was no evidence against Dyson, Fielding, Shaw, Hanson, Brooke, Taylor, and Lunn, and therefore he advised the jury to acquit these persons.

The jury almost immediately returned a verdict of "Guilty" against the defendants.

His LORDSHIP (addressing the counsel for the plaintiff): You do not wish me to give judgment for more than 1s., I suppose?

Mr. SEYMOUR said they would like his lordship to give a judgment which would have a moral effect. He had seen instances, in cases like these, where judgment was passed, but not enforced.

His LORDSHIP took it for granted that, after judgment, the defendants would consider themselves bound by it.

Mr. SEYMOUR observed that the defendants might still go on, and the plaintiffs wished to protect themselves.

His LORDSHIP said he would respite judgment. He would not give judgment now; and, in the meantime, some arrangement or understanding might be arrived at.

Mr. WILLS said that he, of course, represented a company, a body of directors, and, as none of them were in Court, he could not make any definite promise on their behalf.

His LORDSHIP repeated that he would reserve judgment.

QUALITY OF THE NEWCASTLE-ON-TYNE GAS.—Mr. John Pattinson reports as the results of his examinations for the month of March of the quality of the gas supplied to the borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Date.	Illuminating Power		Grains of Sulphur		Sulphuretted Hydrogen.
	in	in	in	in	
	Sperm	Candles.	100 Cubic Feet of Gas.		
March 2 . . .	14.2		6.41		Nil.
" 6 . . .	14.5		7.41		Trace.
" 9 . . .	14.5		6.40		Nil.
" 13 . . .	15.0		6.50		
" 16 . . .	14.2		7.40		
" 20 . . .	14.2		7.14		
" 23 . . .	14.4		6.97		
" 27 . . .	14.2		7.03		
" 30 . . .	14.3		8.38		

A Sugg-Letheby standard Argand burner is used in testing. According to Act of Parliament, the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas.

ACCOUNTS OF THE METROPOLITAN WATER COMPANIES, FOR THE YEAR 1875-6.

(The Accounts of the First Five Companies are for the Year ending March, 1876; the Last Three, December, 1875.)

Statement of Share and Loan Capital, and Expenditure on Capital Account.

COMPANIES.	Total Share Capital authorized.	Share Capital Paid up.	Loan Capital authorized.	Mortgage and Debenture Debt.	Total Share and Loan Capital authorized.	Total Share and Loan Capital Paid up.	Premiums received on Shares Issued.	Total Expenditure on Capital Account.
	£	£	£	£	£	£	£	£
Chelsea	1,058,750	920,600	210,000	137,100	1,268,750	1,057,700	...	1,027,073
Grand Junction	1,000,000	965,415	250,000	244,700	1,250,000	1,210,115	...	1,200,312
Lambeth	1,250,000	1,046,781	248,000	210,015	1,498,000	1,256,796	6,065	1,255,826
Southwark and Vauxhall	1,518,000	1,358,000	482,000	430,581	2,000,000	1,788,581	423	1,771,166
West Middlesex	1,155,066	919,453	200,000	...	1,355,066	919,453	9,365	933,184
East London	1,400,000	1,625,560	620,000	250,000	2,020,000	1,875,560	37	1,898,087
Kent*	600,000	565,340	150,000	42,000	750,000	607,340	5,567	535,910
New River†	2,019,958	1,793,728	1,000,000	977,293	3,019,958	2,771,021	See Note.	2,792,202
Total	10,001,774	9,194,877	3,160,000	2,291,689	13,161,774	11,486,566	21,457	11,413,760

* The Kent Company's "Share Capital Paid up" is stated at £565,340, the actual receipts being £490,055.

† The New River Company's shares, as established by charter, are freehold, and are divided into moieties—one moiety, or 36 parts, being held by the incorporated "adventurers;" the other moiety, or 36 parts, being originally held by King James I., and subsequently by persons now called King's Shareholders, who are not incorporated with the adventurers. Both these moieties are again sub-divided, and held by numerous persons, and being real estate, are subject to entail and to trusts for minors. By this company's Act of 1852 the amount "expended" by the company in their works "then in existence" was declared to be £1,519,958 and upwards, and the capital of the company was deemed to be £1,519,958. This Act did not, however, create shares or a share capital, or alter or affect the nature, rights, or status of the property as existing under their charter, the rights under which charter are, by the same Act, expressly reserved. This Act authorized the taking of certain lands for special improvements in their then existing works; and the company were by that and by subsequent Acts in the years 1854 and 1857 authorized to raise on bond or debenture stock £1,000,000 for special improvements and for their "general purposes." The amount of this bond debt, as it existed on Dec. 31, 1875, is here set forth:—

Bonds at 4 per cent.	£126,700
Debenture stock at the same period, at 4 per cent.	840,593

£977,293

By "The New River Company's Act, 1866," the company were enabled to create a new description of shares, declared to be personal estate, to the amount of £500,000, for their general purposes. The amount of these new shares, as existing on Dec. 31, 1875, is here set forth:—

442 fully paid (£100)	£44,200
4557 on call (£50) paid	227,850

£272,050

Amount received in advance of call

1,720

£273,770

The dividend on these new shares is to be *pari passu* with that paid to the proprietors of the original shares of the company.

Details of Expenditure and Revenue.

COMPANIES.	MAINTENANCE.							MANAGEMENT.				Total Expenditure for Maintenance and Management.	Water-Rents accrued to Date of Account.
	Re-servoirs.	Dis-tribution Works.	Pumping.	Fil-tration.	Salaries, &c.	Thames and Lea Conser-vancy, &c.	Rents, Rates, Taxes, and other Charges.	Directors and Auditors.	Salaries, &c.	Collectors' Com-mission.	Other Charges.		
	£	£	£	£	£	£	£	£	£	£	£	£	£
Chelsea	317	4,857	7,369	958	3,300	1,300	4,360	1,127	2,342	2,036	1,399	29,365	91,500
Grand Junction	334	5,645	*22,963	1,120	3,902	1,450	5,448	870	2,621	3,187	1,172	48,712	122,613
Lambeth	1,939	6,844	20,575	990	4,848	1,251	5,384	1,242	1,643	2,822	1,076	48,614	127,194
Southwark and Vauxhall	582	5,054	21,198	2,843	3,852	1,305	6,854	1,086	1,510	4,780	2,750	51,814	143,328
West Middlesex	664	3,389	12,031	992	5,676	1,318	7,362	2,629	3,070	3,842	1,426	42,399	144,798
East London	3,480	7,513	13,965	2,328	9,124	3,917	17,559	2,160	2,885	5,498	3,429	71,858	179,298
Kent	203	1,714	8,508	...	2,052	...	3,946	1,573	766	2,058	675	21,495	73,400
New River	5,030	27,328	21,580	2,915	6,858	2,433	32,844	6,293	8,848	11,900	4,486	130,515	351,424
Total	12,549	62,344	128,189	12,146	39,612	12,974	83,757	16,980	23,685	36,123	16,413	444,772	1,233,555

* This item includes a sum of £10,000, an extraordinary charge for "Repairs of engines, &c."

Expenditure and Revenue per Million Gallons.

COMPANIES.	MAINTENANCE.					MANAGEMENT.			Total Expenditure per Million Gallons.	Water-rents per Million Gallons.	Average Daily Supply.
	Maintenance and Repair of Reservoirs, &c.—including Cost of Labour and Materials.	Maintenance and Repair of Mains, Pipes, &c., and Works connected with Distribution including Labour and Materials.	Pumping-Engine Charges, Coals, Labour, &c.	Filtration—including Cost of Materials and Labour.	Salaries and Wages of Engineer, &c.	Directors and Auditors.	Salaries of Secretaries and Clerks.	Collectors' Com-mission.			
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	Gallons.
Chelsea	0 2 4	1 15 6	2 13 10	0 7 0	1 4 1	0 8 3	0 17 1	0 14 11	10 14 8	33 8 10	7,474,492
Grand Junction	0 1 8	1 8 3	5 15 0	0 5 7	0 19 6	0 4 4	0 13 1	0 15 11	12 3 10	30 13 10	10,915,400
Lambeth	0 8 2	1 8 9	4 6 6	0 4 2	1 0 5	0 5 3	0 6 11	0 11 10	10 4 4	26 14 8	13,000,742
Southwark & Vauxhall	0 1 8	0 14 9	3 1 10	0 8 3	0 11 3	0 3 2	0 4 5	0 13 11	7 11 1	20 17 10	18,744,121
West Middlesex	0 3 11	1 0 0	3 10 10	0 5 10	1 13 5	0 15 6	0 18 1	1 2 8	12 9 9	42 13 0	9,823,064
East London	0 8 1	0 17 6	1 12 6	0 5 5	1 1 3	0 5 0	0 6 9	0 12 10	8 7 4	20 17 5	23,534,144
Kent	0 1 8	0 13 10	3 8 9	...	0 16 7	0 12 9	0 6 2	0 16 8	8 13 8	29 13 2	6,780,219
New River	0 10 3	2 15 7	2 3 11	0 5 11	0 13 11	0 12 10	0 18 0	1 4 2	13 5 5	35 14 7	26,947,333
Mean	0 5 10	1 9 1	2 19 10	0 5 8	0 18 6	0 7 11	0 11 1	0 16 10	10 7 7	28 15 10	117,219,515

EXTENSION OF WISHAW GAS-WORKS.—In view of the extended consumption of gas, consequent upon the great increase of the population of Wishaw since the gas-works were established in that burgh, a variety of extensive alterations and improvements have been made upon the works during the past winter. First in order, it may be mentioned that the old condensers, which were found to be insufficient for the increased make of gas, have been removed and replaced by others of a more complete and effective character. An engine and boiler have been erected, steam power being required for driving a combined exhauster and washer—an apparatus devised and patented by Mr. Whimster, manager of the Corporation Gas-Works, Perth. The exhauster is used for drawing the gas from the hydraulic main, thereby removing the pressure from the retorts, and affording greater scope for the manufacture of gas. Until these alterations and improvements were effected there was no means of indicating the precise quantity of gas made per ton of coal; now, however, a large

station-meter has been erected for this purpose, which is calculated to pass upwards of 6000 cubic feet per hour. The improvements likewise include a governor for the purpose of regulating the pressure of gas through the town. Formerly, the supply of gas was on continuously, night and day; but by means of the new arrangement the pressure can be so modified as to effect a saving of from 10 to 15 per cent. of the gas. With the view of rendering the works independent of the town's supply of water, a special pump has been sunk to a depth of 18 or 20 feet into the old coal workings underneath the site occupied by the gas-works, and thus an abundance of water has been obtained for quenching the coke and for other purposes. An experimenting-room and offices, &c., have been erected, and the purifying-shed has been raised 3 feet. The improvements, the entire cost of which is stated to be about £2500, have been carried out under the superintendence of Mr. Adams, from plans prepared by Mr. George R. Hislop, of the Paisley Corporation Gas-Works.

Miscellaneous News.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held on Thursday, the 29th ult., at the Albion Tavern. In the absence of Professor Erasmus Wilson, the Chairman of the Company, the chair was taken by Mr. H. P. STEPHENSON.

The SECRETARY (Mr. Magnus Ohren) read the advertisement convening the meeting, and the following report was presented :—

The directors report that the general working of the company during the half year has been satisfactory.

The demands on the company for increasing supply, and the necessity of keeping the plant in the highest state of efficiency, have added considerably to the usual expenditure on works and mains renewal.

Dr. REVENUE ACCOUNT, for the Half Year ended Dec. 31, 1876. Cr.

To Manufacture of gas—			
1. Coals, including all expenses	£20,142	9	2
2. Purifying materials, wages, &c.	864	16	2
3. Salaries of engineer and officers	529	0	0
4. Wages and gratuities	3,174	9	7
5. Works, machines, and retorts—			
Maintenance of, repairs, & labour. £4,096	9	4	
Less old material sold.	24	18	10
	4,071	10	6
	£28,782	5	5
Distribution of gas—			
6. Salaries of chief inspector, inspectors, and clerks in light office	693	0	0
7. Mains and service-pipes, repairs, maintenance, renewal, and labour	1,987	16	11
8. Meters, repairing, renewing, and refixing	1,062	2	2
	3,742	19	1
Public lamps—			
9. Lighting and repairing	582	4	8
Rents, rates, and taxes—			
10. Rents	14	13	6
11. Rates and taxes	1,377	0	4
	1,391	13	10
Management—			
12. Directors allowances	750	0	0
13. Salaries of secretary, accountant, clerks, and messenger	477	4	4
14. Collectors commission	409	7	7
15. Stationery and printing	221	3	11
16. General establishment charges	512	10	8
17. Auditors	30	0	0
	2,400	6	6
Sundries—			
18. Law and parliamentary charges	102	9	4
19. Bad debts	198	14	1
21. Insurance-fund	182	10	6
Total expenditure	£37,383	3	5
Balance carried to profit and loss account	9,415	2	2
	£46,798	5	7

By Sale of gas—			
Michaelmas quarter—			
1. Private rental—			
1,492,600 cubic feet, at 3s. 7d.	£286	1	7
2,178,300 3s. 10d.	390	5	10
47,108,800 4s. 0d.	9,421	15	1
2. Public rental and under contracts	1,720	12	8
	£11,818	15	2
Christmas quarter—			
3. Private rental—			
2,520,400 cubic feet, at 3s. 7d.	£451	11	9
1,142,000 3s. 10d.	218	17	8
108,208,700 3s. 11d.	21,190	17	1
4. Public rental and under contracts	1,729	8	1
	23,590	14	7
5. Meter-rental—the half year	587	4	8
Total rental	£35,996	14	5
Residual products—			
6. Coke, less labour and cartage	£7,916	10	3
7. Breeze	179	15	0
8. Tar	1,620	16	11
9. Sundries	5	0	2
	9,722	2	4
10. Sulphate of ammonia and ammoniacal liquor, less labour, &c.	1,079	8	10
Total receipts	£46,798	5	7

PROFIT AND LOSS ACCOUNT (NET REVENUE).

1. To Balance of net profit to be carried to next account, subject to half year's dividends to the 31st of December.	£9,887	7	7
	£9,887	7	7

1. By Balance from last account	£9,643	18	3
Less dividend to the 30th of June	9,088	5	0
	£555	13	3
Less directors fees, extra-voted at general meeting	250	0	0
	305	13	3
2. Balance from revenue account, being profit for the half year	9,415	2	2
3. Interest, contingent-fund, &c.	166	12	2
	£9,887	7	7

The CHAIRMAN, in moving—"That the report of the directors and the balance-sheet confirmed by the auditors be received, adopted, and entered upon the minutes," said he could have wished that the accounts were somewhat better than they appeared to be. The reasons for their not being quite so good as they could wish were, firstly, that the coke, owing to the low price of coal and the mild winter, had not realized anything like that which it usually did; and, again, their works and mains renewal accounts were somewhat exceptionally larger than they were generally. They had to enlarge some of the mains in the district, and the expense had fallen somewhat heavily upon a half year in which they were, to a certain extent, suffering from a reduction of 2d. per 1000 feet, compared with the corresponding half year. In the rearrangement of some of their work, additional duty had fallen on the secretary's department, and he should have to propose a resolution, recommended by the directors, that the salary of the secretary be increased by £100 per annum. He was sure they would agree in granting that increase to an old and faithful officer.

Mr. LINGEE seconded the resolution, which was agreed to.

The CHAIRMAN moved—"That a dividend for the half year ending the 31st of December last be declared, as follows—viz., at the rate of 6 per cent. per annum on the preference stock, at the rate of 7 per cent. per annum on the ordinary 7 per cent. stock, and at the rate of 10 per cent. per annum on the ordinary 10 per cent. stock, all less income-tax, be made payable forthwith."

Mr. LIVESLEY seconded the resolution, which was agreed to.

Mr. GLAISHER moved—"That Dr. Frederick Hetley be re-elected a director of this company," and the resolution was agreed to.

Mr. NEWTON proposed the re-election of Mr. George Livesey as a director. All gentlemen who knew anything of the gas world must be quite aware of the qualifications Mr. Livesey possessed for any office he might fill in a gas company.

The resolution was seconded by Mr. D. W. OGG, and agreed to.

Mr. LIVESLEY returned thanks for his re-election, and expressed his confidence in the future of the company.

Mr. HYSLOP moved the re-election of Mr. Gray as auditor. The resolution was seconded by Mr. BEETON, and agreed to.

The CHAIRMAN said the next resolution was—"That the salary of the secretary be increased by £100 per annum." He need hardly point out the position Mr. Ohren had occupied in the company for the last 22 years. They all knew him, and no words of his would enhance the credit due to him for all he had done for the company. He felt sure that the proposal would meet with the cordial support of the shareholders.

Mr. HYSLOP seconded the resolution, which was agreed to.

On the motion of the CHAIRMAN, a vote of thanks was passed to the auditors and officers of the company for the efficient discharge of their duties.

The SECRETARY briefly responded, thanking the board and shareholders for their expression of confidence, and also for the addition made to his salary.

Mr. LAYTON proposed a vote of thanks to the directors. He said the chairman had somewhat apologized for the accounts, and promised better things, but he might say, on behalf of the shareholders and those who burnt the gas, that if the board would do in the future what they had done in the past, they would be well satisfied. The business of the company was conducted in a manner that was very much to their credit, and to the advancement of the interests of the shareholders.

Mr. BEETON seconded the motion, which was agreed to.

The CHAIRMAN acknowledged the vote, and the proceedings terminated.

METROPOLIS GAS SUPPLY.

POPULAR.—ELECTION OF A PUBLIC ANALYST.—We have much pleasure in announcing that Mr. W. C. Young, F.C.S., the Gas Examiner for the Corporation of the City of London and the Metropolitan Board of Works at the Beckton testing-station, has been appointed Public Analyst for the Poplar District Board.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health, on the composition and quality of the metropolitan waters in March, 1877 :—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitro- gen. As Ni- trates, &c.	Ammonia.		Hardness (Clarke's Scale).	
				Sal- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.
<i>Thames Water Companies.</i>	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	22.90	0.053	0.195	0.001	0.008	13.7	4.2
West Middlesex	21.40	0.073	0.168	0.001	0.006	14.3	4.6
Southwark and Vauxhall	20.50	0.071	0.198	0.001	0.007	14.3	4.6
Chelsea	21.20	0.054	0.165	0.000	0.008	14.3	5.0
Lambeth	22.10	0.070	0.186	0.000	0.009	13.7	4.2
<i>Other Companies.</i>							
Kent	30.10	0.007	0.375	0.000	0.002	18.8	4.6
New River	21.20	0.066	0.168	0.000	0.006	14.8	4.2
East London	22.50	0.070	0.150	0.000	0.006	13.7	4.2

Note.—The amount of oxygen required to oxidize the organic matter, nitrates, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid, namely:—Grand Junction, West Middlesex, and Lambeth.

C. MEYMOTT TIDY, M.B.

EAST LONDON WATER-WORKS COMPANY.

The following is the Report of the Directors to be presented at the Half-Yearly General Assembly of Proprietors on Thursday next:—

The accounts for the half year ending at Christmas, 1876, duly certified by the several auditors, are herewith submitted to the proprietors.

The revenue from water-rates, as there stated, amounts to £99,080 19s. 1d. The amount at Christmas, 1875, was £94,959 2s.

The costs chargeable to revenue for maintenance and management amount to £36,930 6s. 7d.; in the corresponding period for 1875 they amounted to £36,032. The parochial rates and taxes included are £1100 more in 1876 than in 1875.

The expenditure on capital account is £12,163 10s. 8d., and the balance of expenditure beyond the amount raised, as stated in the account, is £32,442 8s. 6d. This amount has now been repaid from the receipts for new capital.

The £80,000 additional debenture stock, referred to in the last report, was offered to the proprietors by circular issued on the 25th of October last, and allotted to the proprietors offering the highest premiums. The amount received in premiums was £6693 5s.

Considerable progress is making in the works at Hagger Lane, Walthamstow, and the directors hope that some portion of the works will be available during the ensuing summer for the supply of Buckhurst Hill and neighbourhood.

All the works of the company are well maintained and in good order. The directors are happy to report that no damage has been sustained from the severe floods that have prevailed during the past season, and, though slightly turbid from that cause on one or two occasions, the water has well maintained its character, as shown by the returns of the Registrar-General.

The directors are still extending the system of constant supply, and their mode of introducing this alteration by small districts has been satisfactory.

In consequence of the great changes by increase of buildings and the construction of railways, a modification of the boundary line between the New River and the East London Companies has become necessary. Negotiations for this object are in progress.

The quantity of water pumped during the half year ending at Christmas last was 4,565,611,072 gallons, being an increase of 140 millions of gallons, or about one week's consumption over the corresponding period for 1875.

The following extracts, from a report submitted to the Society of Medical Officers of Health, on the composition and character of the water supplied to London during 1876, by Charles Meymott Tidy, M.B., F.C.S., will be of interest to the proprietors:—

I have thought it advisable to collect the samples myself every month from the various stand-pipes supplied by the several companies, without the companies having any knowledge of the day when, or time at which, the collection is made. In this way I have secured, as far as possible, a fair sample of the water for analysis.

I am of opinion that my analyses prove that London enjoys a water supply of very considerable purity; and I am further convinced that, from a medical point of view, no substantial objection can be urged against its wholesomeness for dietetic and culinary purposes.

Three directors go out of office by rotation—viz., Messrs. Coope, Davis, and Barnard—but are all eligible for re-election. They have given notice, in accordance with the company's Act of Parliament.

One of your auditors, Mr. H. J. Baddeley, also goes out of office by rotation, but is eligible for re-election.

The directors recommend that a dividend of 3 per cent. for the half year on the ordinary stock, and of 2½ per cent. on the debenture stock, both clear of income-tax, be declared payable on the 10th of July next in the usual manner.

TUNBRIDGE WELLS WATER SUPPLY.

The Water-Works Committee of the Local Board have recently consulted Mr. Bateman, "to advise them on the present and prospective wants of the town, the existing means of supplying those wants, and the best mode of supplying what may be further required." Mr. Bateman's report thereon was laid before an adjourned public meeting of the inhabitants on the 21st ult. It was as follows:—

I have the pleasure of reporting the result of my examination of your water-works on Tuesday last, the 13th inst., and of the information which I received on the occasion. I was accompanied over the works by your engineer, Mr. Brentnall, and the chairman of the Water-Works Committee, and I received from the former such information upon the yield of your springs and the supply of water, as enabled me to come to definite conclusions.

I am informed that the present fixed population of Tunbridge Wells exceeds 23,000 persons, and that it is rapidly increasing. To these must be added the floating population, consisting of visitors in the summer season, and when the town is full on such occasions, the population is estimated to amount to 30,000 persons at the present time.

These visitors will probably be resident in Tunbridge Wells at periods of the year when the springs are lowest, and the demand for water is greatest.

In my opinion, the gross supply, to include street watering, garden watering, and the various public purposes to which a full supply of water is devoted, should be estimated at 25 gallons per head per day for a town like Tunbridge Wells.

This allowance on 30,000 persons would show that the present requirements, when the town is full of visitors, equal 750,000 gallons per day. Twenty gallons per head per day, with great economy on the part of the consumers, might possibly be sufficient. This will amount to 600,000 gallons per day upon the present population, without providing for future increase. The water-works have been constructed in reliance upon the quantity of water yielded by certain springs, which were supposed to be sufficient for the wants of the town when in their lowest condition, without any assistance from storage.

Mr. Brentnall has furnished me with the gross results of the yield of the springs, and the quantity of water supplied to the town during the years 1874, 1875, and 1876. I find that in 1874 the total yield of the year averaged 785,600 gallons per day. In 1875 (which was a wet year), the total yield was equal to 886,700 gallons per day, and in 1876 the total yield was equal to 734,500 gallons per day.

If all the water thus yielded by springs were impounded when more than sufficient for the wants of the town, the average daily quantity could not safely be estimated at more than 700,000 gallons per day. In the year 1874 the springs yielded at their minimum less than in any of the three years mentioned. The quantity yielded amounted to 206,064 gallons per day, and the average volume of the springs during 189 days of drought, which occurred in that year, was but 294,563 gallons per day. During this period of drought all the water which the springs yielded was supplied to the town, and at the minimum the deficiency must have been severely felt. In the year 1876 the drought extended over a similar period. The springs fell at their lowest to 210,271 gallons per day, the average during the long drought being also little more than in the year 1874.

It is clear, upon these figures, that storage is required, and it is also, I think, evident that even the storage of every drop of water which the

spring would yield would scarcely be sufficient for a full and satisfactory supply to the town.

To make use of all the water to which you are now entitled, and to give a barely full supply to the existing population when increased by summer visitors, would require storage to the extent of about 80 million gallons, in addition to the average yield of the springs during the long drought.

The parliamentary plans of the Bill now before Parliament show a reservoir which, I am informed by Mr. Brentnall, will hold 41 million gallons. If it were made this size it would add about 217,000 gallons per day to the springs, giving a total supply (springs and storage included) of about 511,000, say 500,000 gallons per day. I am informed that the rate-payers object to the outlay required for a reservoir of this size, and they have reduced it to 27 millions.

The produce of a reservoir of this size, added to the springs, will give little more than 400,000 gallons per day during a long drought, such as occurred in 1874 and 1876.

A reservoir of this capacity I consider quite insufficient for the wants of Tunbridge Wells, and I may say that even that proposed of larger capacity is, in my opinion, neither sufficient to make a full use of the water you have, nor to give a full supply to the gross population.

It would, however, enable you to give about double the quantity of water which you have hitherto been able to afford in dry seasons, and as such an addition would, no doubt, be a great boon to the inhabitants, it may with great advantage be constructed of the full size originally contemplated, and by-and-by, if it should prove as I expect, that more water is required, additional storage may be provided.

THE CHEMISTRY OF GAS MANUFACTURE.

By A. VERNON HARCOURT, Esq., F.R.S.,
One of the Metropolitan Gas Referees.

[A course of Four Cantor Lectures delivered at the Society of Arts, London.]

SECOND LECTURE.—MONDAY, MARCH 12.

The condensation, as it is called, of coal gas, consists in cooling the products of the destructive distillation of coal to the temperature of the atmosphere. A separation is thus caused between those portions which are gaseous at this temperature, which becomes the common temperature of all the intermixed gases, and at a pressure which is different for each gas, and those portions which are liquefied under these conditions. The pressure to which each gas is subjected is the atmospheric pressure, *minus* the tension of all the other gases.

This separation is not a separation of different kinds of matter one from another, but of different portions of the same kinds, each kind dividing itself between the gaseous and liquid product in a proportion depending upon its specific volatility or solubility. So completely is this the case, that, of all the substances forming the crude heated gas, there is, probably, not one which does not divide itself, however unequally, between the portion which remains gaseous and that which becomes liquid when the crude gas is cooled. Some hydrogen, to take the extreme cases, is dissolved in the liquor, and some vapour of the solid hydrocarbons, remains in the gas. One or two of the more volatile hydrocarbons, such as benzol, probably divide themselves pretty equally between the condensed liquid and the gas.

I have here a drawing of a set of gas-retorts, showing the position which the retorts occupy in the furnace. They are long boxes of fire-clay, very often made in the shape here shown—the shape of the letter D, with the straight side downwards, sometimes closed at the far end, and sometimes open at both ends. Into these the coal is put, either thrown in with a shovel, or thrust in with a scoop. Then a lid is placed over the mouth, the temperature being kept constantly at bright redness, so that for six or seven hours the coal is exposed to this degree of heat, the maintenance of which is essential to the production of a large quantity of gas. The only issue for the gases formed from the heated coal is by the ascension-pipes, which are shown in the drawing. Through them the gas passes, and thence enters this large and long pipe, into which most commonly the ends of the smaller pipes descend for a certain distance, so as to open below the level at which the condensed liquid runs off. This pipe remains full of liquid, chiefly the less volatile portions of tar, and the gas, as it is formed, bubbles through the liquid, and so goes off.

What I propose now to follow is not the permanent gas, but that which becomes liquid when the heated mixture of gases is cooled. Some of this liquid passes along the downward pipe, and forms the first portion of what is separated from the gas by condensation. The gas, however, is still quite hot when it leaves the hydraulic main, as it is termed. It passes from thence through a system of pipes so arranged as to present a large cooling surface to the gas, in order to the more complete separation from it of those parts which are liquefiable. The drawing represents an arrangement of the condensers, in which the gas ascends in one pipe and descends in the other, so that it is exposed during its course to the cooling influence of the air, the heat of the gas traversing the sides of the iron pipe, and thus an exchange of temperature between the gas and the surrounding air going on through the whole of the passage. Under these influences a further portion of liquid is condensed out of the gas, which runs down into a tank, and is collected in the well at a lower level. The liquid divides itself into two parts, a lower layer of tar, of which I gave you a short account in my last lecture, and an upper layer of water holding various substances in solution, which is commonly called gas liquor, or ammoniacal liquor, of which I have to speak to-night.

A list is placed on the wall of the substances derived from the destructive distillation of coal, and I will refer to those which are found in gas liquor. At the head of the list comes water, which is the first substance given off when coal is heated; and it is by its solvent action that many other substances are removed from the crude gas at this stage.

The compounds of hydrogen with carbon are sparingly soluble. Hence in spite of the abundance of these substances in coal gas, very little of any of them dissolves in the condensed water. The compounds of hydrogen with nitrogen and with sulphur are both soluble in water, and the substance produced by their union is soluble. Carbonic acid also dissolves in water to some extent, and abundantly in water containing ammonia. By the action of ammonia upon carbon bisulphide, ammonium sulphocyanide, another soluble salt, is formed. In some coal mines a stream of salt water has been found, and chlorine, probably existing as sodium chloride, is an element present in small quantities in the ash of coal. Like the elements already named—carbon, oxygen, nitrogen, and sulphur—chlorine escapes from the heated retort in combination with hydrogen, and this compound, or rather the product of its union with ammonia, is found in gas liquor.

Acetic acid, which is produced largely by the destructive distillation of wood, is also formed in small quantity from coal, and dissolves as ammonium acetate. The presence of sulphate of ammonia, to a small extent, may be due either to oxidation of sulphur compounds in the heated gas, or to the subsequent action of the air upon the sulphur compounds in solution. Of this latter action, the principal product is a salt, corresponding to the sodium salt used as a "fixing" agent by photographers—ammonium hyposulphite. Another secondary product of a reaction between the cyanides of the liquor and the iron of the condensing-pipes, is ammonium ferrocyanide.

I come now to the treatment of this ammoniacal liquor. It is a substance of which the value was at one time not appreciated. It used to be got rid of, and probably still is so at many gas-works, as a waste product. But, commonly, it is converted into sulphate of ammonia, either at the works or by the chemical manufacturer.

From the tank in which it is stored, it is pumped to the top of a vessel such as is called a "scrubber" in gas-works—a tower filled with coke or pebbles, or it may be an arrangement of alternate shelves, down which it trickles, exposing a large and constantly renewed surface. The liquid runs off from the bottom of this tower into a tank or boiler, and into this tank or boiler there is blown a current of steam, and there is also injected a little stream of milk of lime.

Let us consider first what passes in the tank. There the liquor, which has already lost a part of its ammonia, is strongly heated by the steam which is blown into it, and it is also exposed to the action of the lime. Lime decomposes the substances of which I was speaking just now, sometimes called the fixed salts of ammonia, substances which contain ammonia in a condition heat alone will not drive off. A mutual decomposition takes place between these salts, such as ammonium chloride and sulphate, and the lime which is in the tank, and salts of lime are formed, and ammonia is driven upwards with the steam. This steam, then, already containing ammonia, passes into the tower, and as it rises up meets a descending stream of gas liquor. The proportion between the two is such that the high temperature of the steam reaches just to the bottom of the tower, and when the liquor that comes over meets the ascending heated current, it gives off at once so much of its ammonia in a free condition, as is combined with substances which leave it still volatile. So that from the top of the tower there passes over a quantity of gas, consisting of ammonia and the volatile acids which were combined with ammonia, principally carbonic acid and sulphuretted hydrogen. These gases are conducted into a wooden tank lined with lead, which is filled with sulphuric acid, the ordinary brown oil of vitriol, and there the ammonia is condensed. It combines at once, with the production of great heat, with the sulphuric acid, and as the quantity accumulates, it crystallizes in combination with the sulphuric acid as ammonium sulphate. I have here a specimen of gas liquor before treatment, and a specimen of the salt which is formed from it. This is the white sulphate of ammonium which is got by the process I have described. The carbonic acid and the sulphuretted hydrogen are got rid of either by conducting them to the bottom of the furnace of the works, so as to destroy the sulphuretted hydrogen, or else by passing them through a purifier containing oxide of iron; or else, which is the best plan, the gases are burnt, and the products passed into lead chambers, and thus the sulphuretted hydrogen is converted immediately into sulphuric acid by the same process by which the vitriol maker converts native sulphur, or iron pyrites, into sulphuric acid.

There is a question of some importance as to the way in which the ammoniacal liquor, which is sold by the gas manufacturer to the chemical manufacturer, should be estimated. The ordinary way, I believe, of making its estimation is by mixing directly the ammoniacal liquor with sulphuric acid, and observing how much acid of a known degree of dilution must be added to a measured quantity of the liquor before it is completely neutralized. The strength of the liquor is ordinarily described by a statement of the quantity of sulphuric acid that it is capable of neutralizing, so that the expression 10-ounce liquor means that a gallon of the liquor contains ammonia enough exactly to combine with and neutralize 10 ounces by weight of sulphuric acid. The direct determination of ammonia in this way gives a very imperfect and unequal estimate of the value of the ammoniacal liquor. Imperfect, for the reason that besides free ammonia which can be directly boiled out of the ammoniacal liquor, and which alone neutralizes the sulphuric acid, the ammoniacal liquor contains also combined ammonia, which is got out of it and turned to account by the chemical manufacturer, and which is not estimated by this mode of testing. It is also an unequal mode of testing, because the proportion of free to fixed ammonia appears to vary greatly in different samples of liquor. Therefore, it must be very much better, and I have no doubt it will ultimately become the general practice, to use some means of determining the value of ammoniacal liquor more exactly. The most obvious way of doing it is by means of such an apparatus as I have here set up.

It consists of a little flask connected with a Liebig's condenser, in which the steam formed on boiling the liquid in the flask passes along a narrow tube surrounded by a larger tube, through which cold water is kept flowing. The ammonia from the liquor, and from the fixed ammoniacal salts—for I have placed in the flask besides ammoniacal liquor a small quantity of lime—passes along the inner tube. It is dissolved by the water which distils with it, and drops into the coloured liquid which has been placed beforehand in the receiver into which the tube passes. The liquid is dilute sulphuric acid, a measured quantity of an acid of known strength, coloured with a little litmus. I have taken, for convenience, 16 c.c. of ammoniacal liquor, which, before being distilled, was mixed with twice its volume of water. In the receiver I have placed 16 c.c. of the standard acid which is commonly employed—namely, the acid which contains one pound of strong sulphuric acid in one gallon of dilute. This measure of acid will be sufficient to neutralize all the ammonia that can be given off, unless the liquor is more than 16-ounce liquor. It is only necessary to carry on the distillation until about one-third of the liquid in the flask has passed over. At the outlet of the receiver is a tube with two bulbs blown upon it, which hold a little of the liquid. By turning it round, it is made to serve also as a funnel for bringing the acid into the receiver. At the end of the distillation this tube is turned round, and the liquid which is in the bulbs runs back into the body of the receiver. By substituting a solid cork for that which holds the bulb-tube, and removing the receiver with its contents, and running in standard ammonia from a burette till the litmus changes colour, the quantity of acid which has not been neutralized, and hence the quantity neutralized, and the quantity of ammonia in the volume of liquor operated upon, are known. The solution of ammonia is made of just half the strength of the acid, so that two measures of this solution will neutralize one measure of the acid. Now, supposing the liquor I am testing is exactly 16-ounce liquor, I should find, when the distillation was complete, that the litmus would just have acquired a neutral colour. But supposing the liquor is not so strong, and that 4 c.c. of standard ammonia have to be added at the end of the operation to neutralize the remaining acid, the volume of acid neutralized by the distillate is 14 c.c., and the liquor tested is 14-ounce liquor. That is a very simple and obvious way of estimating the value of a sample of liquor.

Another process which is still simpler, requiring no application of heat, and no watching, but occupying a rather longer time, can be executed with the compact apparatus which I hold in my hand.

It consists of a ground-glass plate, a small dish into which a measure of acid is put, a crucible supported on a triangle over the dish, which is charged with a measured quantity of liquor and a pinch of lime, and, lastly, a bell-glass which stands upon the glass plate, and encloses the smaller vessels.

The ammonia is not given off very quickly, so that there is no fear of any loss during the half minute required to discharge the pipette into the

crucible, and place the bell-jar over it again. Ammonia is so volatile when in aqueous solution, that if we take some solution of ammonia and pour it into a flat dish, and examine it a few hours afterwards, we find it contains no ammonia at all. The ammonia escapes wholly into the air. Therefore, if we have in separate vessels, within the same enclosure, a solution of ammonia and a liquid which will combine with ammonia, and will absorb and fix it, in the course of time—and it is only a few hours that is required—the whole of the ammonia will have transferred itself to the liquid which is capable of combining with it. So that, having measured the acid into the lower vessel, and the ammoniacal liquor into the upper vessel, it only remains to let them stand through the night, and in the morning to determine, as before, with standard ammonia, the quantity of acid which remains unneutralized. The calculation is just the same as in the former case.

I come now to the question of the purification of gas from ammonia, an operation which needs to be accomplished for two reasons. The presence of ammonia in gas is undesirable, because ammonia has a prejudicial action, especially upon brasswork, and its combustion produces some of the corrosive oxides of nitrogen. But also the whole of the ammonia is very well worth collecting.

Owing to the volatility of which I was speaking just now, the condensation of the gas does not remove the ammonia completely, and it is necessary to employ some other means. That which is commonly employed is washing with water; and the most usual mode of applying water is by means of a scrubber. In this vessel the gas which still holds ammonia ascends through the material with which the scrubber is filled, which is most commonly coke, or it may be boards or other materials, and a current of water is allowed to descend through the same.

But it is not easy to secure the distribution of both gas and water over the whole of the contents of the scrubber. If we fill such a tower as is shown in the drawing with any material—say, coke—and allow a small quantity of water to run down, the water will by no means spread itself over the whole of the contents of the tower, but, on the contrary, it will find for itself a watercourse, and will follow that. This depends upon a fact which we have often occasion to observe, that solid materials are not so readily wetted by water when they are dry as when they have already been wetted. If we watch rain falling on a window-pane, we see the drops run quickly where the glass is already wet, and hang, or move slowly, where the glass is dry. Thus it happens with the coke in the scrubber; where the water has trickled and found its way, the water will continue to run, but where the surface has once got dry, that part will remain dry. But, of course, the gas chooses its route independently, and prefers those open spaces where there is no counteracting current of water descending. Therefore it may well be the case that the water which we use to take out the ammonia will follow one set of channels, and the gas will follow another. A systematic arrangement of shelves, after the manner of Coffey's still, is better than any hap-hazard arrangement, such as filling the tower with a material like coke. Besides scrubbers, there is also another class of vessels for applying water, called "washers." I shall not attempt to describe the various forms of washers which have been proposed. The principle common to them all is that the liquid is stored in a tank, and the gas is forced through a few inches of the liquid in streams of bubbles, at a multitude of different points.

I have set up here, partly in illustration, partly because I venture to think the particular form a good one for the purpose, a small washer, which I have made out of a piece of glass tubing. An obtuse double bend has been made in the tube at intervals of four inches, so that it consists of several portions which are parallel, and are now placed horizontally, connected by shorter portions, which are inclined. Two smaller tubes at each end, passing through the corks which close it, serve for the inlet and outlet of gas and water. At the upper end water enters at the rate of one drop every two or three seconds. It stands in a series of shallow pools, where the tube is horizontal, and flows in a slow stream down the inclined portions.

The gas passes first into this three-necked bottle, at the bottom of which I have placed some dilute ammonia, and thence into the lower end of the tube washer. A small jet is attached to the third neck of the bottle; and the gas, after passing through the washer, escapes by a similar jet.

I will now try whether there is any difference in the amount of ammonia in the gas as it issues from the bottle, and after it has passed through the tube. I hold over the first jet a piece of red litmus paper. It becomes blue at once where the gas impinges upon it. This shows that the gas which enters the washer contains abundance of ammonia. I now apply the same test to the gas which has passed through the washer. You see that the colour of the paper remains wholly unchanged.

The way in which my small apparatus works is by exposing each portion of the gas to successive portions of water, of which each is purer than its predecessor. The gas does not bubble through the water, but only passes over its surface, and perhaps, therefore, the apparatus does not so much resemble a washer as a Coffey's still, with its shelves spread out horizontally. I doubt whether its action could be improved by agitating the gas with each portion of the liquid successively.

According to the molecular theory of the constitution of gases, which has now attained a high degree of probability, gases are not at rest when we are not causing them to move, but are of themselves in a state of continual and rapid motion. It has been calculated that the molecules of hydrogen, at the ordinary pressure, and at the temperature of the freezing point, are moving about with an average velocity exceeding one mile a second. Now, if it is the case that gases are moving about, striking in all directions, causing a pressure, which their elasticity exhibits, by virtue of the continual impact of their molecules on the sides of the containing vessel, they also, without our using force to drive them through, must be coming—each molecule in its turn—into collision with any liquid surface with which they are in contact, or over which they pass. And, therefore, when, as in this case, the gas is not anywhere bubbling through the liquid, or forced into contact with it, but only streaming over its surface, nevertheless, as each particle of gas is, with an inconceivable rapidity, zig-zagging backwards and forwards between the upper surface of the glass and the water, this motion produces, without requiring the application of any external force, actual contact between every part of the gas and the liquid spread out beneath it.

But what is required, in order that the purification should be complete, is that the gas should be successively exposed to fresh portions of the liquid used to purify it. This is absolutely necessary where the liquid, as in the case of a solution of ammonia in water, is one which does not fix the gas, but only reduces its tension.

When ammonia is dissolved in water, it still possesses a certain tension, according to the strength of the solution; and if we have a solution of ammonia sufficiently saturated, ammonia will remain as a gas over the surface of that solution, just as it remains as a gas over a surface of mercury; and this tension of ammonia in solution only ceases when the solution becomes indefinitely dilute. Thus, by no amount of agitation, and no length of exposure, could we wash ammonia out of another gas, with water which contains itself a small quantity of ammonia. A short time will serve; but the time must be occupied in the exposure of the gas to successive quantities of liquid—that which contains

some ammonia being removed, and other water, which does not contain any, being substituted for it. And no arrangement of washer or scrubber will accomplish anything like a perfect purification of gas from ammonia, which does not provide for a complete renewal of the washing liquid. Where that which is employed to remove the ammonia is a substance which can fix it, this condition is not necessary. For example, if I take a bottle of ammonia, and pour into it some water, and shake up the water in the bottle, and then hold a piece of litmus or turmeric paper in the bottle, to see whether the ammonia is removed, I find it is not; and if I were to prolong the shaking for a long time, still, however much the volume of water exceeded that required to dissolve the ammonia, it would never so take it out but that I should find enough in the bottle to show with test-paper that ammonia was present. But if, instead of water, I took sulphuric acid, or a solution of sulphate of iron, or any liquid which combines with ammonia to form a fixed substance, then the removal would be complete. But, using water only, the frequent and complete renewal of the water is a *sine qua non* for the success of the operation.

I have spoken of the substances which are condensed in the form of tar, as we call the mixed liquid, from gas. Now, it is a question which must have occurred to every one who has seen the process of tar distillation, how it comes to pass that substances so volatile as are the lighter distillates from coal tar, and so exceedingly valuable in respect of their illuminating power, are always being removed in the process of coal gas manufacture. I may perhaps illustrate the illuminating power and volatility of one of these substances by a simple experiment. I have here an apparatus for making hydrogen, and I have arranged a pair of tubes so that I can either pass the hydrogen directly to a burner, where it gives a very feeble light, as you see, or I can make it pass over some of this substance which has been got out of the coal gas—namely, benzol, which is the first of the substances distilled off from coal tar, and the most volatile. When the hydrogen gas is passed over the benzol, it mixes with the vapour of benzol, and the mixture of the two burns with a very luminous flame; but if I open the communication again, so as to allow the hydrogen to pass directly to the burner, there is hardly any light produced. That illustrates the volatility and illuminating power of some of the substances which are removed from coal gas. How comes it to pass that these substances are removed?

I will try to illustrate the matter by another experiment. I have here a little coal gas in a glass cylinder over water, and I have placed an india-rubber band round the cylinder, so as to mark the height the water stands. Now I will pass up through the water into the cylinder a few drops of a volatile hydrocarbon. You see at once, to some extent, and rather more when I agitate the liquid, so as to promote its diffusion, that the water falls. That happens because the substance, being very volatile, exercises a considerable tension. We have now under the same pressure, and at the same temperature, a volume of gas which is increased by about one-half. If I now take a portion, not of the same liquid, chemically speaking, but still of a liquid which was distilled from the very same sample of petroleum, differing only in being of a higher boiling point than the portion which I first passed up, what is the effect I shall produce? I shake the cylinder a little to bring the liquid last added into contact with its other contents, and the effect is, that instead of this liquid adding its portion of vapour to that which the jar already contained, on the contrary, it has produced a considerable reduction of volume, and if I were to add a little more the volume would return to about that which the coal gas occupied originally. This illustrates what happens in the condensation of the hydrocarbons produced by the destructive distillation of coal. If they were without action one upon another, we should have some little addition to the volume of the gas, and a more considerable addition to its illuminating power. But these substances are, in fact, solvents one of the other, and just as we can wash ammonia out of gas by the action of water, so the lighter of these hydrocarbons are washed out of the gas by the solvent action of those substances of the same class which have higher boiling points.

I have still a few words to say about the purification of gas from two other ingredients—carbonic acid and sulphuretted hydrogen. You know that for the removal of sulphuretted hydrogen there are two substances which are commonly employed—lime and oxide of iron. Either of these substances is perfectly good for the purpose for which it is employed, and will completely purify gas from sulphuretted hydrogen.

Oxide of iron has over lime this great advantage, that the sulphur which the gas contains, when removed by oxide of iron, appears ultimately in the uncombined state, and can be made into sulphuric acid, whereas the sulphur which is removed by lime cannot, as far as we know, be turned to any account afterwards. Another advantage of the oxide of iron is that it may be used over and over again. It is a much more costly substance than lime, and it never could be used for purification if it could be used but once. I have here a sample of it ready for work, and another in the condition in which it comes out from the purifiers after it has been used. The second sample has already lost a little of the black colour which it had when I first poured it out; and gradually, by exposure to the air, it loses that black colour entirely, and becomes of the same red colour as the other sample, which is in the condition in which it is placed in the purifier. The chemical change which is now taking place is that, by the action of the oxygen of the air, the iron, which was oxide when first put in, and which has been converted into sulphide by the action of the sulphuretted hydrogen of the gas, is being reconverted into oxide; the sulphur which had combined with it being separated in the elementary condition.

Now, although oxide of iron serves equally well with lime the purpose of removing sulphuretted hydrogen, it does not serve in any degree the purpose of removing carbonic acid. The presence of carbonic acid in gas is injurious, not to the consumer, but to the maker of gas, for it affects the illuminating power; and if this is deficient owing to the presence of carbonic acid, it has to be increased by the production of a larger proportion of illuminating gases, which must be effected by the addition of a larger dose of cannel to the coal used in making the gas. Therefore it is desirable that the carbonic acid should be removed; and either lime or some other mode of removing the carbonic acid is generally employed. To some extent the carbonic acid is removed in the operations of condensation and scrubbing, for it combines with ammonia and forms a solid substance. Both it and sulphuretted hydrogen can be removed from gas by the action of ammonia, if the ammonia can be readily obtained, and can in a suitable manner be brought to bear on the gas. The process devised by Mr. Hills, which is now in use in the South Metropolitan Gas-Works, appears to me to be an admirable process for the production of ammonia in a condition suitable for the purification of gas. This process consists in exposing gas liquor to conditions exceedingly similar to those I endeavoured to explain in describing the manufacture of sulphate of ammonia, with this difference, that the quantity of steam is less relatively to the amount of ammoniacal liquor, and therefore the temperature is not raised so high. The result of this limited heating may be explained as follows:—We may regard ammoniacal liquor as being a solution of three gases—ammonia, sulphuretted hydrogen, and carbonic acid. These three gases are unequally soluble, ammonia being very much the most soluble; sulphuretted hydrogen next in order, but much less soluble than

ammonia; and carbonic acid much less soluble still. Now, gases are less soluble in proportion as the temperature of the dissolving liquid is higher, and, consequently, when by heating the water we diminish the solubility of these gases, they are given off in a proportion corresponding in inverse order to their solubility. When ammoniacal liquor is heated so that the escaping gases have to pass over an entering stream of cold liquor, it parts first and most readily with carbonic acid, then with sulphuretted hydrogen, and not until it is pushed much harder does it part with ammonia. By so regulating the temperature that there shall be always passing down a sufficient quantity of cold ammoniacal liquor, the heat may be kept at that point at which carbonic acid and sulphuretted hydrogen are driven out and ammonia is retained, and by carrying on this process continuously, the liquid which is drawn off contains ammonia, which is practically free from carbonic acid and sulphuretted hydrogen.

I will illustrate to you the different solubility of these gases. I have here three tubes, each of which I have filled with one of the three gases, and I will now open them under water. In the first, which is filled with carbonic acid, you see the water hardly rises at all, the gas being only sparingly soluble. In the one containing sulphuretted hydrogen, it rises rather more, and in course of time and by agitation the tube will become filled with water, the gas being wholly dissolved; but you see in both cases solution proceeds slowly. Now I will compare with them the effect on the tube filled with ammonia. The moment I remove the cork, the water shoots up to the end of the tube. That illustrates the great difference between the solubility of these gases.

I will only detain you for a few moments to show you another application of this little washer—namely, to the removal of sulphuretted hydrogen from gas by washing it with ammonia.

By the process I have described, we can obtain sufficiently pure caustic ammonia. What needs next to be done is to use this ammonia, so far as may be, for the removal of carbonic acid and sulphuretted hydrogen from the gas; for, if that can be done, we have a complete and excellent round of processes. From the ammoniacal liquor the carbonic acid and sulphuretted hydrogen are driven out by steam, and passed through a purifier containing oxide of iron. The carbonic acid escapes into the air—and it is clearly better that it should go right away into the air than that lime should be used to remove it, which has first had to be freed from its own carbonic acid by burning in a kiln. The sulphuretted hydrogen is stopped, so that no nuisance is produced, and the sulphur is not lost.

I will now illustrate the application of the ammonia so produced to the purification of gas from sulphuretted hydrogen. Here, again, I have to make my gas impure to show the test. I have placed in the three-necked bottle some ammoniacal liquor, which will no doubt yield a sufficient quantity of sulphuretted hydrogen. On testing the gas, as it leaves the bottle, by a piece of lead paper, you see the paper is blackened directly; but now I will test it at the other end, after it has passed along the bent glass tube down which the solution of ammonia is trickling. No effect is produced on the lead paper, though it furnishes a most delicate test for minute quantities of sulphuretted hydrogen. I have repeated this experiment several times; for the little washer really surprised me by its efficiency—that it should be possible thus, with ammonia dropping at this slow rate, to remove sulphuretted hydrogen from gas so completely. On trying it in this way when gas was passing through even more rapidly, not being forced into contact with the ammonia, but simply being exposed successively to fresh portions of the liquid, the sulphuretted hydrogen has been completely removed.

IRON AND STEEL INSTITUTE. TUESDAY, MARCH 20.

The following is an extract from the Inaugural Address of C. W. SIEMENS, Esq., F.R.S., the president:—

Next in importance to cheap, or rather to efficacious labour in the production of iron and steel, comes cheap fuel, a subject to which, as you are aware, I have devoted considerable attention, and I would, therefore, treat it, with your permission, rather more fully than other subjects of perhaps equal importance. Fuel, in the widest acceptance of the word, may be said to comprise all potential force which we may call into requisition for effecting our purposes of heating and working the materials with which we have to deal, although in a more restricted sense it comprises only those carbonaceous matters which, in their combustion, yield the heat necessary for working our furnaces, and for raising steam in our boilers. The form of fuel which possesses the greatest interest for us, the iron smelters of Great Britain of the nineteenth century, is, without doubt, the accumulation of the solar energy of former ages, which is embodied in the form of coal, and it behoves us to inquire what are the stores of this most convenient form of fuel. Recent inquiry into the distribution of coal in this and other countries has proved that the stores of these invaluable deposits are greater than had at one time been supposed.

I have compiled a table of the coal areas and production of the globe, the figures in which are collected from various sources. It is far from being complete, but will serve us for purposes of comparison.

	Area in Square Miles.	Production in 1874. Tons.
Great Britain	11,900	125,070,000
Germany	1,800	46,658,000
United States	192,000	50,000,000
France	1,800	17,060,000
Belgium	900	14,670,000
Austria	1,800	12,280,000
Russia	11,000	1,392,000
Nova Scotia	18,000	1,052,000
Spain	3,000	580,000
Other countries	28,000	5,000,000
	270,300	274,262,000

This table shows that, roughly, the total area of the discovered coal-fields of the world amounts to 270,000 square miles.

It also appears that the total coal deposits of Great Britain compare favourably with those of other European countries; but that, both in the United States and in British North America, there exist deposits of extraordinary magnitude, which seem to promise a great future for the New World.

According to the report of the Coal Commissioners, published in 1871, there were then 90,207 million tons of coal available in Great Britain, at depths not greater than 4000 feet, and in seams not less than one foot thick, besides a quantity of concealed coal, estimated at 56,273 million tons, making a total of 146,480 millions. Since that period there have been raised 600 million tons up to the close of 1875, leaving 145,880 million tons, which, at the present rate of consumption of nearly 132 million tons annually, would last 1100 years. Statistics show that during the last 20 years there has been a mean annual increase in output of about 3½ million tons, and a calculation made at this rate of increase would give 250 years as the life of our coal-fields.

In comparing, however, the above rate of increase with that of population and manufactures, it will be found that the additional coal consump-

tion has not nearly kept pace with the increased demand for the effects of heat, the difference being ascribable to the introduction of economical processes in the application of fuel. In the case of the production of power, the economy effected within the last 20 years exceeds 50 per cent., and a still greater saving has probably been realized in the production of iron and steel within the same period, as may be gathered from the fact that a ton of steel rails can now be produced from the ore with an expenditure not exceeding 50 cwt. of raw coal, whereas a ton of iron rails 20 years ago involved an expenditure exceeding 100 cwt. According to Dr. Percy, one large work consumed, in 1859, from 5 to 6 tons of coal per ton of rails. Statistics are unfortunately wanting to guide us respecting these important questions.

Considering the large margin for further improvement regarding almost every application of fuel which can be shown on theoretical grounds to exist, it seems not unreasonable to conclude that the ratio of increase of population and of output of manufactured goods will be nearly balanced, for many years to come, by the further introduction of economical processes, and that our annual production of coal will remain substantially the same within that period, which, under those circumstances, will probably be a period of comparatively cheap coal.

The above-mentioned speculation leads to the further conclusion that our coal supply at a workable depth will last for a period far exceeding the shorter estimated period of 250 years, especially if we take into account the probability of fresh discoveries, of which we have had recent instances, particularly in North Staffordshire, where a large area of coal and black-band ironstone is being opened up, under the auspices of the Duke of Sutherland, by our member, Mr. Homer.

Wherever coal-fields are found in Great Britain, they exist, generally speaking, under favourable circumstances. The deposits are for the most part met with at reasonable depths, the quality of the coal is unsurpassed by that of other countries, and although the coal and ironstone do not occur together in all the iron-producing districts, the distance from the coal to the iron is small, compared with that met with in other countries, and the insular position of Great Britain renders water carriage, both for internal communication and for the purpose of export, more readily available than elsewhere. These advantages ought to decide the present contest for cheapness in supplying the markets of the world with iron and steel in favour of this country.

Coal assumes, in many instances, the form of anthracite, and although the South Wales district contains large deposits of this mineral fuel, comparatively little use has been hitherto made of it for smelting purposes. When raw anthracite is used in the blast-furnaces mixed with coke, it has been found that the amount so used should be limited to from 10 to 15 per cent., or the furnace is apt to become choked by an accumulation of decrepitated anthracite. At Creusot, in France, this difficulty was overcome many years ago by crushing the anthracite coal, mixing it intimately with crushed binding coal, and coking the mixture of about equal proportions in Appold's vertical coke ovens. The result is a somewhat unsightly, but exceedingly hard and efficacious coke. A similar method has been followed for some time in South Wales, where coke is now produced containing as much as 60 per cent. of anthracite, bound together by 35 per cent. of binding coal, and a further admixture of 5 per cent. of pitch or bitumen, the whole of the materials being broken up and intimately mixed in a Carr's disintegrator prior to being coked in the usual manner. Coke of this description possesses great power of endurance in the furnace, and is worthy the attention of iron smelters.

In the United States of America, anthracite plays a most important part, being, in fact, the only mineral fuel in the Northern States east of the Alleghany Mountains. Its universal application for blast-furnaces, for heating purposes, and for domestic use, imparts to the eastern cities of the United States a peculiar air of brightness, owing to the entire absence of smoke, which must impress every visitor most agreeably, and the difference of effect produced by the general use of this fuel, as contrasted with that of bituminous coal, is most strikingly revealed in a short day's journey from Philadelphia, the capital of the anthracite region, to Pittsburg, the centre of application of bituminous coal.

In visiting lately the deposits of anthracite coal of the Schuylkill district, I was much struck with their vastness, and with the manner and appliances adopted for working the same. The American anthracite is less decrepitated than ours, but its successful application to its various purposes is the result chiefly of the judicious manner in which it is prepared for the market. The raw anthracite, as it comes from the mine, is raised to the top of a wooden erection some 80 or 90 feet high, in descending through which it is subjected to a series of operations of crushing, washing, sieving, and separating of slaty admixtures, after which it is delivered through separate channels into railway waggons, as large coal, as egg coal, walnut coal, and pea coal, each kind being nicely rounded and uniform in size. The dust coal, which amounts to nearly one-half of the total quantity raised, is allowed at present to accumulate near the mine, but experiments are now being carried out to utilize this also for steam-boiler purposes.

Next in importance to mineral fuel, properly speaking, come lignite and peat, of which vast deposits are met with in most countries. These may be looked upon as coal still in course of formation, and the chief drawback to their use, as compared with that of real coal, consists in the large per centage of water which they contain, rendering them inapplicable in their crude condition to the attainment of high degrees of heat. These difficulties may be overcome by subjecting the wet material to processes of compression, desiccation, and coking, whereby excellent fuel and products of distillation have been obtained, although the cost of their production has hitherto exceeded their market value. Crude air-dried peat has, however, been rendered applicable for obtaining high degrees of heat such as are required for metallurgical operations by means of the regenerative gas-furnace; and it is important to observe that the calorific value of a ton of air-dried peat or lignite, if used in this manner, is equal to that of a ton of good coal, if deduction is made in both cases of the per centage of moisture and earthy matter. The carbonaceous constituents of peat yield, indeed, a very rich gas suitable for melting steel or for reheating iron, and the only precaution necessary is to pass the gas from the producer over a sufficient amount of cooling surface to condense the aqueous vapour it contains, before its arrival at the furnace. This precaution is not necessary, however, in dealing with some of the older lignites, such as occur abundantly in Austria and Hungary, and which may be ranked as almost equal in value with real coal, except for blast-furnace purposes.

Fuel also occurs naturally in the gaseous condition—a fact but too well known to every practical coal-miner. Occasionally, however, it is found separated from the coal with which it may have been primarily associated, and in those cases it has been made practically available as fuel. At Bakoo, on the Caspian Sea, natural gas has issued spontaneously from the ground for centuries past, and the column of perpetual fire thus produced has served the purpose of giving the Parsees a holy shrine at which to worship their deity. In the district of Pennsylvania a more substantial application has been made of the gas issuing from many of the borings, in providing fuel for working pumping machinery, and in lighting the district. The quantity of gas issuing from some of these wells may be judged from the fact that one of them, after discharging for three years as

much gas as could escape into the atmosphere under a pressure estimated at not less than 200 lbs. on the square inch, has lately been connected by means of a 5-inch pipe with Pittsburg (a distance of 18 miles) where 70 puddling and reheating furnaces are worked entirely by the fuel so supplied. But even this result furnishes only an imperfect idea of the calorific power represented by this single issue of natural gas, inasmuch as the combustion is carried on in these furnaces on the most wasteful plan, the gas being mixed imperfectly with cold air, and converted to a large extent into dense masses of smoke. An analysis of this gas gives:—Hydrogen, 13.50; marsh gas, 80.11; ethylene, 5.72; carbonic acid, 0.66.

Although the use of natural gas is not likely to assume very large proportions, owing to its rare occurrence, its application at Pittsburg has forcibly reminded me of a project I had occasion to put forward a good many years ago, namely, to erect gas-producers at the bottom of coal-mines, and by the conversion of solid into gaseous fuel, to save entirely the labour of raising and carrying the latter to its destination. The gaseous fuel, in ascending from the bottom of the mine to the bank, would acquire in its ascent (owing to its temperature and low specific gravity), an onward pressure, sufficient to propel it through pipes or culverts to a considerable distance, and it would be possible in this way to supply townships with heating gas, not only for use in factories, but, to a great extent, for domestic purposes also. In 1869 a company, in which I took a leading interest, were formed at Birmingham, under the sanction of the Town Council, to supply the town of Birmingham with heating gas at the rate of 6d. per 1000 cubic feet, but their object was defeated by the existing gas companies, who opposed their Bill in Parliament, upon the ground that it would interfere with vested interests. I am still satisfied, however, that such a plan could be carried out with great advantage to the public; and, although I am no longer specifically interested in the matter, I would gladly lend my aid to those who might be willing to realize the same.

Fuel also occurs naturally in the liquid state, and if mineral oils could be obtained in quantities at all comparable to those of solid fuel, liquid fuel would possess the advantages of great purity and high calorific value; but, considering its rare occurrence and comparatively high price even in the oil districts of Pennsylvania and Canada, its use, as a fuel for smelting purposes, need not be here considered.

According to the general definition of fuel given above, we have to include the evaporative effect of the sun's rays, by which sea water is raised to elevated mountain levels, whence it descends towards the sea, and in doing so is capable of imparting motion to machinery.

This form of fuel, which takes the place of the coal otherwise expended in raising steam, has been resorted to in all countries since the dawn of civilization, and it is owing to this circumstance that the industries of the world were formerly very much scattered over the valleys and gorges of mountainous districts, where the mountain streams gave motion to the saw-mill or flour-mill, to the trompe of the iron smelter, and to the helve of the iron and steel manufacturer.

THE ECONOMICAL CONSUMPTION OF GAS.

Mr. JOHN WEST, Manager of the Maidstone Gas-Works, delivered a Lecture on the above subject at a meeting of the Maidstone and Mid-Kent Natural History and Philosophical Society, on the 22nd ult.

Mr. West commenced his lecture by remarking that although the use of gas had become almost general, on account of its purity and cheapness, as compared with other artificial means of lighting and heating, there were comparatively few persons who sought the most efficient and economical way of obtaining the maximum amount of light contained in the gas consumed. Knowing that defective burners caused a great loss of light to the public, he thought he might be rendering some service if he dwelt briefly on the cause of the loss of illuminating power when defective burners were used, and suggested the best known principles. For some years past several eminent men, such as Dr. Frankland, Dr. Letheby, and others, had given the question of gas-burners their special attention, and some of the manufacturers had spent large sums of money in producing the most efficient specimens. The burners now in use were Argands, which gave a ring of light and required glass chimneys, and those with flat flames known as bat's-wings and fish-tails. The relative power of these artificial lights was determined by the use of photometry—by the well-known law in optics of a light lessening in proportion to the squares of the distance. The standards of comparison were sperm candles, as defined by Act of Parliament, which stated that the gas supplied in Maidstone should be tested with an Argand burner, and when consuming 5 feet per hour, should give a light equal to 12 sperm candles of six to the pound, burning at the rate of 120 grains per hour. Pointing to two rows of jets before him, where the same kind of gas was used with a variety of illuminating power—the one row producing splendid yellow bands, which gave forth innumerable rays of light, while in the other (selected from some Maidstone houses) the luminous bands were scarcely visible—the lecturer remarked that to the existence of the solid carbon particles the light of candles or coal gas was mainly due. If the conditions were altered a little, a great change would be effected. By taking a candle and blowing into the flame, the result would be that most of the light would disappear. The reason of this was that in blowing into the flame the oxygen was forced in, so that when the separation of the elements of the gas took place, the carbon could combine with the oxygen, as well as with the hydrogen, and there were then no free particles of carbon in a state of suspension to be heated, as in the case of light-giving flames. In the Bunsen burner, which was extensively used for heating purposes, air was mixed with the gas before it was burnt; the carbon combined easily with the oxygen, and there was no light. Tripod burners had been in use at St. Peter's Church for the combined purpose of lighting and heating, and when taken down for repairs, he (the lecturer) recommended that four of Bray's burners should be fixed upon each standard. These, it was found gave more light, and consumed less gas than the four original burners, although these were tripods. One of the latest improvements was called the "Bray special." These were excellent burners, and the cost was so small that he was convinced they would be largely adopted. The lecturer next spoke of the Argand burners, which he considered the most perfect instruments for consuming gas. These burners were of proportions which had been very nicely worked out, so that the quantity of gas the burner was required to consume might pass out at an inappreciable, or the least possible, pressure, in order that the oxygen of the atmosphere, slowly ascending through the centre and round the flame, might combine with the burning gas by natural affinity. All these improved burners had obstructions in them for checking the flow of gas to the point of ignition, while the pressure of the gas in the old ones exerted itself at the very tip of the burner, and forced the gas boisterously into the atmosphere. If air were forced into a flame, it destroyed its light-giving properties; so, on the other hand, if the gas were forced boisterously into the atmosphere, there was a like result. It was the different ways in which the gas issued from the various burners which caused the difference in the amount of light. In one case there were burners which required great pressure to force the gas through the small orifices, with the result that they induced currents of air to rush boisterously into them. In the other case the gas streamed forth gently, and the air quietly drew to it the necessary supply of oxygen. Before regulating instruments,

or "governors," were used for the street-lamps of Maidstone, the double burner was in operation. This burner had been tested by himself and a late surveyor of Maidstone (Mr. Buckham), and compared with the regulator or governor, and they found that the increase of light due to the governor when consuming the same quantity of gas was between 3 and 4 candles. The public might therefore, it was discovered, have this increase of light for the same money. The local authorities saw the advantage, but then came the question as to who ought to pay for them. The directors of the gas company, however, generously instructed him to fix them upon all the lamps in the town. Regulators could be adjusted to consume a given quantity of gas, and would remain nearly accurate under all the varying pressures in the gas-mains. As such accurate measurements could be obtained, all that was to be done was to decide the number of hours the lamps should be lighted. This was the way the gas company contracted with the local board, and he said unhesitatingly that when local authorities and gas companies had confidence in each other this was the best mode of supplying the gas to the public lamps, and he believed time would prove it. But if towns were not satisfied with this mode, by all means let them have meters attached to the lamps, which meant, of course, a large outlay, and constant expense. The chief thing now was to see that the regulators supplied the quantity of gas contracted for, and burnt during the proper number of hours. These regulators were made any size, and could be adapted either to private meters or burners. Both for the health and pocket's sake, those burners should be used which produced the most light, and extracted from the air the smallest quantity of oxygen. In conclusion, the lecturer remarked that gas might be used economically for cooking and heating purposes, but in all cases the products of combustion should ascend the chimney. For heating purposes, the Bunsen burners were commonly used, and many persons believed that gas burned in this way gave out more heat than the ordinary luminous flame. This was quite an erroneous idea, the chemical combination being the same. The Bunsen flame, however, was better suited for some purposes, as the thing to be heated might be placed in contact therewith, without soot or carbon being formed on the bottom. Mr. West illustrated several of his remarks by tables, which showed that of nine burners selected from various houses in Maidstone, three, when calculated to consume 5 cubic feet of gas per hour, gave respectively a light only equal to 5.9, 8.23, 3.23 sperm candles, the average illuminating power of the nine examples being 7.56 candles. During the experiments, the gas gave by the standard test burner, when consuming 5 cubic feet per hour, a light equal to 15.13 candles. At the same time, the illuminating power of 15 improved kinds of burners, as supplied by the gas company, when calculated to consume 5 cubic feet per hour, ranged from 11.46 to 15.66 candles, varying according to the sizes and kind of burners used. The deduction drawn was that there is a loss to the public of from about 20 to 70 per cent. of light when gas is consumed through bad burners. The lecturer, while upon this point, added that improved burners had for some time past been used in Maidstone, which was now better supplied in this respect than most other towns. He had for years endeavoured to get consumers to use good burners, as he found that most of the complaints received arose through defective ones being employed.

At the close of the lecture, Dr. Monckton, who presided, invited discussion.

Mr. M. A. ADAMS, after remarking that the lecturer had dealt with his subject in an admirable way, said that gas contained about 50 different substances, the chief of which consisted of marsh gas, or coal damp, as it was called in the mines; another part was hydrogen; and the remaining parts existed in very minute proportions. Mr. Adams then entered into a long explanation of the way in which the gas was consumed, and the various parts of the flame acted upon by the air, and concluded by saying that he quite agreed with Mr. West that the thick flame was better than the other forms.

Mr. EDMETT asked if the blue light was equal in heat to the yellow, when given out from a Bunsen burner.

Mr. WEST, in reply, said Mr. Adams had spoken of gas containing about 50 substances; but he (Mr. West) had not gone into this branch of the subject, as he did not think that it came within the range of their inquiry that evening. With regard to the Bunsen burner, there was the same amount of heat from a blue, white, or yellow flame. To illustrate the usefulness of this burner, he might mention that while a luminous flame, in a recent experiment, took two hours to boil 60 gallons of water, the Bunsen only took about half that time, burning the same amount of gas. The advantage of these burners was that they were quick and clean in their action; but he repeated that no more heat was given out from them than from the ordinary luminous flame.

Dr. MONCKTON felt his soul harassed by what had been said about the Bunsen burner. He looked upon that arrangement as a valuable heat-appliance, and as not at all deserving to be contemptuously mentioned. Judged in any ordinary way, he believed the flame would be found less voluminous and of greater heat than common flame, and this because, from the interfusion of air, the combustion of the carbon was more instantaneously complete, none of that collection into reservoirs, and gradual exposure to oxygen on the outer surface only, which Mr. Adams had described, having to be gone through. Although, of course, neither this device, nor any other, could increase the total amount of heat which a foot of gas would yield, it was quite possible to bring that heat to bear more compactly and pointedly on practical work. Later on, while tendering the hearty thanks of the meeting to Mr. West for his practical address, Dr. Monckton expressed a wish that the gas company would assume a more active responsibility for the apparatus wherewith their product was consumed; the public should be accustomed to rely upon them for those suggestions and improvements, in search of which they were now often made a prey of by itinerant pretenders.

The vote of thanks to Mr. West was then heartily accorded, and the proceedings terminated.

GAS AFFAIRS IN AMERICA.

REPORT OF THE GAS COMMISSIONERS IN RELATION TO THE SUPPLY OF GAS TO THE CITY OF BOSTON.

(Concluded from page 466.)

Competition.

In regard to the admission of another gas company into Boston to compete with the Boston Gaslight Company, we are firmly of the opinion that no such competition should be permitted, unless the competing company be owned and managed by the city of Boston itself; and this opinion has been formed from a study of numerous cases of unsuccessful competition in supplying gas to cities in both the United States and Europe. By unsuccessful we mean that the competition has not succeeded in permanently lowering the price of gas to the citizens. It has invariably resulted in a compromise as to price or district, except in the case of Detroit, where the battle is still raging. In New York the city is divided between the New York, Manhattan, and Metropolitan Companies, each supplying a separate district, and the New York Mutual Company is allowed to lay its pipes anywhere in the city and compete with the other three. The result of this is that

the citizens are obliged to pay 25 cents more per 1000 cubic feet than in Boston; whereas the price should, if anything, be lower than in Boston. The citizens are in each district, therefore, obliged to pay the interest on two capitals instead of one. The same is true of Brooklyn, N.Y., where there are six companies—the Brooklyn, Citizens, Nassau, Metropolitan, People's, and Williamsburg. Here the compromise has been effected by dividing the district, and raising the price to 50 cents per 1000 cubic feet more than is paid in Boston. Up to April 1, 1876, the price was 3.00 dols.; but at that time it was reduced to 2.75 dols. On Sept. 1, 1876, the price was reduced by the Citizens Company to 2.50 dols. Recently permission has been granted to a seventh company to lay pipes in the streets and compete with the others. What will be the result of this remains to be seen, but it will probably be the same as heretofore—viz., another division of the district. In San Francisco, a competing company was allowed by the city authorities to lay gas-mains in the streets under a written agreement that it should not sell out to the old company; but after a short season of cheap gas the new company was absorbed by the old one, under a change of name, and we now find the citizens paying advanced rates, and seeking redress in the Legislature, where an Act has been passed recently, authorizing the supervisors of the city of San Francisco to fix the price and quality of the gas at rates not exceeding 3.50 dols. per 1000 cubic feet for gas of not less than 15-candle power. This price may appear very high; but it must be remembered that the gas coals are all imported from Australia, at a cost of 11 or 12 dols. per ton, and that the rates of labour are far in excess of our own.

In reference to this question, we may quote the paragraph from John Stuart Mill, which was read at the hearing before the Board of Aldermen in 1874 (page 124), by Mr. Nathaniel C. Nash, which the experience in all cities in which competition has been thoroughly tried substantiates:—

When, in any employment, the *régime* of independent small producers has either never been possible, or has been suspended, and the system of many workpeople under one management has become fully established, from that time any further enlargement in the scale of production is generally an unqualified benefit. It is obvious, for example, how great an economy of labour would be obtained if London were to be supplied by a single gas or water company, instead of the existing plurality. While there are even as many as two, this implies double establishments of all sorts, when one only, with a small increase, could probably perform the whole operation equally well; double sets of machinery and works, when the whole of the gas or water required could generally be produced by one set only; even double sets of pipes, if the companies did not prevent this needless expense, by agreeing upon a division of the territory. Were there only one establishment, it could make lower charges consistently with obtaining the rate of profit now realized. It is, however, an error to suppose that prices are even permanently kept down by the competition of these companies. Where competitors are so few, they always end by agreeing not to compete. They may run a race of cheapness to ruin a new candidate, but as soon as he has established his footing they come to terms with him. When, therefore, a business of real public importance can only be carried on advantageously upon so large a scale as to render the liberty of competition almost illusory, it is an unthrifty dispensation of the public resources that several costly sets of arrangements should be kept up for the purpose of rendering to the community this one service. It is much better to treat it at once as a public function; and if it be not such as the Government itself could beneficially undertake, it should be made over entire to the company or association which will perform it on the best terms for the public. In the case of railways, for example, no one can desire to see the enormous waste of capital and land (not to speak of increased nuisance) involved in the construction of a second railway to connect the same places already united by an existing one; while the two would not do the work better than it could be done by one, and, after a short time, would probably be amalgamated. Only one such line ought to be permitted; but the control over that line never ought to be parted with by the State, unless on a temporary concession, as in France; and the vested right which Parliament has allowed to be acquired by the existing companies, like all other proprietary rights which are opposed to public utility, is morally valid only as a claim to compensation.

The relation of the public to the gas companies does not materially differ from its relation to the railroad corporations. It is practically dealing with what, from the nature of things, must be a monopoly. The manufacture and sale of gas is not to be considered similar to other branches of manufacturing. When extraordinary profit is realized from other branches of manufacturing, new capital is attracted and profits find their level. New gas companies cannot be established within the same territory. Competition is not to be relied on to control prices in the manufacture and sale of gas any more than in the reduction of transportation charges on railroads. Competition in each case is only incidental, and, while railroad and gas corporations may for a time engage in competition, it is only for the purpose of eventual combination, in which the public interest must suffer. In the early days of railroads in this country and England, competition was regarded as a sovereign remedy for high rates of transportation; but the result has shown a vast waste of capital, and compelled the public to pay interest on the cost of many lines which should never have been built. In gas companies the result has been the same, wherever competition in the same district has been carried to its legitimate and necessary issue. But one line of main-pipes was necessary to supply the public wants, and wherever two were laid, in some form or other the consumer must pay the cost upon the unnecessary expenditure. Such a competition has led to precisely the result which might have been expected—a combination of, or compromise between, the companies, and an increased rate for gas to the consumers, to pay the interest on the unnecessary outlay of capital.

While the public interest in the proper and economical management of gas companies is less in extent than that in the management of railroad corporations, it is precisely of the same nature. Both are and must remain monopolies. Both are liable to be conducted arbitrarily and in a manner to injure and abuse. The railroad corporations of this State have been always controlled by law, while the gas companies have been left to pursue their way unchecked and untrammelled; and it is due to their managers to say that, in most instances, they have not abused the licence they have enjoyed.

The railroad corporations have been required from the outset to render to state officials public returns of their investments and business, which, if not strictly accurate, still in some measure enable the public to understand the extent of their business, and the amount of their earnings and profits. The gas companies, enjoying a practical monopoly, have been required to do nothing of the kind, and there has been a complete ignorance, on the part of the public, of the nature of their business, its extent, and the amount of their profits.

At the hearing before the city authorities, in 1866, it was found impossible to ascertain the cost of the manufacture of gas, and its details could not be satisfactorily learned at the hearing in 1874. If the same publicity of accounts had been required of the gas companies as of the railroad corporations in former years, the labour of this commission would have been simplified, and much less time have been required in reaching its results. It is easy to examine the condition and business of the London gas companies to the most minute detail, while it is impossible to state with absolute confidence the cost of making gas in this country.

There would seem to be no reason why the gas companies of this State should not be required to make public the details of their business in the same manner as the railroad corporations, in the same manner as the London gas companies are required to do. While there should be, and probably is, no disposition to complain of a reasonable profit to be realized from the manufacture and sale of gas, fairly commensurate with the capital employed and risk involved, the privacy with which the accounts of these companies have been kept has led the public to believe that the profits are

very large, and has probably induced the feeling of hostility to gas companies which it cannot be denied is very prevalent in the community.

If it be conceded that it is desirable to follow as nearly as we may the English plan, and establish the principle that the supply of gas shall be furnished by corporations, which shall enjoy a substantial monopoly of the business, but as a condition of such monopoly shall be subject to strict regulation, and should make public the details of their business and profits, the question at once arises, in whose hands shall be placed the supervision and inspection which in London is given to the Board of Trade? We have no body similar in form and position to the London Board of Trade. There is no city official to whom the Legislature would be likely to grant such power if it could; and it may well be doubted if the Legislature could grant such a power to the city of Boston, or any board or official to be appointed by the city. If it is a need of the city of Boston, it may well be considered a public want, to be provided for by a general law applicable to all the gas companies in the State.

What is needed is the establishment of a permanent board of competent men, who shall make it their business to become acquainted with the business of manufacturing gas, and with the operations of the various companies engaged in the manufacture within the State. The corporations should be required to make returns semi-annually of all their doings to this board, as fully as the London companies are required to. The board should be required to make frequent inspection of the quality and purity of the gas furnished by the different companies, and make public from time to time the results of their inspections. It should be empowered to investigate all complaints against gas companies by their customers. It would not be necessary, and perhaps not wise, to give such a board compulsory power to enforce its decrees. It should be rather an advisory board, with sufficient knowledge of the subject to understand fully the matters with which it is dealing; to keep the public fully informed of all improvements made in the manufacture of gas; and to keep the corporations informed of all advances made by other companies—in a word, to keep a careful watch over all the business of all gas corporations in behalf of the public, as the managers of gas companies do in behalf of their stockholders, and to be able at any moment to advise the corporations and their customers and municipal corporations of the proper economies of the gas manufacture, and of the methods and success of any particular corporation; to suggest experiments, and advise what steps should be taken to correct abuses and prevent complaints.

The results of the establishment of a Board of Railroad Commissioners in this commonwealth suggests the propriety of the establishment of a similar commission for the manufacture and sale of gas. The Board of Railroad Commissioners was established in 1869, and was practically a board without direct powers, intended to be an advisory board of competent men, in permanent session, to examine into the condition and business of the railroads, and to make such suggestions and recommendations to the railroad corporations and to the public authorities as seemed judicious; to hear complaints and disputes, without power to adjudicate and enforce its decrees, but simply to advise, and, in case its advice is unheeded, to report facts to the public and the Legislature.

It would derive its power from two sources—first, from the influence which a competent arbiter should have, whose sole duty is to carefully study the various questions arising in the transaction of business of great importance, and from its nature not understood by the public at large; and, second, from the natural effect of public opinion directed and controlled by an official body upon corporations, which are peculiarly sensitive to popular feeling.

There can be little doubt that the influence of the Railroad Commissioners has been powerful over the railroad corporations of this commonwealth. Without direct power, it has hastened the adoption of improvements in railroad economies, has secured the keeping of more accurate accounts, and has kept the public informed of the business of the corporations, and the corporations of the advances made by each other, and of the inaccuracies which had crept into their own system and accounts. It has corrected many popular fallacies in regard to the duties and business of railroad corporations, and has shown to railroad managers, through the results of actual experiments over other lines, the possible effect of similar trials upon their own.

Just such a commission upon the manufacture and sale of gas we believe would be of great benefit to the gas corporations and to the public. The law establishing such a commission should require returns to be made by the gas companies of the State as are now made by the London gas companies, and power should be given to recommend improvements and experiments. It should have the same power and jurisdiction in hearing complaints as is given in similar cases to the Railroad Commissioners, and above all should keep the public fully informed of the condition, business, and profits of the gas companies of the State. Upon the last feature we place great reliance, as promising an improved relation between the gas companies and the public. Publicity of expenditures and accounts should be the condition absolute upon which monopoly can be allowed. The vague darkness in which the business, accounts, and profits of the gas companies are shrouded, and which is the cause of a great part of the jealousy with which they are now regarded, should be for ever abolished.

The present law of Massachusetts professes in the title of the Act, c. 168 of 1861, to provide "for the inspection of gas-meters, the protection of gas consumers, and the protection and regulation of gaslight companies." So far as the interest of gas consumers is concerned, it provides fairly enough for the inspection of gas-meters. This is well; but it is not in the measurement of gas that consumers commonly suffer. It provides in a very inadequate way for an examination of the quality and purity of the gas; it fixes the quality of the mercantile gas at 12 candles, which is too low, and makes no suitable provision to ensure purity of the gas, which is no less essential than its illuminating power. The other provisions of the Act are to promote the interests of the gas companies, to enable them to collect their dues and protect their property. The contrast with the severity of the English law is very striking, and not particularly flattering. The English view of the duties of the gas companies commends itself to our judgment. It treats gas companies as what they must be, monopolies, but subjects them as a condition of the necessary monopoly to strict regulation, and, above all, requires the utmost publicity in all their affairs.

The expenses of such a permanent commission for the whole State could not be very great, to be added to the whole amount paid for gas in the State. These expenses should be assessed upon all the gas companies in proportion to their sales, and in this way distributed *pro rata* upon the consumers of gas. And, if the affairs of such a commission were conducted with ability, it would in the end result in a large saving to the public.

Conclusions.

Our conclusions are, for reasons already given, as follows:—

1. That the citizens of Boston are being supplied by the Boston Gaslight Company with gas of excellent quality, and at a price, in comparison with the cost of coal and the quality of the gas, lower than in most of the cities of the United States.* No fair comparison can be made in regard to price

* In Lowell 16-candle gas is supplied to the citizens for the same price as in Boston, although the cost of the common coal is 1.00 dol. more per ton, the consumption less, and the district more unfavourable than in Boston.

with European cities, on account of the great difference in the cost of labour and material, and the value of residuals.

2. That there are other processes than those in use in the various companies in this city by which illuminating gas can be made, and for which great improvements in regard to cost and quality are claimed; but none of these, with one exception, have yet been tried for a sufficiently long time, and upon a sufficiently large scale to warrant an unqualified recommendation. That exception is the substitution of naphtha or petroleum in the place of enriching coal. By this means we consider that great saving may be made, providing that the price of naphtha does not much exceed 10 cents per gallon delivered at the works, and the advisability of employing this substance in the manufacture of gas depends entirely upon the probability or certainty that the price shall not materially exceed this figure. At this present time, however, it would probably be impossible for a large gas company, like the Boston Gaslight Company, to make use of any process for the manufacture of illuminating gas from naphtha or petroleum without either paying a considerable royalty or becoming involved in lawsuits for the alleged infringement of some patent. It is, nevertheless, doubtful whether any of the patents for using petroleum or naphtha in gas-making are valid.

Of the various other processes for manufacturing gas, those now in use in Poughkeepsie and Manayunk, and known as the "Gwynne-Harris" and "Lowe" water-gas processes, offer in our opinion a fair prospect of success, and should be carefully watched and studied. If the recommendations in the next paragraph are adopted, the careful investigation of these processes may safely be left to the permanent commission, who can devote the necessary time, and make the necessary experiments, to enable it to recommend to the gas companies in the State that process which is the most scientific and economical.

3. In regard to the other subjects included in the order quoted at the beginning of this report, we recommend that virtually the same measures should be adopted which have been found, by long and careful consideration of the relation of gas companies to the public, to be best in reference to the London gas companies—viz., the fullest publicity in relation to their entire business. In order to accomplish this result, we would advise the city of Boston to petition to the Legislature of Massachusetts for the appointment of a permanent Board of Commissioners, similar to the Railroad Commissioners, who shall have authority to thoroughly inspect the gas of all the companies in the State, and also, through a competent auditor, to examine all of the accounts of the companies. These accounts should be published annually, so as to ensure publicity, and should be kept according to some one definite plan. The gas inspector or inspectors should be provided with an office at a distance from the works, should examine the gas frequently, and should publish the results of the examinations at least quarterly. The gas should at no time have an illuminating power below 16 candles; it should at all times be free from sulphuretted hydrogen, and should contain an amount of sulphur and ammonia not exceeding 20 grains of the former, and five grains of the latter, per 100 cubic feet.

The commissioners should have the power to recommend the price of gas in all the cities and towns in the commonwealth, at such rates as would allow the earning of a dividend of not more than 10 per cent. on the capital, and any excess of profit should go towards ensuring a diminution of the price the following year. This commission should be the tribunal authorized to investigate all complaints between consumers and the corporation, and the establishment of such a commission would probably result in bringing about such changes in legislation, in regard to its powers and duties, as actual experience should show to be necessary and judicious.

In London it was found impossible to induce the gas companies to consent to all the regulations of Parliament, until a strong effort was made to obtain permission for the municipal government to erect gas-works and sell gas to the citizens, when the companies were obliged to accede to all of the propositions, for fear of the unequal competition with the government. Although we do not deem it necessary to resort to the same expedient, yet the same difficulty can arise in the case of any company whose charter was granted previous to March 11, 1831, at which time an Act was passed rendering all charters granted after that date subject to alteration by the Legislature. We, therefore, recommended that the city of Boston petition the Legislature for an Act permitting the city to erect gas-works, and manufacture and sell gas to its inhabitants; and should it happen that the Boston Gaslight Company, or any other, whose charter is dated previous to 1831, if there be any such, will not comply with such reasonable regulations as may be deemed necessary to ensure publicity in regard to their business, proper inspection of their gas, and a limitation of their earnings, we would recommend that the city of Boston itself, providing the right can be obtained from the Legislature, erect works (or purchase those already erected within its limits) and manufacture gas for the supply of its citizens. The gas supply can be managed in about the same manner as the water supply, which, it cannot be denied, has in past years been very successfully carried on.

We advise, most decidedly, against the admission of another private gas corporation within the limits of Boston to compete in the sale of gas with the existing companies, as being disadvantageous to the public generally.

In the performance of such business as the sale of gas or water, which must be a monopoly, in which the public cannot have the benefits of competition, we consider it beneficial to the public interest that the system of discounts to large consumers should be abolished.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The week has again passed over quietly as regards most branches of the iron trade, yet I am pleased, in a certain sense, to be able to note that in some branches a rather better tone is apparent. Some brands of forge pig iron appear to be recovering from the long continued depression which has affected them, and are changing hands with a little more freedom than has been observable of late. This is more particularly the case with some of the North Lincolnshire pigs, which are being more largely used by the Leeds and West Yorkshire houses than heretofore. Foundry pig is pretty well upheld in price, and is in very fair request. Particularly good Derbyshire brands, such as Clay Cross, Thorncliffe (South Yorkshire), and Leeds Airedale foundry produce is selling very well, several of the chief concerns being now steadily engaged on actual work in hand, besides having their order-books well filled; prices in consequence are fairly firm.

With reference to the supply of the township of Chapeltown by the Sheffield Water Company, I may state that the main will be laid from the existing pipes of the company at Wadsley, and not from Pitsmoor, as has been stated.

In merchant iron there is a decided tendency to lower prices, as has been evinced during the past few days by the Butterley Company lowering all classes of manufactured and merchant iron to the extent of £1 per ton, making bars £8 at the works, £8 10s. at Sheffield; plates £9 10s.; and sheets £9 10s.

The coal trade remains exceedingly depressed, and prices of all kinds, except slack, have downward tendencies. Coke, too, is abundant and cheap, local qualities being obtainable at 12s. to 14s., and Durham soft at 15s. to 18s. per ton.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade generally throughout this district is quiet, and although one or two of the large firms in the Manchester district have been filling up their stocks during the past month, supplies of round coal are plentiful, the only class of fuel that is at all scarce being slack, which is due to the small winter demand for house-fire coal. There have been a fair number of inquiries for cannel, but there has not been much placed, and, apparently, the inquiries are only intended to feel the market. Colliery proprietors, therefore, are not pushing their get, but are rather limiting their production wherever they can without injury to their mines. For the very best qualities of coal, which are in few hands, the demand is pretty nearly equal to the supply; but, in seconds and inferior sorts, the production is considerably above the market requirements, and, where the pits are not put on short time, stocks are accumulating. Good burgy meets with a fair inquiry, but common sorts are a drug. For slack more money is being asked; this month one of the large firms in the Manchester district having advanced their quotations 5d. per ton, and in the South-West Lancashire district, advances of 3d. and 6d. per ton are being asked. The average pit prices, for sales in bulk, are about 9s. 6d. to 10s. per ton for good Arley; 8s. 6d. to 9s. for common; 8s. 6d. to 9s. for good Pemberton four-feet; 6s. 6d. to 7s. for common coal; 5s. to 5s. 6d. for burgy; and 3s. 6d. to 4s. 6d. per ton for slack.

In the shipping trade there is very little doing beyond a few gas coal shipments, and low prices and keen competition are still the prevailing feature.

Systematic short time is now being adopted at some of the pits in the Wigan district, and other collieries, as a rule, are simply working up to their orders, which keep them going about four days a week.

In the iron trade there is still very little doing, and extremely low prices continue to rule in this market for most of the outside brands. Local makers, however, still make no change, and for delivery into the Manchester district they will not quote less than 56s. to 57s. per ton for No. 3 foundry; and 54s. 6d. to 55s. 6d. per ton for No. 4 forge, less 2½ per cent. For finished iron, quotations are much about the same; Staffordshire bars, delivered into this district, being quoted at £6 17s. 6d. to £7; and Middlesbrough, Lancashire, and Sheffield ditto, at £6 11s. to £6 17s. 6d. per ton; but this branch of trade is very flat, and prices are weak.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The shipments of coals from the Tyne and Wear were better last week. There was a very large supply of tonnage. More gas coals were shipped, and some few more contracts have been made abroad for the supply thence of gas, steam, manufacturing, and coking coals, but at low figures. It is pretty clear that low as steam coals are in price, they will have to be reduced; and as the season is approaching when there will be less demand for gas coals, these sorts will not hold such a commanding position in the market. In fact, the general character of the operations which are going on, and the few new contracts which have been made upon Newcastle Quayside for forward delivery, are done upon the presumption that coals will be lower the further we get into the spring. The Durham coalowners have given notice to their engineers, and to the coke burners and other off-handed men, of a further reduction of wages. The shipments of gas coals by steamers maintain a fair average coastwise. There is also a pretty fair demand for the Scandinavian ports, and for the Lower Baltic. Business is likewise opening for Cronstadt and the Upper Baltic ports.

Freights continue to favour shippers, who have the command of the market, and, if business continues as it is, will do during the first half of 1877. There is absolutely no change in the value of coasting freights. There is an abundance of little ships to load fire-bricks and other goods needed to be taken above bridge in London, and also for the large ports. Steamers do more than two-thirds of the coal trade to London, Rochester, Hamburg, and the French ports; and they take less money per ton than sailing ships are able to do. The rates paid to steamers to load coals for the Baltic and the Mediterranean are likewise low.

The best gas collieries keep up to full time; second-class cannot do that, and the steam collieries do not average five working days a fortnight.

Manufacturing business has a little more cheerful look as the spring advances. The trade which is doing, however, is for immediate delivery. There is no extension of works going on anywhere of moment; hence bricks and fire-clay goods of all kinds, new machinery, and cement are not greatly looked after, and are mostly shipped in small parcels. The chemicals most in demand abroad are bleaching powder and soda. The chemical market is undoubtedly firmer, and manufacturers continue to decline to take orders for forward delivery at the current rates.

Little need be said with regard to the iron trade. The amount of business transacted during the last week was comparatively insignificant. Makers were reported to have a large stock of pig iron on hand. Owing to the state of political affairs on the Continent, there have been few purchasers of pig iron in the market. The finished iron trade remains in a depressed state.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a meeting of the committee of the North British Association of Gas Managers, held in Edinburgh last Wednesday, the resolution was carried into effect, which was passed by the members of the Association at the last annual meeting—namely, to present Dr. Stevenson Macadam, F.R.S.E., with a small testimonial in recognition of his many valuable services freely given to the Association, and likewise as a mark of the high esteem in which he is held by the members. The present took the form of a handsome silver epergne, bearing a suitable inscription. The presentation was made by Mr. A. Macpherson, of Kirkcaldy, the President of the Association, and was acknowledged by Dr. Macadam. Cake and wine were thereafter served, and several toasts suitable to the occasion were proposed and responded to.

Within the last few weeks I had occasion to mention that it had been resolved by the Glasgow Corporation Gas Committee to divide the gas supply area into a number of districts for the purpose of instituting a system of applying a gas-governor to each of them. The suburban district of Pollokshields, which is quite adjacent to the Tradeston Gas-Works, is to be the first to enjoy the benefits of a regulated pressure. I am informed that the governor to be employed is one that has recently been devised and patented by Mr. Foulis. In the first instance, it is to be fixed upon an 18-inch main. As regards its simplicity of structure, its great sensitiveness when in action, and its small size relatively to the mains upon which it may be used, it has been very favourably spoken of. It was recently on view at the Corporation gas testing-station and meter-works, Alston Street, and it is expected that in the course of a week or two we shall be able to have its powers tested on an actual working scale.

At the village of Kilmacolm, which is fast becoming an important residential suburb of Glasgow, although it is at a distance of ten miles or so, strenuous efforts have been made during the past winter to have the roads and streets lighted with gas. By means of a voluntary subscription

raised amongst the feuars, a number of lamps were erected, and for the past three months they have been doing good service. Quite recently a public concert has been given in the village, for the purpose of adding to the fund. The lamps have now been handed over, free of expense, to the villagers as their property, and a committee, consisting about equally of feuars and ratepayers, have been appointed to provide the ways and means for maintaining the lighting in future; or, I suppose, until the time when the village shall become a burgh by the adoption of the Police (Scotland) Act.

During the past winter street lighting has also engaged the attention of the municipal authorities of the city of Aberdeen. An improvement has taken place in the lighting of the principal streets, by the introduction of flat-flame burners in place of the old cockspur jets. There are now 930 lamps which have the new burners, and as quickly as arrangements can be made for doing so the remaining 1186 will be supplied with them. With the view of still further improving the light, it is intended to supersede the present tin-plate tops by glass ones, which act in a measure as reflectors, thereby throwing the light over a greater area than is possible by the present arrangement. The lamps, to the number of 182, of about ten or a dozen public thoroughfares, have been furnished with the new tops, and gradually the lamps in the other districts of the city will be similarly improved.

Serious complaints are being made by gas consumers in Forfar regarding the quality of the gas which is supplied to them. One correspondent says that in his case it cannot be due to the small size of his meter and distributing-pipes, as they are suited for the supply of 30 burners, whereas he generally uses only five. Neither is it due, he says, to the use of old and inefficient burners; and he affirms that, in place of the gas supply improving, it is every week getting worse, both in quality and in quantity. Mr. Lowson, chairman of the Gas Committee, is inclined to treat the complaints lightly, if not even cavalierly.

The Denny Gas Consumers Company have declared a dividend of 5 per cent., and notified a reduction in the price of gas of 5d. per 1000 feet. It is 16 years since the company were formed, and this is the first dividend they have been able to declare.

The action-at-law raised in the Court of Session by Messrs. Edington and Sons and Messrs. D. Y. Stewart and Co. against the Dundee Water Commissioners, for payment of a large sum of money, which is alleged by the pursuers to be due to them for extras, is now under the consideration of Lord Curriehill and a jury. A number of important witnesses have been examined on behalf of the pursuers, and it would almost seem as if the case were to last for some days longer yet. While it is still *sub judice* it is not desirable that I should express any opinion upon the merits of the case. Several of the most eminent advocates at the Scottish bar, including the Lord Advocate, are engaged in it.

There is now every likelihood that the drainage of the extended burgh of Kirkcaldy will be immediately pushed forward. At one time it was thought that the ratepayers and feuars of Pathhead would insist upon the district being made a special drainage district; but they have wisely resolved to join with the other parts of the extended burgh for a general system of drainage, to be carried out by the imposition of a uniform rate over the whole district. A sum of at least £9000 will be expended on the proposed works. It is expected that operations will be commenced without much further loss of time.

The pig iron trade has been exceedingly dull during the past week, and the market closed on Thursday afternoon with the price at 53s. 7½d. cash. Owing to wages disputes, a number of blast furnaces have been temporarily damped out.

There have been a few more orders for house coal recently, and shipping orders have also been more plentiful, but prices are in an unsettled condition, with little or no appearance of improvement.

GAS APPARATUS EXHIBITION.—We call the attention of our readers to the announcement made in our advertising columns, that the opening of the exhibition projected by the South Shields Gas Company will take place on Monday next. From the interest attached to this exhibition we trust there will be a large attendance.

DEATH OF MR. C. E. CAWLEY, M.P.—The announcement of the death of this gentleman, so well known in political and gas circles, appeared in the papers of yesterday. Mr. Cawley was by profession a civil engineer, and was for some years chairman of the Salford Corporation Gas Committee. Since 1868 he had represented the borough of Salford in Parliament.

SCARBOROUGH WATER COMPANY.—A meeting of the shareholders of this company was held on Monday, March 26th—the Mayor (Mr. B. Fowler) presiding—to present a testimonial to the chairman of the company, Mr. John Woodall, who had presided over their affairs ever since the formation in 1845. The memorial consisted of a large and massive silver vase, 36 inches in height, parcel gilt and oxidized, and bearing a suitable inscription.

REDUCTIONS IN THE PRICE OF GAS.—The Leamington Priors Gas Company have agreed to make a reduction of 3d. in the price of gas, which will now be charged 4s. per 1000 feet. At the meeting of the Horncastle Local Board on the 22nd ult., it was decided that the price of gas from Jan. 1 to June 30, 1877, be 4s. 7d. per 1000 feet. This is a reduction of 1s. 3d. per 1000 on the amount paid before the purchase of the gas-works by the local board.

SALE OF PROVINCIAL GAS SHARES.—On Tuesday, the 20th ult., twelve £10 paid-up shares in the Folkestone Gas Company were sold by auction, and realized £21 7s. 6d. each; and three shares of the same company of the capital created in 1876, at £15 17s. 6d. each. Ten £5 paid-up shares in the Rochester and Chatham Gas Company were sold by auction on the 27th ult., and realized £8 5s. each, and ten £10 shares in the Hornsey Gas Company for £20 each.

STOCKTON AND MIDDLESBROUGH CORPORATIONS WATER-WORKS PURCHASE.—The joint committee appointed by these corporations to arrange the details for the transference of the water-works under the Act of last session, have served the requisite notices on the directors of the water company, in order thereon to obtain possession of their undertaking, and they have recommended the councils to appoint Mr. Venables, Q.C., their leading counsel when the Bill was in Parliament, to act for them in the approaching arbitration. The recommendation has been approved.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

1049—WESTON, G., Sheffield, "The lighting and extinguishing of public and other lamps." March 16, 1877.

1063—LAKE, W. R., Southampton Buildings, London, "Improvements in gas motor engines." A communication. March 16, 1877.

1064—LAKE, W. R., Southampton Buildings, London, "An improved method of treating sewage for separating the liquid from the solid portions thereof, and deodorizing and purifying the same." A communication. March 16, 1877.

- 1068.—BRADSHAW, A., Accrington, Lancs, "Improvements in gauges for recording pressures." March 16, 1877.
- 1104.—FIRMIN, W., Hackney Road, London, "Improvements in ball-valves or ball-cocks." March 20, 1877.
- 1126.—SPRUYT DE BAY, C., Westminster, "A new method of and apparatus for giving movement or power to liquids or air or other gas, or for receiving it from the same." March 21, 1877.
- 1127.—CLARK, A. M., Chancery Lane, London, "An improved process for preventing the accumulation of carbon in retorts used for the distillation of carburetted hydrogen." A communication. March 21, 1877.
- 1152.—COTTON, J., Bradford, York, "An improvement in the construction of taps and cocks." March 23, 1877.
- 1158.—BELL, W., Great Suffolk Street, London, and BLAGEBURN, C., Newcastle-on-Tyne, "Improvements in pumps." March 24, 1877.
- 1160.—WILSON, W. P., Peckham, London, "Improvements in apparatus used in the manufacture of gas." March 24, 1877.
- 1167.—MORGAN, T., Charing Cross, London, "Improvements in engines and pumps actuated by steam or other power." A communication. March 24, 1877.
- 1180.—SINGER, A. W., Coventry, Warwick, "Improvements in shifting spanners." March 26, 1877.
- 1184.—PARIS, J., Stratford, London, "Improvements in flat irons to be heated by gas and air, and in burners for the same." March 26, 1877.
- 1209.—VERSTRAETEN, T., Brussels, "Improvements in joining together the ends of pipes and tubes." March 27, 1877.
- 1223.—SRIÉ, C. A., Paris, "An improved apparatus for carburetted lighting gas." March 28, 1877.
- 1246.—YOUNG, W., Clippens, Renfrew, N.B., "Improvements in the destructive distillation of coal and other bituminous substances, the same being in part applicable to the manufacture of oil and gas." March 29, 1877.
- 1250.—BRINJES, J. F., Whitechapel, London, "Improvements in machinery or apparatus for raising, forcing, and exhausting water and other liquids, also air and gases." March 29, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3786.—BREWER, E. G., Chancery Lane, London, "Improvements in fire-engines and pumps, and in apparatus connected therewith." A communication. Sept. 28, 1876.
- 3884.—MARTIN, J. R., Shoreditch, London, "Improvements in rotary pumps and engines." Oct. 7, 1876.
- 4296.—WESTINGHOUSE, G., jun., Pennsylvania, U.S.A., "Improvements in and in apparatus for lighting railway carriages." Partly a communication. Nov. 7, 1876.
- 108.—OSMOND, S., Bishopsgate Street Within, London, "Improvements connected with supplying water to closets and for domestic uses." Jan. 9, 1877.
- 21.—CAMARGO PINTO, F. DE, Kennington Road, London, "Improvements in steam or other fluids, motor-engines, or pumps." Jan. 2, 1877.
- 422.—KIRKHAM, C.E., T. N., Westminster, HULETT, D., High Holborn, London, CHANDLER, S., jun., and CHANDLER, J., Newington Causeway, London, "Improvements in apparatus for the purification of gas." Feb. 1, 1877.
- 487.—MATHER, W., Salford, Lancs, "Improvements in apparatus to be used in raising water from artesian and other wells." Feb. 5, 1877.
- 491.—OTTO, N. A., Deutz, Germany, and CROSSLEY, F. W., Manchester, "Improvements in gas motor engines." Feb. 5, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

- 813.—GOOLD, G., "Improvements in cocks or valves for regulating the flow of liquids." March 5, 1874.
- 815.—HASELTINE, G., "Improvements in dry gas-meters." March 5, 1874.
- 839.—WILLOUGHBY, J., SOUTHWELL, W. A., BRIGGS, T. J., and WILLOUGHBY, S., "Improvements in apparatus for distilling tar and the products thereof." March 7, 1874.

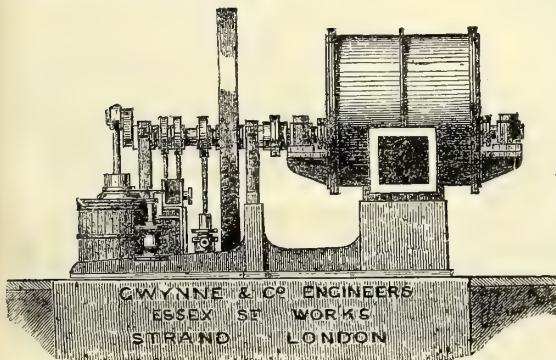
Share List of Metropolitan Gas and Water Companies.

(Corrected by Mr. F. N. GOLDING, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent. p. Ann.	Latest Quotations.
10000	£	GAS COMPANIES.	£ s. d.	£ s. d.	£	5000	£	GAS COMPANIES.	£ s. d.	£ s. d.	£	9000	£	GAS COMPANIES.	£ s. d.	£ s. d.	£
5000	20	Anglo-Romano . .	20 0 0	9 0 0	20-22	50000	50	Hong Kong (Lim.)	10 8 0	10 0 0	183-193	1500	10	United General . .	4 0 0	2 10 0	3-3½
1000	20	Bahia (Limited). .	20 0 0	2 0 0	14-16	2500000	Sk.	Imprl. Continental	43 15 0	9 10 0	96-98	1500	10	Wandsw. & Putney	10 0 0	10 0 0	19-20
1500	20	Do., do., redeem.	20 0 0	2 0 0	25-27	1500000	Sk.	London	100 0 0	10 0 0	219-223	2957	10	Do.,	10 0 0	7 10 0	11-12
40000	5	Do., 2nd pref. . .	5 0 0	7 10 0	21-22	14450	Sk.	Do., 1st pref. . .	100 0 0	6 0 0	140-145	993	10	Do.,	3 0 0	7 0 0	..
10000	5	Bombay (Limited). .	5 0 0	7 10 0	71-73	4350	Sk.	Do., 2nd pref. . .	100 0 0	6 0 0	115-120	16000	5	Do.,	5 0 0	10 0 0	8-8½
10000	5	Do., fourth issue.	4 0 0	7 0 0	51-53	25	Sk.	Do., 3rd pref. . .	100 0 0	6 0 0	115-120	10000	5	West Ham	2 10 0	10 0 0	3-4
10000	20	British (Limited). .	20 0 0	10 0 0	41-43	268057	All	Do., A shares . .	12 10 0	6 0 0	34-36			Do., new shares .	2 10 0	10 0 0	..
7500	20	Cagliari (Limited). .	20 0 0	5 0 0	16-17	15000	5	Do., Debent. stk.	100 0 0	57 & 67.	..						
5500000	Sk.	Commercial . . .	100 0 0	10 0 0	0 217-222	6000	5	Malta and Mediter-	5 0 0	2 0 0	21-3						
70000	100	Do., 7 per cent. .	20 0 0	6 0 0	150-155	20000	5	anean (Limited). .	5 0 0	7 10 0	5-5½						
20000	20	Continental Union.	12 10 0	6 0 0	22-23	25000	5	Do., preference . .	2 0 0	..	4-1						
10000	20	Do., new	20 0 0	7 0 0	11-13 pm	8000	20	5 Mauritius (Limited)	20 0 0	8 0 0	19-20						
10000	20	Do., preference . .	20 0 0	7 0 0	26-28		20	Monte Video (Lim.)	20 0 0	8 0 0	..						
75000	Sk.	Crystal Palace Dis-	100 0 0	0 0 0	0 215-220		10	Nietheroy, Brazil	10 0 0	3 10 0	..						
125000	Sk.	Do., 7 per cent. .	100 0 0	7 0 0	0 150-155		5	(Limited)	5 0 0	9 10 0	81-83						
50000	Sk.	Do., preference . .	100 0 0	6 0 0	0 135-140		5	Oriental (Calcutta).	3 0 0	9 10 0	21-23 pm						
23406	10	European (Limited)	10 0 0	10 0 0	0 182-192		5	Do., new shares . .	5 0 0	3 10 0	21-23						
12000	10	Do., new shares . .	7 10 0	10 0 0	0 67-8 pm		10	5 Ottoman (Limited).	5 0 0	3 0 0	21-23						
35406	10	Do., new shares . .	5 0 0	10 0 0	0 51-52 pm		20	Para (Limited) . .	10 0 0	7 0 0	5-5½						
3797770	Sk.	Gaslight & Coke A.	100 0 0	10 0 0	0 216-218		100	Phœnix	20 0 0	10 0 0	44-46						
1000000	Sk.	Do. B.	100 0 0	4 0 0	0 85-90		100	Do., new	60 0 0	7 10 0	103-108						
30000	10	Do. 5 per ct. pref.	all	5 0 0	0 201-21		Sk.	Do., capitalized . .	100 0 0	5 0 0	107-112						
50000	10	Do. conv., 3rd issue.	all	5 0 0	0 201-21		20	Do., new, 1876. . .	20 0 0	10 0 0	..						
50000	10	Do. do., 4th do. .	6 0 0	5 0 0	0 94-92 pm		5	Rio de Janeiro (L.)	5 0 0	7 10 0	51-53						
2000000	Sk.	Do. do., 5th do. .	2 0 0	5 0 0	0 99-94 pm		5	Singapore (Limited)	5 0 0	7 10 0	51-53						
3000000	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	0 230-233		32½	Do., preference . .	5 0 0	7 10 0	51-61						
1650000	Sk.	Do. D do. do. . .	100 0 0	10 0 0	0 230-233		50	Shanghai	32 10 0	12 0 0	30-32						
3000000	Sk.	Do. E do. do. . .	100 0 0	10 0 0	0 230-233		12½	South Metropolitan	50 0 0	10 0 0	112-115						
2000000	Sk.	Do. F 5 do. do. .	100 0 0	5 0 0	0 114-116		12½	Do.,	12 10 0	10 0 0	28-29						
600000	Sk.	Do. G 7½ do. do.	100 0 0	7 10 0	0 165-170			Do., new shares .	10 10 0	10 0 0	13-14						
13000000	Sk.	Do. H	100 0 0	7 0 0	0 153-156						pm.						
6200	5	Georgetown, Guiana	5 0 0	5 0 0	..		10	Surrey Consumers.	10 0 0	10 0 0	22-24						
							10000	Do., new	8 0 0	10 0 0	10-11 pm						

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

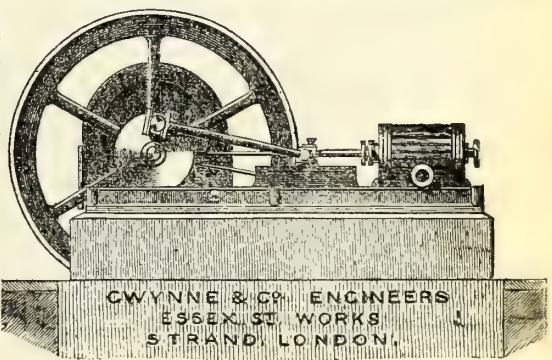
Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines, with many others of all Sizes.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

WANTED, a steady single Man, as STOKER, by the SPILSBY GAS COMPANY.

WANTED, by a respectable Married MAN, aged 35, a situation as STOKER in a small country gas-work; 15 years testimonials.
Address X. Y. Z., 142, Columbia Road, Hackney Road, LONDON, E.

WANTED, by a Lancashire Manufacturing Chemist, large or small quantities of strong Gas AMMONIACAL LIQUOR, above 8° Twaddell.
Address No. 353, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a respectable Young MAN, aged 20, a situation as CLERK and COLLECTOR in a Gas-Work where opportunity is afforded to learn the main-laying and gas-fitting. Four years good reference.
Address P., Gas-Works, Bulth, BRECON.

WANTED, a situation as a Working MANAGER in a small Gas-Work. Well up in manufacturing and purifying gas. Can do all main and service laying, and all fittings in works and out.
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WANTED immediately, an efficient FOREMAN for a small Gas-Work, to lay mains and services, and to do repairs on works, and competent to take charge of the works in the absence of the Manager.
Apply, with testimonials, and stating wages, to Mr. G. SMEDLEY, Gas-Works, BUXTON.

WANTED directly, two good steady MEN, as STOKERS, used to scoop, and able to control other men working under them. Wages 33s. per week. None need apply who cannot be well recommended.
Address No. 356, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

METER REPAIRER.
WANTED, at the Reading Gas-Works, a steady and experienced METER REPAIRER. Used to both Wet and Dry Meters. The situation is a permanent one.
Apply, stating age, experience, and wages required, to Mr. E. BAKER, Engineer.

SMALL Gas-Works wanted, to Purchase or RENT, within 20 miles of London.
Address, with full particulars, "Gas," care of Ashurst, Morris, and Co., 6, Old Jewry, LONDON, E.C.

TO BE LET or SOLD, a Property in the vicinity of London, admirably adapted for the erection of Water-Works, having an abundant supply of the purest spring water from the chalk.
For further particulars, apply to DRIVER and HAYWOOD, 5, Victoria Street, WESTMINSTER, S.W.

TO BE SOLD, Four Cast-Iron Purifiers, 6 ft. square, with hydraulic centre-valve; also Ten 18-in. round, and Sixty-two 15-in. round Retort Mouthpieces, and Forty-seven 6-in. H-Pipes.
Apply to W. WINSTANLEY, Manager, Gas-Works, NEW-CASTLE-UNDER-LYME.

TO GAS COMPANIES, CORPORATIONS, &c.

THE Advertiser (age under 40) has had nearly 20 years experience as ASSISTANT-ENGINEER of one of the largest gas establishments on the Continent, and is thoroughly acquainted with the construction and working of all the apparatuses connected with the manufacture, distribution, and analysis of gas; speaks and writes English, French, and German, and is at present resident engineer on Gas-Works of 300 to 400 million cubic feet working capacity (on the Continent). He is desirous to find a more remunerative, and equally permanent, APPOINTMENT than the one he now holds, and is in a position to offer first-rate references.
Address E. F. 4613, care of Messrs. Haassenstein and Vogler, Hamburg, GERMANY.

WALTON-ON-THAMES AND WEYBRIDGE GAS COMPANY.

FOR SALE, Three Engines and Exhausters (Two by Gwynne, and one by Waller) for 15,000 feet per hour. Being about to be replaced by larger ones.

Can be seen at the Works, Walton-on-Thames, or particulars can be had of Mr. GEORGE ANDERSON, 35a, Great George Street, WESTMINSTER.

GASHOLDERS.

FOR SALE, Two Telescope Gasholders.

One 50 ft. by 16 ft., the other 70 ft. by 20 ft., each complete, with cast-iron tanks, columns, girders, and inlet and outlet pipes, valves, &c., both of modern construction, in good condition, and made by Messrs. Piggott and Co., of Birmingham. To be seen at work at the Gas-Works, Birkenhead. Cause of removal to make room for extensions. To be sold a bargain, taken down and re-erected ready for work.

For particulars apply to ASHMORE and WHILE, STOCKTON-ON-TEES; or to view, apply to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

FOR SALE, Two Telescope Gasholders.

One 52 ft. diameter by 22 ft., the other 52 ft. diameter by 28 ft., and one Single-Lift GASHOLDER, 50 ft. diameter by 14 ft., each complete, with columns, girders, inlet and outlet pipes, valves, &c.

Also Two 7-in. Parkinson's GOVERNORS. May be seen, and further particulars obtained, on application to Mr. C. Hunt, Engineer, Gas-Works, Windsor Street, Birmingham.

Tenders will be received not later than the 21st inst., to be addressed to the CHAIRMAN of the Works Sub-Committee, Gas Offices, Old Square, BIRMINGHAM.

Birmingham, April 3, 1877.

THE Swansea Gaslight Company have

for immediate SALE, the following Plant:—

A 6-h.p. Patent Trunk Engine. (Beale.)

Exhauster to pass 15,000 feet per hour. (Beale.)

An 8-h.p. Grasshopper Engine. (Easton and Amos.)

Exhauster, 20,000 ft. per hour. (Beale.)

Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.

Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.

A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.

May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.

Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

READING GAS COMPANY.

FOR SALE, as they now stand, and at any reasonable price, as the ground upon which they stand is wanted, four 12-ft. square Cast-Iron PURIFIERS, with centre-valve and connexions, grids, tee bars, &c., complete.
Apply to Mr. E. BAKER, Engineer, Gas-Works, READING

THE Blackburn Gaslight and Coke Company have FOR SALE one 25,000 feet per hour EXHAUSTER and ENGINE combined, with one 10-horse power BOILER. The Exhauster is by Musgrave and Co., of Bolton, and is only to be sold as it has been replaced by a larger one. Also four Wrought-Iron GIRDERS, 32 ft. long, 18 in. deep, 17 in. wide, double plated, at top, bottom, and web, with 3-in. plates.

Application for price, &c., to be made to the undersigned.

S. R. OGDEN, Engineer.

THE Kingston-upon-Thames Gas Company have FOR SALE, cheap, second-hand PLANT as under:—

Two 12-ft. square PURIFIERS, with wrought-iron lids and lifting apparatus complete.

A quantity of 9-in. RACK-VALVES and connexions.

A Cornish BOILER, 4 ft. diameter by 10 ft. long, with safety-valves, furnace work, &c., complete.

A STATION-METER, made by Parkinson, to pass 20,000 feet per hour.

The whole of the above have been thrown out of use to make room for plant of larger dimensions.

H. F. PACKHAM, Engineer and Manager.

CANTERBURY GAS AND WATER COMPANY.

TO MANUFACTURING CHEMISTS.

OFFERS are invited for about 100 Tons of SPENT OXIDE.

Samples will be sent on application to the Manager of the Gas-Works.

JAMES BURCH, Secretary.

March 26, 1877.

TO COAL MERCHANTS.

THE Directors of the Horsham Gas Company, Limited, in Sussex, invite TENDERS for a supply of COALS for One year commencing May 1, 1877.

The description to be either Pelaw, Felton, or Holmside. The quantity required will be about 150 tons per month, to be delivered as required at the Horsham Railway Station, carriage paid.

The coals delivered in each month to be paid for by cheques drawn on the second Monday of the following month.

Sealed tenders, endorsed "Tender for Coals," to be sent to the undersigned on or before Saturday, April 7.

ROBT. SHEPPARD, Secretary.

TO MANUFACTURING CHEMISTS.

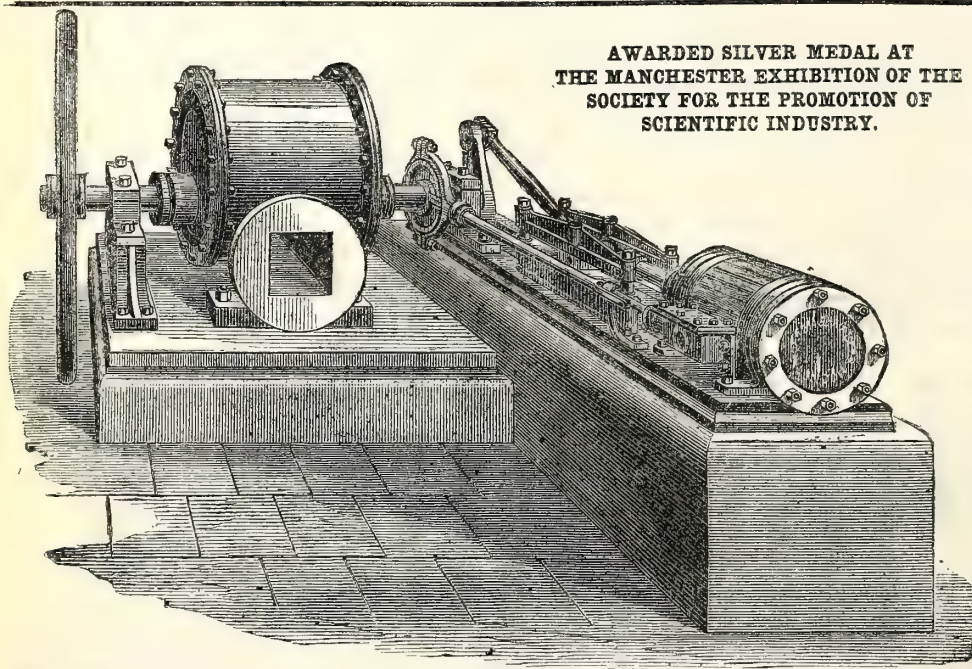
THE Macclesfield Corporation Gas Committee are prepared to receive TENDERS for the purchase of the TAR and AMMONIACAL LIQUOR made at their Gas-Works for a period of One, Two, or Three years, dating from May 1, 1877, at the option of the Committee.

Sealed tenders to be delivered at the Town-Hall, Macclesfield, not later than Saturday, April 21, 1877, endorsed "Tender for Tar and Ammoniacal Liquor," and addressed to the CHAIRMAN of the Gas Committee, Town-Hall, Macclesfield.

The Committee do not bind themselves to accept the highest or any tender.

March 27, 1877.

AWARDED SILVER MEDAL AT
THE MANCHESTER EXHIBITION OF THE
SOCIETY FOR THE PROMOTION OF
SCIENTIFIC INDUSTRY.



BEALE'S
Improved Patent
GAS-EXHAUSTERS
WITH
ENGINES COMBINED.

Sole Makers,
GEORGE WALLER & CO.

Makers of
**ENGINES, EXHAUSTERS,
INDEX and DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BY-PASS VALVES,
TAR, LIQUOR, and other PUMPS,
SCRUBBERS and PURIFIERS,
CONDENSERS, BOILERS, &c.**

**PHENIX ENGINEERING WORKS,
HOLLAND STREET, S.E.,
AND
STROUD, GLOUCESTERSHIRE.**

D. BRUCE PEEBLES & CO.,
ENGINEERS,
FOUNTAINBRIDGE WORKS, EDINBURGH,
MANUFACTURERS OF WET AND DRY GAS-METERS;
Patentees and Sole Manufacturers of "PEEBLES' GAS-GOVERNORS,"
FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS,
OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.
"These Lamp-Governors are so superior that they are likely to supplant all others."—Dr. Wm. Wallace, F.R.S.E., F.C.S.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

A COUNTRY MANAGER.—The almost universal rule is six-tenths pressure from sunrise to sunset, and eight-tenths from sunset to midnight. It is difficult to answer your second question without a knowledge of the character of the district, the diameter of the pipes, and the initial pressure.

LECTURES ON THE CHEMISTRY OF GAS MANUFACTURE.—Mr. Vernon Harcourt's third lecture is in type, but the pressure upon our columns this week compels us to defer its publication.

R. W., London.—Received.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 10, 1877.

Circular to Gas Companies.

On Friday last Mr. Raikes duly brought forward his motion for the adoption by the House of Commons of a new Standing Order, which, if carried, will require the introduction, in every future Gas Bill (and, of course, Provisional Order), of a clause compelling the sale of all newly-issued capital by public auction. The motion met with a more strenuous opposition than we had anticipated, considering the shortness of the notice given, and the consideration of it has been deferred for a time. In consequence of the action taken by the Gas and Water Companies Association, Mr. Raikes was made fully aware of the objections which would be made to his proposal, and these he endeavoured to answer, in his speech, by anticipation. We may be excused for believing that he succeeded very badly in fulfilling his task. The first and fundamental objection to such a Standing Order as proposed is, that it would virtually repeal one section of an Act of Parliament (the Companies Clauses Act, 1863), the existence of which has a distinct and pronounced influence in settling the value of stocks and shares in Gas Companies. In arriving at the worth of these, consideration has always been given to the fact, that the Legislature had provided for allotment of new shares to existing shareholders, if they desired to become possessed of them. It is but simple fairness to original investors, who have risked their money on a doubtful venture, that they should participate in the advantages to be derived when their undertaking proves successful; and it is no more than fair that investors, who bought original shares at a considerable premium, should be seized in the privileges appertaining to the shares they bought. That was

the view taken by the Board of Trade in 1863. But, "other men, other measures." To-day we are in face of officials whose efforts are directed towards reducing the profits of trade to a minimum, as far their (happily limited) powers allow.

It is the peculiarity of Gas Companies (and Water Companies as well) that, with well-chosen districts, their operations are continually extending, so that their capital, as a rule, requires to be doubled every eight or ten years. It is a knowledge of this fact which has induced investors to purchase shares at a premium, relying on the parliamentary guarantee that they would participate in the benefits to be derived from extensions. As a consequence, "millions of capital have changed hands in the last few years, at a price they would not have realized but for this beneficial contingency." Auction clauses would, of course, extinguish this "beneficial contingency," and would, therefore, confiscate not a small portion of the investor's money.

Looked at in another light, the proposed "Standing Order" appears to be of an eminently unconstitutional character. Standing Orders, says Sir Erskine May, in his "Practice of Parliament," are agreed to by both Houses for the permanent order and guidance of their proceedings. We do not pretend to be learned in the matter, but we do not remember any Standing Order which can be said to dictate the terms of any enactment. There is, we believe, no "Standing Order" which limits the dividend on new capital to seven per cent. The rate has been accepted because Lord Redesdale willed it, and the Commons Committees agreed to his dictation. It is, then, rightly contended, that if it be expedient to alter the present law, it should be done in a legal manner, by means of an Act, and not by a dictatorial "Order" worthy of a Turkish Parliament. What is the next "Standing Order" we may expect to be proposed? It is perfectly competent for Parliament to repeal or alter any of the general Acts which now regulate the management of joint-stock undertakings; but it should be done openly, so that all parties interested may use every constitutional means for their protection. There is, in this case, a doubt entertained by those competent to judge, whether or not the right to petition against a proposed Standing Order, which, as we said above, is only to guide the proceedings of the House, exists. There was once a Vice-Chancellor, who prefaced a judgment by inquiring of the Bar whether any short Act, altering all the law of England, had been recently passed. If he were alive now, he might ask whether any "Standing Order" had been made dictating the law. It is, of course, perfectly competent for a Select Committee to insist on the insertion of particular clauses in private Bills, and they may insist on auction clauses if they choose. That is constitutional, though it may be unjust in some cases.

Mr. Raikes may be said to have "let the cat out of the bag" when he brought forward the case of the Isle of Thanet Gas Company. Possibly the decision of the Select Committee on their Bill did not please the officials of the Board of Trade, who are notoriously favourable to the transfer of gas undertakings to Local Authorities. The object, therefore, was to get the Standing Order adopted before the Company's Bill came before the Committee for the consideration of clauses. Now, whatever may have been the sins of the Isle of Thanet Company—and, whatever they may have been, they have been purely legal sins—we do not see why every Gas Company who may go to Parliament in the future should be compelled to make an expiatory sacrifice. Let the Committee inflict auction clauses on the Isle of Thanet Company if they choose, but let all other Companies stand on their merits.

We have to confess that we do not clearly appreciate the force of Mr. Speaker's explanation. It may be competent for the House to reject an auction clause on the third reading of the Bill, after it had been inserted by a Committee; but, in our innocence, we have supposed that a "Standing Order," unsuspended, bound the House as much as a Committee. Apart from its importance to Gas Companies, the question has much parliamentary interest, and the further discussion of it will be looked forward to with great curiosity.

There is one point to which we have neglected to allude. To secure, if he could, the votes of Railway Directors, Mr. Raikes urged that the Order he proposed could never be made applicable to Railway Bills. Why not? we should like to know. Take the case of the Taff Vale Railway Company, paying ten per cent., and with stock worth in the market £208. They will, no doubt, in time, require to raise further capital. Any extension they make must certainly be profitable, and why should not their new shares or stock be put up to auction? The stock of the London and North-Western is also at a high premium. The Company are certain to want new capital, and nothing but a complete collapse of trade can prevent them from continuing to do a very profitable business. Why should not their new capital be put up to auction?

We publish to-day, as we promised, the correspondence between the Gas Referees and the Board of Trade and the Chartered Company. Unhappily, as will be seen on a perusal of the letters, the correspondence has culminated in something like a stand-up fight between the Referees and the Company, and, under present circumstances, we dare not attempt to arbitrate. The matter referred to in the correspondence will presently be fully discussed before a Parliamentary Committee. We do not anticipate the legal proceedings which Mr. Phillips seems to expect. The small Metropolitan Local Authorities are very much averse to engaging in expensive Chancery business, and, therefore, we have no doubt the Referees will be left to defend themselves and their Instructions before a Committee of the House of Commons. We are assuming, of course, that they will be called, by one side or the other, on a Speaker's Warrant, when the Bill promoted by the Chartered Company is under consideration. It is, as our readers may see, "a very pretty quarrel as it stands," and we shall not interfere, at all events at present.

The summer Instructions of the Metropolitan Gas Referees have been issued, and they present some rather remarkable features. The most noticeable is—and it has called forth a good deal of comment—the more stringent test prescribed for the presence of sulphuretted hydrogen. Until now it has been prescribed that all the gas to be tested for illuminating power should be passed through a vessel in which was suspended a strip of bibulous paper, moistened with a solution of acetate of lead. Until the passing of the Acts of last year, the tests were three in number, made during the hours of maximum consumption. Under the recent Acts, however, the tests may be made at any hour of the day, at irregular intervals, and now the Referees have prescribed that the gas tested for sulphur and ammonia shall be passed through the apparatus containing the strips of lead paper. Under the old regulations, gas passed the lead test at the rate of five feet per hour, for about three hours and a half. Now the lead paper will be exposed to a stream of gas passing at the rate of half a cubic foot per hour for twenty hours. The occurrence of sulphuretted hydrogen in Metropolitan Gas is so rare, that we do not think the Companies need care for this undoubtedly more stringent test.

Tests for pressure are now introduced under the Acts of 1876. Six (except in a case to be mentioned presently) are to be made daily; three between the hours of sunrise and sunset, and three between the hours of sunset and midnight. The obligation to make these tests is a very serious matter for the Gas Examiners. The majority of those gentlemen are chemists of more or less reputation—one holding a professorship, and others having day engagements in laboratories. The obligation to make these pressure-tests in the daytime, will cut them off from their present day employment. Their whole time will now be occupied in gas-testing, and the Metropolitan Board of Works will necessarily be requested to reconsider the salaries of the Examiners. The exception to which we alluded above is the case of the Commercial Company, as regards which the Referees do not prescribe any number of pressure-tests. Perhaps this exception has been made in deference to the Metropolitan Board of Works, who, as we have already informed our readers, have appointed one Examiner to test the gas at two stations over three miles apart. To have required that gentleman to make six tests at each station, would have obliged him to walk about thirty-six miles a day. In mercy to him, therefore, until he has been trained by Weston, the Referees have left him to make the tests at his discretion. But this cannot be regarded as satisfactory. Six tests in the twenty-four hours are necessary or not. If necessary, they are as important at the East as at the West End. The sulphur and ammonia maxima, we may add, remain the same as fixed for the corresponding half of last year. The Commercial Company, who now, for the first time, come under the Instructions, have had a maximum of 30 grains fixed, pending the completion of their purifying arrangements.

Another large Gas Company are about to disappear. The Leicester Gas Company have agreed to sell their undertaking to the Corporation. The Company will go on with the Bill now before Parliament, with purchase clauses included. We shall refer to the consideration to be paid by the Corporation next week.

There exists in Liverpool an Association designed, it seems, to promote Municipal Reform. There are many statements in the programme they have issued which are undoubtedly true, and we believe that the shopkeepers and small ratepayers in the borough of Liverpool have real grievances. But they must not blame the Gas Company, who have only fulfilled the obligations imposed on them, taking care, we may admit, of themselves all the time. It is, however, a mere dream of the Association to think of starting competing works in the borough. Parliament

would allow nothing of the sort. If competing works should be started, the Company owning them must take the "rough with the smooth." They will never be allowed to confine their operations to the most valuable part of the United Company's district. No doubt gas could be supplied cheaper in a limited district with a large consumption, than it is now over the whole limits of the United Company; but we must caution the authors of this programme, who seem to have some real grievances to complain of, against risking their money in an endeavour to establish competing gas-works.

We feel a positive pleasure in confessing to have made an unlucky guess last week. The Directors of the Commercial Company have resolved on reducing the price of gas, after Midsummer next, to 3s. 5d. per 1000 feet. We congratulate them on their resolve, and feel sure that the consequence of the reduction will be to give much satisfaction to the consumers, and a large increase of business. A few may, perhaps, be disposed to regard meter-rents as an imposition, but most will see that when the rental is paid there is a substantial gain to the consumer.

These may be said to be "halcyon days" for Gas Companies, so the half-yearly meetings naturally pass off very pleasantly, with mutual compliments and congratulations. Of course, Mr. Raikes's proposed Standing Order attracted the attention of most speakers at the meetings, and met with universal condemnation. The Metropolitan Companies are, we think, particularly interested in this matter. When any one of them goes to Parliament, great efforts are certain to be made to inflict auction clauses upon them. As matters now stand, they may be successful in resisting the imposition, as the Commercial Company were. But if this Order be adopted, no escape will be possible.

The accounts which we publish to-day in no case call for remark. They all present satisfactory features. There is, however, a general falling-off in the amounts received for coke, which we may regret, but cannot mend.

The Alliance and Dublin Company will now appear, for the first time, as a 10 per cent. Company, and there is every promise that the rate will be maintained in the absence of disturbances in the coal trade. It is gratifying to see the business of the Company rapidly growing. We have no doubt it will go on increasing with the reduction of price. With cheap gas, perhaps Dublin tradesmen may think it to their interest to keep their shops open later. The actual state of the affairs of the Company is well described in the speech of the Chairman. On one point, we fear, he will find himself mistaken. When the last reduction of price to private consumers was made, the Corporation of Dublin agreed to pay the same price, and the Company calculated on being recouped from that source to the extent of £2000 a year. The Corporation, however, are about to "keep the word of promise to the ear, but break it to the hope." They will cheerfully pay 4s. 6d. instead of 3s. 11d., but then they will reduce the consumption in the public lamps, so that their bill may not be increased. This is sharp practice, but then the Corporation are so impecunious that they may be forgiven for practising petty economies. But really they ought to find money to pay their late gas advisers. Mr. M'Evoe has wickedly suggested that Messrs. Clemminshaw and Pritchard should do as the creditors of the Sheffield Corporation—sue the Town-Clerk who engaged their services.

The accounts of the Sheffield United Gas Company show a profit for the past half year of £29,160 11s. 7½d., and, of course, maximum dividends will be paid, leaving a balance in hand of £5724, which will be carried to the reserve-fund. That fund will then amount to £50,956. With such a sum in hand, the directors announce their intention to reduce the price of gas twopence per 1000 next June.

The gas accounts of the Corporation of Wigan for the past half year have just been issued. They show a gross profit of £10,047. After wiping off the loss in the previous half year—£2189—and paying all charges, there remains a balance of net profit of £4151 11s.

Water and Sanitary Notes.

THE subject of the water supply of rural districts was brought before the House of Commons, by Mr. A. Brown, on Friday last. The object of the honourable member was to induce the House to pass a resolution expressing the opinion that it was desirable to give Local Boards further powers to remedy existing evils. That meant, that whenever the water supply of a village or small town was considered by somebody unsatisfactory, the Local Government Board should have power to compel the Local Authority to furnish a better supply; and, further, to compel the inhabitants of the district to use it. It is obvious the charge for giving this extraordinary supply would fall mainly

on property-owners, and, in a House full of property-owners, the proposal of the member for Wenlock was promptly rejected. Perhaps the honourable member did not fully estimate the extent of the powers for which he was asking. The present Government are by no means backward in making advances towards centralization; but Mr. Selater-Booth evidently saw that if such legislation as was suggested were carried, it would create an uproar all over the country. There are many Local Boards who display "a masterly policy of inaction;" but we believe that, as a rule, the newly-constituted authorities are doing their work as well as could be expected. They have great difficulties to contend against, the chief being the disinclination on the part of their constituents—shared, no doubt, to some extent, by themselves—to pay rates. No water-works in the rural districts could be expected to pay. They must be constructed and maintained out of the public rates, and a shilling rate, in addition to some charge for water, would be a serious grievance to a ten-pound householder, who may have a well behind his house, the water of which he and his family have drunk all their lives, and have never been harmed. Still, we seriously believe that the question deserves a fuller consideration than it has yet received. We are inclined to regret that the Government did not issue the Royal Commission once suggested. The Rivers Pollution Commissioner, in his last report, only tells us when he considers the water bad, and does not indicate where and how a better supply is to be obtained and distributed; and this latter is the information wanted. Rural Authorities, we believe, would do their duty in respect of water supply, if they were shown how to do it at a reasonable cost.

Correspondence.

AUCTION CLAUSES IN GAS BILLS.

SIR,—Your readers will have seen by the papers that Mr. Raikes's motion for a new Standing Order was brought on in the House on Friday last, and that it was adjourned till Tuesday, the 17th inst., to afford time to consider the best mode of dealing with this question.

As the motion referred to gas companies alone, the discussion was necessarily confined to the effect it would have upon gas companies. It must not, however, be inferred from this that the opposition to the motion was confined to gas companies, or to the effect it would have upon gas property.

The motion was opposed by members of all shades of political opinion, and the opposition was directed against the principle of making such a regulation by a Standing Order. On this ground the railway interests took an active part in the opposition, and contributed largely to the result.

The Companies Clauses Act, 1863, provides that when the shares of a company are at a premium, and additional capital is required, the shares for such capital shall be allotted rateably among the holders of the existing capital.

The motion submitted to the House was that every gas Bill should contain a provision for all new shares for additional capital being sold by auction, and this, the opponents of the motion contended, would be, in effect, repealing an Act of Parliament by a Standing Order.

During the discussion, the Speaker was asked whether a Standing Order repealing an Act of Parliament could be put from the chair; and the Speaker, in reply, said, in effect, that if such a provision as the one under discussion were inserted in a Bill, and the Bill were passed, the Act of 1863 would be repealed by the Act, and not by the Standing Order.

Technically speaking, this is no doubt true, but if an Act of Parliament says that all new shares for additional capital shall be allotted rateably among the holders of existing shares, and a Standing Order says, in effect, that no Bill shall pass the House with such a provision in it, if it is not actually repealing that Act it is overriding it, and the fact of its being made applicable to one class of companies only merely makes the matter worse.

It would doubtless have been more satisfactory if the question had been enlarged, and the Speaker asked whether, considering the effect and operation of such a provision, it came within the scope and intent of the Standing Orders, and notice given the day before of the intention to ask it, so as to have enabled him to consider the matter before giving an answer.

As the matter now stands, a question has been asked, Is it competent for the House to entertain a certain proposal? and the reply is that the motion before the House does not contemplate such a proposal, which settles nothing.

The honourable member who moved the motion said it did not apply to railways, for reasons which he explained; but in discussing principles, it is not possible to limit them to any single point of detail. The principle here is, is the raising of capital for commercial undertakings, authorized by Acts of Parliament, to be governed by Acts of Parliament or by Standing Orders?

If the House is justified in passing a Standing Order that the shares in all future capital shall be sold by auction, it would, in strict analogy, be justified in passing an Order that no future capital shall be allowed to receive a higher dividend than 5 per cent., and this is the question that the House, when the motion is brought up again, will have to decide.

All this, however, is apart from the object the authorities have in view, and that is, how to deal with the future capital of gas companies.

It is said, on the one hand, that the companies have a monopoly of their respective districts, and that, as a condition of that monopoly,

they are required to supply the public with gas at the lowest price at which it can be manufactured, consistently with the provisions of the Gas-Works Clauses Act, 1847, which authorizes the payment of dividends of 10 per cent., and the making of a reserve-fund at the same rate, and provides that any profit beyond that shall be applied to a reduction of the price, but that the companies, tempted by the 10 per cent., enlarge their capital unnecessarily, and keep up the price to maintain the 10 per cent., to the prejudice of the public.

When a company have a special Act, they are, no doubt, secured a monopoly of their district. For a long time it was considered that this gave to the company a great advantage, as it was the practice of local authorities, under the belief that they had the power, to allow any new company to open the streets in districts where the supply was not in the hands of an incorporated company; but recent decisions having conclusively established the fact that the local authorities cannot give this power, a company are, in effect, almost as secure in their district without a special Act as with one.

The companies subject to the present regulations are required to supply gas at all times of the same uniform quality, and are limited in price, dividend, amount of capital, and district, the dividend on the original capital being 10 per cent., and additional capital 7 per cent.

The companies not subject to these regulations may, and do, supply gas of any quality the coals they happen to be using will give, and pay any dividend they can earn upon old and new capital alike, and very frequently they charge a price that not only enables them to pay a larger dividend than 10 per cent., but to make the greater part of their extensions out of profits as well.

The companies without special Acts very naturally avoid placing themselves under regulations as long as they possibly can, and this, as they number more than two to one of the others, causes great dissatisfaction, and the public, not being able to distinguish one from the other, or not being aware that there is any difference between them, blame all companies alike, and think that all the existing regulations are a farce, and the companies override them at pleasure.

The present state of things in the provinces is very unsatisfactory, and ought to be altered, but the selling of shares by auction will not make any improvement; on the contrary, it will merely be a vexatious regulation, limited in its operation to those companies against whom, as a body, there is no just ground of complaint, and leaving untouched all those against whom it ought to be directed.

Under the present state of things, the companies who have submitted to regulations have no advantages over those who have not, yet they are made the scapegoats of all the irregularities; first in having their dividends limited to 10 per cent., then reduced to 7 per cent., and now for the new shares to be sold by auction.

If the (say) independent companies were unwilling before to come under statutory regulations, they will be still more unwilling to do so if all new shares are to be sold by auction, and it may be confidently predicted that they never will do so unless they are obliged; the effect, in the public interest, of the provision will, therefore, be to do more harm than good.

With all deference to the authorities, this is not the proper mode of proceeding. While there are so many companies not under any regulations at all, and these various alterations are so limited in their operation, it is unwise to make them. They only cause irritation, lessen the inclination to provide for the public, and do no appreciable benefit to any one.

The proper course to take would be to amend and enlarge the Gas-Works Clauses Acts, and to make it compulsory upon all the independent companies to place themselves under those Acts within a given time.

It will be said that this would be a very arbitrary interference with private enterprise; but, on the other hand, it must be borne in mind that no person has a right to open the streets, stop up the thoroughfares, and obstruct his neighbour's business, for his own special gain; and that it has been decided that Parliament alone can confer such a right; and as the independent companies are doing this continually without authority, no one can question the right of Parliament to stop it.

When companies apply to Parliament for these powers, they are allowed to have the exclusive supply of their respective districts, upon certain conditions; but the independent companies are, by the operation of the general law, secured in their respective districts, and exercise all the same rights and privileges as the other companies, without taking upon themselves any of the conditions upon which such powers are granted, and the irregularities consequent upon this state of things are the cause of a strong feeling of dissatisfaction against gas companies generally.

If all companies were placed under regulations, much of this dissatisfaction would disappear of itself, and these incessant alterations would become unnecessary; but while, under the present state of things, they are unavoidably so limited in their operation, and cannot be of any public benefit, it is unwise to propose them.

W. LIVESLEY.

Gas and Water Companies Association, 6, Victoria Street,
Westminster, April 9, 1877.

A NEW INTOXICANT.—On Wednesday last a man was charged at the Aston Police Court with drunkenness. He was seen by a police-constable tumbling about the road in a state of intoxication, and was taken into custody. In defence, he pleaded that he "was not intoxicated with drink, but with gas." He was, as he explained to the Bench, a gas-fitter, and, having been engaged at work, had inhaled a quantity of gas. Instead of taking some spirits, as he generally did under such circumstances, he imprudently drank a small quantity of beer. This on top of the gas reduced him to the condition in which he was found by the police. As it was difficult to ascertain which had made him drunk, the gas or the beer, the magistrates gave him the benefit of the doubt, and dismissed the case, advising him, however, "not to inhale too much gas next time." The case is worthy of note by the police, who, when exercising their proverbially sharp noses in attempting to detect the smell of spirits, should try also for gas, which may have been turned too freely on at the tap.—*Pall Mall Gazette*.

Parliamentary Intelligence.

HOUSE OF COMMONS.

THURSDAY, APRIL 5, 1877.

The Dundee Gas and the West Surrey Water Bills were read the third time, and passed.

The following Bills, as amended, were considered:—Maryport District and Harbour Gas; Middlesbrough Corporation; Rotherham Corporation; Warrington Corporation Gas.

The Woolwich, Plumstead, and Charlton Consumers Gas Bill was read a second time, and committed.

The Examiners reported that no Standing Orders, not previously inquired into, are applicable in the case of the Lowestoft Water, Gas, and Market Bill (Lords).

The petitions were withdrawn of Owners, &c., of the township of Turton against the Bolton Improvement Bill; and of the Great Western Railway Company against the Bristol United Gas Bill.

The Select Committee on the Glasgow Corporation Water and Perth Water Bills was again changed by the appointment of Mr. W. W. Beach as chairman in place of Mr. Heygate.

AUCTION CLAUSES IN GAS BILLS.

Petitions against the motion for a new Standing Order respecting the sale of gas companies shares by auction were presented by Mr. Rodwell, from The London Gaslight Company; by Colonel Makins, from the Phoenix Gaslight and Coke Company, the Surrey Consumers Gaslight and Coke Company, and the Crystal Palace District Gas Company; also from the Harrow, Kingston-upon-Thames, Sheffield United, City of Durham, Tunbridge Wells, York United, Farnworth and Kearsley, Dartford, Derby, West Ham, Croydon Commercial, Leicester, Altrincham, Hampton Court, Barnet District, and the Isle of Thanet Gas Companies.

In reply to Mr. KNATCHBULL-HUGGESS, Mr. RAIKES said nothing would be done in regard to this matter without sufficient consideration and deliberation. His notice had now been in the paper for something like a fortnight, and there was a special reason for proceeding without delay, as there were awaiting commitment a considerable number of gas Bills, to which the proposed Standing Order would apply. He thought it convenient the matter should be brought before the House on Friday, when, of course, it would be competent for the House to deal with it as it thought fit.

FRIDAY, APRIL 6.

On the motion of Sir CHARLES FORSTER, the Order of Feb. 19, "That the Tunbridge Wells Water Bill be committed," was discharged, and the Bill withdrawn.

The petitions were withdrawn of the Westhoughton Local Board against the Bolton Improvement Bill; of the London and North-Western Railway Company against the Carnforth District Water Bill; and of the Caledonian and Glasgow and South-Western Railway Companies and others against the Glasgow Corporation Water Bill.

AUCTION CLAUSES IN GAS BILLS.

Petitions against the new Standing Order, proposed by the Chairman of Ways and Means, were presented by Sir Henry Havelock, from the Sunderland and South Shields Water Company; by Mr. Rodwell, from the Eastbourne, Newcastle-under-Lyme, Ashton, Maidstone, South Shields, Taunton, Ecclehill, Windsor Royal, Chelmsford, Bath, Richmond, Wandsworth and Putney, Sunderland, Preston, Eland-cum-Greetland, Bristol United, Cheltenham, and Barnsley Gas Companies; by Mr. Young, from the Wilmslow and Alderley Edge, Stalybridge, Swinton and Mexbrough, Hartlepool, Torquay, Wells (Somerset), Stourbridge, Hastings and St. Leonards, Plymouth and Stonehouse, Wrexham, Guildford, Portsea Island, Cardiff, Baintree and Bocking, Slaithwaite, Mitcham and Wimbledon District, Sevenoaks, Drighlington and Gildersome, Heckmondwike, and Barking Gas Companies; by Sir R. B. Harvey, from the Eton Gas-Works Company; by Mr. Wilbraham Egerton, from the Knutsford Gas-Works Company; by Mr. Boord, from the Woolwich, Plumstead, and Charlton Consumers Gas Company; by Mr. Mellor, from the Dukinfield Gas Company; by Mr. Marten, from the Cambridge University and Town Gaslight Company; and by Mr. Bolekow, from the Southbank and Normanby and the Brocton and Lofthouse Gas Companies.

Mr. RAIKES, in moving the adoption of the new Standing Order, to follow Standing Order 188, relating to private business:—"Gas Companies—Additional Capital.—In every Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender at the best price which can be obtained"—said: I am not surprised that a proposition of this sort should have been met with a good deal of criticism, and something more than criticism, on the part of persons in the country, who regard their interests as materially affected by the proposed Order. I should be the last person to blame in any way those who, having a pecuniary interest at stake, endeavour, as far as they can, to persuade the House to adopt their own views. But at the same time the House is well aware that it cannot be guided altogether by questions of private interests of persons, however estimable, outside the House, and that it has a duty to perform to the public; and I think if I can succeed in showing that the change in our Standing Orders that I venture to propose is one that really will promote the public interest, and, at the same time cannot be held to unfairly interfere with the rights of the gas companies, I hope I shall have sufficiently satisfied the House of the propriety of the policy I respectfully venture to submit. I may say, at the outset, that there is a special reason for dealing, on this occasion, with the question of gas companies, as distinguished from other undertakings of a more or less cognate character. Some people have ventured, or endeavoured to inflame the public mind by hinting that this legislation will be followed out by similar steps with regard, for instance, to railway companies. Now, it appears to me, that none of the reasons, which I will endeavour to adduce for the change I propose, will in any case apply to railway companies. The whole of the ground on which I base the proposed change is, in consequence of the policy laid down by Parliament in limiting the dividends of gas companies, and providing that gas companies, whenever they pay more than a certain dividend, shall then be called upon to provide for the public interest out of the profits above that amount. There is no such provision in the case of railway companies, and I do not think that any one would seriously contemplate any proposition such as that I am now venturing to make with regard to railway companies. I am anxious to say this because I wish to disabuse the minds of honourable members who may have come here under an apprehension that I was going to propose something affecting that class of property. Well, sir, the history, so far as I may shortly sketch it, of the gas question in this House begins with the Gas-Works Clauses Act of 1847. It was by that Act provided that the gas companies should be allowed to earn a dividend up to 10 per cent. if they could. And there is provision further made, that when they have earned that, they may make a reserve-fund up to the amount of one-tenth of their capital, which they may employ for the pur-

poses to which profits are applicable. It is also provided that gas companies shall be able, out of those profits, to make up the dividends of the last ten years to 10 per cent., in case of any years that have fallen short of that amount. And having taken, as I think, such extraordinary good care of the interests of gas companies, the Legislature then provided that any surplus profits above that amount should go towards the reduction of the price of gas, and for the benefit of the consumer, I ask the House to adopt this new Standing Order. I shall, of course, be told—and I admit that this is a strong argument, and be it understood that I do not wish to underrate the value of arguments that may be brought now against my proposal—I shall be told, I say, that the Gas-Works Clauses Act provides that the shares or stock in new capital, when the shares are at a premium, are to be allotted to the shareholders at par. That, no doubt, is a very fair observation with regard to companies in general. A clause to this effect is incorporated in the gas Acts of the various bodies who come to Parliament for money, and on it they rely to enable them to deal with their capital as they now do. But, sir, I wish to point out that if the existing state of things is allowed to continue, and if the companies are to be allowed to create new capital, and to allot among themselves, at par, the capital which will command a premium in the market, they have the greatest possible temptation to abstain from ever making any reduction in the price of gas for the benefit of the consumer. The consumer may wait and watch for years and for years without finding himself any nearer the reduction of the price of that which is supplied by the company, who practically have a monopoly. The companies, as we know, have a monopoly of the supply of light to very large populations, and when they find that they have got a profit on their undertaking, which exceeds in amount a dividend of 10 per cent., it is a very frequent and common practice for them to create new capital which is at a premium, and acquire it themselves at par. We will suppose the case of a company with a capital of £50,000. We will suppose them to be earning £15,000 a year, and that they are able to pay their 10 per cent. dividend, and then to apply the whole of the additional profits to reducing the price of gas. But if they are to come to this House, and to ask to be allowed to create additional capital, the interest on which will swallow up the whole of that additional profit, and the shares in which will command a premium, it is clear that the happy shareholders to whom the shares are allotted will be in receipt of that which ought to go towards the reduction of the amount the public have to pay for gas. There is a better illustration of the evils of the system. There was a Bill to which my attention was invited the other day, dealing with a town of some size and importance, which is supplied with gas by a company whose original capital was £16,000. That company tried and succeeded, by some irregular means or other, to get their capital increased to £24,000. They came to Parliament subsequently, and asked to be allowed to increase their capital by £48,000. They are, I say, in possession of £24,000 capital, and they ask to be put in possession of additional capital of £48,000, and the value of this undertaking is such that the company have been offered no less a sum than £110,000 by the local board of the district, which they decline, as being an inadequate price. I humbly venture to think that the difference between the original £24,000 and the £110,000 represents the capitalized value of profits, which have gone into the pocket of the company, but which ought to have gone into the pockets of the ratepayers. Of course, in all these questions there is much more interest felt on behalf of those who think themselves assailed than on behalf of the ratepayers. The feeling that exists on behalf of the latter is of a more languid character; but I think the House will be committing a great error if it tolerate a practice of this kind, and do not step in to carry out what was its original intention in early legislation. I now come to legislation of a more recent period. There was a committee on the subject of supplying the Metropolis with gas, or rather, of regulating the gas companies of the Metropolis. It sat in 1875, and was, to the great benefit of the public, presided over by the right honourable gentleman the member for Bradford (Mr. W. E. Forster), whom I am glad to see in his place to-day, and with the result of that inquiry I think may be said to commence something like a new epoch in gas legislation. The main result of their deliberations may be found in the Acts that were passed the following year—The Gaslight and Coke Company and the South Metropolitan Gas Acts. In each of those Acts a clause was inserted similar to that which I am asking the House to make general—a clause providing that any new capital in these undertakings shall in the future be put up to auction. I shall be told, of course, that in these cases there was a *quid pro quo*—namely, a sliding scale introduced with regard to dividend and price of gas. That, I quite admit, is a valid and important consideration, but I invite the House to consider that in the proposition I am making I am not in any way precluding any committee in the future from introducing this provision into any gas Bill, and that any committee finding themselves by Standing Order required to put in this clause will have it as much in their power to provide for the sliding scale with regard to dividend and price of gas as had the committee to which I have referred. I do not know whether that consideration has been sufficiently apparent to the minds of some of the gentlemen who have taken an active part in opposing this proposition, but I invite their attention to it because I think it is of some value in dealing with the question, and I think it will be held to give that elasticity to the proposed new system which it has been said in some quarters to lack. There have been a good many other cases besides that of the Metropolis in which the principle I have described has been adopted. In fact, there are so many that I certainly should not like to worry the House with the mere enumeration of them. But I may mention that auction clauses have been introduced into gas Bills relating to places of no less importance than Nottingham, Swansea, Reading, Yarmouth, Exeter, Birmingham, St. Helen's, and Newcastle-on-Tyne. It cannot be said, therefore, that the principle is in any way a new one. The interests of the public have been so well watched over, in these large communities, by the municipalities in these cases that the clauses have been inserted; but at the same time I fear it is only too likely to be the fact that in cases of towns and districts where there is not a great and influential and watchful corporation to look after the interests of the ratepayers you will not have that healthy opposition in the House that is necessary to secure the adoption of these clauses. It is for these cases that I think the House should now especially provide. I may say, with regard to an argument which is likely to be used, that the new Order would interfere with the pecuniary value of property which has been acquired under the existing system; that some years ago, by the practice introduced into the other House of Parliament, the dividend on all new capital was summarily fixed at a maximum of 7 per cent. And that was done without even a Standing Order of either House of Parliament, and was adopted by the public as a satisfactory treatment, so far as it went, of that particular question, and it is, at the present moment, recognized by all the parties who come to Parliament, as an essential of a private gas Bill. I do not think, therefore, that any parties have a right to complain of the proposition I make, that they should do, by a Standing Order of the House of Commons, or of the other House of Parliament, that which they must have been forced to do by a great authority in matters of Private Bill legislation. I am sorry to detain the House so long, but the matter is a very important one, and I wish to offer every explanation in my power. There is an amendment on the paper in the

name of the honourable member for Cambridgeshire (Mr. Rodwell), in which it is proposed to strike out all the words after the word "capital" in the proposed new Standing Order, in order to insert the words, "it shall be an instruction to the Select Committee to consider the expediency of provision being made for the offer of such capital by public auction or tender at the best price which can be obtained;" that is to say, to make the adoption of the new system optional, and at the discretion of the committee on any particular Bill. Well, I have no doubt my honourable and learned friend will choose his arguments with great care, but I do not think he will be able consistently to question the propriety of Parliament taking such a course as it may think proper with regard to this particular class of capital when he proposes to relegate to the discretion of an individual committee the propriety of dealing with this class of capital. But he knows—and there is no one in this House who knows better than my honourable and learned friend—what is the course too frequently with committees in dealing with instructions of this sort, when they have come to an end of a long argument on a Bill. I do not believe that there exists in the world a better tribunal than a Select Committee of either House of Parliament, as far as the broad general principle—as far as the proving of the preamble—is concerned; but I am bound at the same time to say that when the preamble has been proved, and the committee come to matters of detail in the clauses, there is, I am bound to say, sometimes something like a perfunctory discharge of their duties. Matters are very much slurred over at that time, and I think that counsel of well-known experience, whose opinions have influence and authority, will weigh very much more with a committee who are anxious to get away, almost more than any general rule, the force of which is clear and obvious to the House. I think, therefore, the proposal of my honourable and learned friend is one that, on the whole, should not be allowed to interfere with the satisfactory settlement of this matter. But I think it is just possible—and on this I should be glad to listen to any suggestion that may be made in the House in the course of the debate—that some recommendation will be made by which it might be rendered obligatory on the committee to insert this clause or clauses which would be drawn in accordance with the Standing Order, unless on inquiry they found that there was a valid reason for not putting them in, and by which in every such case the committee would have to report to the House their reasons for not putting them in, and the facts upon which their opinion was founded. This is already the case with regard to other classes of public enterprise. I may perhaps cite to the House the 156th Standing Order of the present time, which is a short one, and which deals with the question. It says, "No railway company shall be authorized to construct or enlarge, purchase, or take on lease or otherwise appropriate any canal, dock, pier, or weir, or to acquire and use any steam vessels for the conveyance of goods or passengers, or to apply any portion of their capital or revenue to other objects distinct from the undertaking of the railway company, unless the committee on the Bill report that such a restriction ought not to be enforced, with the reasons and facts upon which their opinion is founded." I venture to submit to the House that that would be a much more satisfactory mode of enforcing something like a general practice, and throwing upon the committee the responsibility of deviating from it, than the course recommended by my honourable and learned friend. At the same time, I honestly confess it would be better for the public, and fairer to the companies, if a general rule—such as that I have suggested—were laid down. I think it would be easy to frame clauses by which the arrangement might be carried out, and I have no objection to drafting a clause which it would be optional for the committee to put in as a sequence to the clauses relating to the auction of shares, by which they might provide, on the model of the South Metropolitan Gas Act, for a sliding scale of dividend and price, if they thought the circumstances of the case required it, and thus they might mitigate the effect of this Order. I must now leave the matter to the consideration of the House. I am sorry that any interest in the country should feel itself aggrieved by the matter being brought forward, as some honourable members have suggested, at such short notice; but I may state that it has been for a considerable time known to the parties likely to be affected that such a change would be proposed. It is now several weeks since I received a deputation of parliamentary agents on the subject, and those gentlemen are thoroughly conversant with the matter. The proposition was put upon the paper a fortnight ago. I subsequently postponed it until Monday or Tuesday before the holidays, in order to meet the convenience of parties concerned; and again, at their request, I postponed it until after the recess. During the whole fortnight that has elapsed there has been opportunity for the consideration of the matter, and there is now great reason for settling it as soon as possible. I have five unopposed gas Bills before me, which I have postponed in order that I may have the opinion of the House on this matter, and there is also a private Bill before a committee, which also stands adjourned pending the consideration of this proposal. This is my excuse for bringing the subject forward now. I thank the members for the great kindness with which they have listened to what I fear is a very tedious statement, and I hope that honourable gentlemen on the opposite side of the House, and on this side, who may think they will be affected by the legislation I propose, will give me credit for not being actuated in my present course by any feeling of hostility to their interests, but will believe me when I say that I come forward merely for what I conceive to be the good of the public in a matter concerning my department.

Mr. RODWELL moved the following amendment to the proposed Standing Order—namely, to leave out all the words after the word "capital," and insert, "it shall be an instruction to the Select Committee to consider the expediency of provision being made for the offer of such capital by public auction or tender at the best price which can be obtained." He said: I can assure the House that it is not without great reluctance that I find myself acting in opposition to my honourable friend the Chairman of Ways and Means, to whom we are all indebted for the admirable way in which he discharges his duties with regard to public and private Bills; and I am quite sure the House will give him credit for the spirit by which, in his concluding remarks, he claims to be actuated, and will readily believe that in proposing this Standing Order he is unwilling to interfere unfairly with the interests of any class. I do not see my way to accepting the proposed new Standing Order, nor the honourable gentleman's compromise; and with regard to the latter, I think he has put himself out of court by what he has said. He has stated that a Private Bill Committee, when they have disposed of the preamble of a Bill, are apt to discuss the details of the clauses in a hurry. If that were so, it would be a great reason why I should decline to accept the proposal, because the committee would be disinclined to hear the case against the suggested clause by the promoters of the Bill. I can speak with some authority on this subject, and I can assure the House that the result of my experience is that the hardest part of a private Bill to dispose of is the clauses. I can also say that, except in very extraordinary cases, I have never seen an intention displayed by a committee to shirk business, or to refuse to listen to claims put forward. I have accepted the responsibility of putting my amendment on the paper, because I find the question is one that materially affects the interest of millions and millions of money that has been invested in the gas companies of this country. I am told and I believe

that there is something like £100,000,000 of money invested in this country in gas shares and gas property. Every borough in England is interested in this question, and therefore it occurred to me, when my attention was drawn to the proposed new Standing Order, that the matter was one well worthy of the attention of the House, and not one which could be passed over *sub silentio*, as it were. The reason I have brought the amendment forward is because, as I will explain to the House, it gives a committee a discretion in dealing with these matters, and prevents the operation of a hard and fast law which would otherwise exist, and from which no gas company could by any possibility escape; for this reason, that no committee could ever dispense with such a Standing Order as that proposed by the honourable gentleman, and the committees having it fully in mind, every Bill which was brought before them would make its appearance, as it were, with a rope round its neck, confessing that it would accept that which would amount to what was given to all the companies in 1863. I believe the proposed Standing Order would operate most unjustly towards holders of gas shares and persons interested in gas property. I believe it would act most prejudicially at present, but I believe that if the matter was left in the hands of the committees, to be dealt with in the ordinary way, justice might be done, and an adjustment might be made to satisfy all parties. The old legislation, with reference to gas companies, will be defeated if the proposal of the honourable gentleman is accepted, and I would remind the House of this—I am not very experienced in the ways of the House here, but it seems to me to be a very strange method of proceeding, that a Standing Order should be introduced, dealing with the vast property I have referred to, which would actually repeal an Act of Parliament, or a clause of an Act of Parliament, passed in the year 1863. In the words of that Act it is provided that the shares and stock in any additional capital raised by any company, whose shares are at a premium, shall be apportioned rateably among the existing ordinary shareholders. I appeal to those who are more interested in this matter than I am myself, and I ask, is it proper that this Standing Order, from which there would be no escape, should absolutely repeal an Act of Parliament passed as lately as the year 1863? That is a matter I should like to have answered by the Secretary to the Board of Trade, who, I understand, is likely to approve of this Standing Order. Is that, I ask, a proper way to deal with this matter? It will come in the midst of a group of Standing Orders, but when you come to look at it, it is repealing legislation on the faith of which parties who have invested their money in gas property bought their shares. Of these shares, or of the user of them, you are about to deprive them, and the proposal is one which I therefore say is founded on neither justice nor reason. My honourable friend has referred at length to the legislation with regard to gas companies, so that he has saved me the trouble of saying anything on that head. But I rather think that a popular error is abroad with regard to the position of the 10 per cent. dividend of the gas companies. It seems everywhere to be taken for granted that the gas companies are guaranteed 10 per cent. There never was a greater fallacy than that—never a greater fallacy. What is the fact? In 1847, when the Gas-Works Clauses Act was passed, all the liberties and privileges of the gas companies on the one hand, and of the consumers on the other, were considered, and there is a digest of the law with regard to the relations of both these parties. What the Act says with regard to the 10 per cent. is this: "You shall have 10 per cent. dividend after you have supplied gas of a certain price, quality, and illuminating power," but it does not guarantee 10 per cent. It only says, "After you have done that you may divide the profit at 10 per cent. if you can, and after that the money goes to the benefit of the consumer." That is a very different thing from saying that all the shareholders in gas companies are guaranteed 10 per cent. on their capital. It may happen, and it has happened to my knowledge, when the price of coal has increased, and the price of labour is high, and things rise very materially, in a manner that you could not very well foresee, or which you cannot well think of, that the dividends go down considerably, and so much did the Legislature feel this that actually, in some of the Acts of Parliament, provision is made for the time when the price of coal shall be high and the labour market raised; therefore it is not at all clear that gas companies are to receive 10 per cent. It is only on certain conditions that they are to receive it. A prudent man who has been buying gas shares will have taken into consideration the fact that he would be entitled at some time or another, when an increase of capital was required, to what I may call the purchase of those new shares. I think it would have been a fair and legitimate matter for a man to contemplate, in considering the amount he should pay for his shares, and I think it only proper that he should have said, "In the course of some years I shall be entitled, under the Act of 1863, to have the first offer of the new capital that is raised." Is a man justified—a prudent man justified—in taking that into consideration, and giving a price and value according to the bargain Parliament has made with him? If he is not, my case is altogether gone. If, on the other hand, he is, I think the case of my honourable friend, the Chairman of Ways and Means, is altogether gone. On the principle of justice, and that which ought to apply to every commercial transaction in life, I cannot understand why a man, who has given a certain value for shares in 1874, on the faith of the Act of 1863, should, by a stroke of the pen, be asked to relinquish the rights he possesses, and to give up that which he anticipated when he bought the shares. Before the House divides, I hope some satisfactory answer will be given to that which I think is a plain and straightforward question. With regard to the railway companies, my honourable friend says—and I think his language is very much at fault with regard to that—that this Standing Order, which he wishes to establish, cannot apply to them. He draws a distinction between the gas companies being limited with regard to their dividend, and the railway companies being unlimited. It appears to me that when the railway companies are in a prosperous position, they may divide 10 per cent., and that then some Chairman of Ways and Means may say, "You are paying too large a dividend, and we must deprive you of the right you, as a shareholder, have now, of having incorporated with your original shares any extra capital that may be required. That acts unfairly on the public." Some one might, in the future, use the arguments my honourable friend below me has used with regard to gas companies, and say that, in the future, shares must be put up to public auction. I cannot conceive anything more logical and sequential than that, if this Standing Order is passed; therefore, if any one is interested in railway matters in this House, I hope he will not be lured into a position of false security by my honourable friend. If I may illustrate this by another case, take water companies. Why could not the same argument apply with regard to them? The fact of gas companies being limited to 10 per cent. has nothing whatever to do with the matter. It is simply a question of the arrangement Parliament has made, and I say Parliament is now asked to break a bargain deliberately entered into by the Legislature, which has been going on now for 25 years. During these 25 years the most able men in the House have ratified that bargain, and they have been assisted by competent committees, and the whole thing has been thrashed out. That is what I have to say with regard to the shareholder. Now with regard to the public. I believe this will operate unfairly and prejudicially as regards the public, and I say so for this reason. When extensions of mains are required, and expenditure is rendered necessary, and is demanded by the circumstances, it often happens,

particularly in suburban districts, where the places are thinly inhabited, that the first or original outlay is not a profitable one. What is the consequence of that? If you increase the capital of a company, you *pro tanto* diminish the interest of the original shareholders; that is to say, there is more capital over which the earnings of the company are to be divided for the purpose of paying a dividend. Well, if you put the shares into the hands of strangers, they get the benefit of the whole of the capital, and the original shareholder is actually a loser by the transaction, therefore he has no inducement or temptation whatever to spend money, because he would be in a rather worse position than before by such a proceeding. The amendment which I suggest is this—not, as my honourable friend proposes, that every gas company should go into the committee-room with this clause upon them, but that it should be left to the discretion of every committee to determine whether these regulations should be imposed. According to the practice of Parliament, when a company come to ask a favour or indulgence, then is the time to review the whole of their policy and impose any fresh rule upon them which is considered desirable, and not till then. I think I could give the House a strong illustration of that. A certain body at Bridgewater for years would not come to Parliament, because some time ago they obtained an advantage with regard to rates, which they knew would be disturbed if they came to Parliament. I say you have no right to interfere with gas companies without first allowing them to go before a committee where their whole conduct could be reviewed, and where they could have a penalty inflicted upon them if they were found to deserve it. When the terms laid down by committees are too onerous, what do the gas companies do? Why, they decline to take the Bills, and that has been done over and over again. I say with regard to my amendment, that if a gas company want to go before a committee for fresh capital or anything, it should be in the power of that committee to say in what form that capital should be granted. That is a very different proposition from that which my honourable friend suggests in this Standing Order, and is a fair and legitimate way of dealing with the question by which the position of a company can be altered, and fresh terms can be imposed. If a gas company do not like the fresh terms, they can decline to take the Bill. That is the way in which legislation should proceed, and not the summary manner suggested by my honourable friend. I will now only say that I felt it to be due to Mr. Raikes to give my reasons, to the best of my ability, for opposing him, and that I hope, whatever the House may think of my amendment, it will give me credit for having acted in thorough honesty of purpose in this matter, which is one of the greatest importance. I beg to move the amendment which stands in my name on the paper.

The SPEAKER having read the original motion and the amendment, Serjeant SIMON said: I thoroughly agree with the arguments of my honourable and learned friend opposite who has just sat down; but my object in rising is not so much to enter into the general question, which has been so exhaustively treated by my honourable and learned friend, as to take your opinion, Mr. Speaker, as to a question of order—namely, as to whether this new Standing Order can be put from the chair. By the Companies Act of 1863, as stated by my honourable and learned friend just now, provision is made that the shares or stock in any additional capital raised by any company whose shares are at a premium shall be apportioned rateably among the existing ordinary shareholders. Well, what is the proposal of the honourable gentleman, the Chairman of Ways and Means? He proposes that in every Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender, at the best price which can be obtained. If that Order is carried, it will be a direct repeal of the provisions of the Act of 1863. I take it that no lawyer who hears me—and I may say I am glad to see the two law officers of the Crown present—can differ from that proposition. If you were framing an Act of Parliament to repeal the Companies Act of 1863 in this particular, you could not possibly devise anything more apposite for the purpose than the form in which the Order is couched. There is another proposition, which I need not cite authorities to bear me out in—namely, that you cannot repeal an Act of Parliament except by another Act of Parliament. You cannot repeal, either directly or indirectly, a statute solemnly passed by Parliament, through the medium of a vote of this House alone, although that is what the honourable gentleman opposite proposes to do in this Standing Order. If, sir, you agree with the view I take, that the operation and effect of the proposal of the honourable gentleman opposite is entirely in contravention of the provisions of the Act of 1863, then, sir, the whole question is at an end. It is a proposal to repeal, by a Standing Order of this House, an Act of Parliament solemnly passed. It may be said that there is option left; but there is not even option left to the promoters and shareholders of a gas company, who come to ask for additional powers in dealing with their capital. The Act of Parliament of 1863 fixes the particular mode in which the capital is to be dealt with. The Standing Orders would produce a condition of things entirely subversive of the authority of the Companies Act of 1863, for it says, you shall not come before a committee to ask for any extension of new capital, or for the raising of new capital, unless you come here with a clause that will prevent you from availing yourselves of the Act of 1863. That is the operation and effect of the order proposed by the honourable gentleman, the Chairman of Ways and Means. Now, sir, if I am correct in this view—and it really does seem to me that it does not require the astuteness of a lawyer, or of a gentleman trained in legal interpretation, to grasp this; but that any honourable member, and any man of common sense, reading these two things together, must inevitably come to the conclusion—if the Standing Order means anything, it is that the companies are not to be able to avail themselves of the Companies Act, 1863; therefore it is subversive of that Act, and is a virtual repeal of it—a repeal which I venture to say will be of no effect, for if even the House of Commons were to pass it, it would have no legal or binding effect on the gas companies. I do not know by what process of law the House of Commons could be reached. We could not touch the House of Commons for contempt of the law, but we should be in this position: The House of Commons would, by an order of its own, be overriding an Act of Parliament, and injuriously affecting those people for whose benefit the Act of 1863 was passed, and leaving them without a remedy. I regret very much the lateness of my instructions—I mean, I regret the lateness of the notice I received, for, until I came into this House this afternoon the point I have raised did not present itself to me, otherwise I should have given you, sir, longer time for the consideration of the matter. The paper I hold in my hand was given to me here, and when I spoke of “instructions,” I had no more instructions than any other honourable member here. I have come to the conclusion, whilst I have been here, that I should put this question to you. I repeat that the proposed Standing Order will, in effect, repeal a statute, and have the effect I have described. With all respect, therefore, I ask you, Mr. Speaker, whether you would not be doing an improper act in putting it from the chair, because an Act of Parliament can not be repealed by a Standing Order of the House. I venture to think it would be irregular and improper if you were to put it.

The SPEAKER: The honourable and learned member asks me whether the Standing Order can be put from the chair, inasmuch as it repeals, as he says, an Act of Parliament. Now the Standing Order, strictly speaking,

would not repeal an Act of Parliament. The Standing Order is in the nature of an instruction to the committee to introduce clauses to give effect to certain things described in that Standing Order; those clauses, being introduced in pursuance of that Standing Order, would, of course, come before the House incorporated in the Bill, and if the Act of 1863, or any other Act, were repealed, it would be by a Bill passed through its usual stages in this House, and not by a Standing Order.

Mr. MUNTZ: I am not so much interested in this matter as the honourable and learned member for Dewsbury (Serjeant Simon), because I have not received any instructions; but it appears to me that the question is a very simple one, and, stripped of all the rhetoric with which it has been surrounded in the arguments of the honourable and learned member for Cambridgeshire (Mr. Rodwell), it is simply this: whether the gas companies were made for the public, or the public were made for gas companies. What is the fact? We all know that these gas companies have had certain monopolies granted to them for certain purposes, and the Legislature, in its wisdom, in granting those monopolies, have fixed the amount of the dividends which the companies may receive, probably because they considered such a dividend—whether 6, 7, 8, 9, or 10 per cent.—as sufficient for their remuneration, and after that the public are to have the advantage of the monopoly by being able to get their gas so much cheaper, in consequence of so much greater facilities being given to the gas companies. In fact, it has been a contract between the Legislature and the gas companies, in which the Legislature has said: “We grant you a certain monopoly, giving certain advantages, and when those advantages have been obtained the public shall enjoy any surplus in the reduction of the price of gas.” But what has been the result? The companies have taken advantage of their position to invade that which the Legislature intended, and whenever there was a surplus, which would have enabled them to reduce the price of their gas, they have issued new shares to their shareholders, or sold them at a considerable premium, and thereby they have paid themselves much more than the Legislature intended. I do not mean to say that they have all done this, but a great many of them have unquestionably done so, so that you have some gas companies actually providing gas for the public at a price of 2s. 9d. or 3s. per 1000 feet, and paying themselves the very good profit of 8, 9, or 10 per cent.; while you have others who have evaded the spirit of their contract with the Legislature, and who have taken advantage of the old prices which they used to charge, and which they still maintain. Parliament has decided that it is for the interest of the public that while the gas companies have their monopoly untouched, and see their road to realize the dividends which they are allowed to share, the public should have their advantage secured also, and I think that will best be secured by passing the resolution proposed by the Chairman of Ways and Means.

Sir EDWARD COLEBROOKE: I only wish to add one argument to those put forward by the honourable and learned member for Cambridgeshire, and it will not take the House two minutes. I think the Chairman of Ways and Means has rendered good service in bringing this question before us; but my position is simply this: To a great number of the members of the House this question is quite new; some of the arguments which have been used have never been heard before, and are probably only known to those who have served on Gas Committees. But I would put it to the honourable gentleman (Mr. Raikes) to say whether it is fair, considering the importance of the interests which are concerned, to attempt to decide this question, which really affects an Act of Parliament, by a mere resolution of this House. Our Standing Orders have rendered most important service to us in the discharge of our private business, and they are of the utmost convenience; but there exists in the Standing Order Committee, of which I am a member, a general power of relaxing the severity of those Orders in particular cases. But this proposal is an exception to that rule, for, if this resolution were agreed to, it would be imperative, and would apply to all cases, and once passed it would be impossible to repeal it. I put it to the House whether, if it adopts this resolution, it will not be setting a most dangerous precedent. I quite agree with the honourable and learned member for Dewsbury in his objection that, in point of fact, if not in point of form, the resolution would repeal an Act of Parliament. It is quite true, as you, sir, have pointed out, that you cannot repeal an Act by a resolution, but by the cleverness of this contrivance you are to decide for all time as to what certain clauses are to be. Then this is to be an iron rule. I think the honourable gentleman, the Chairman of Ways and Means, has quite failed in some parts of his argument. In the first place he has failed as to his statement that he would reconcile the interests of the public with these of the shareholders. That has been set right by the speech of the honourable member for Birmingham (Mr. Muntz), who has pointed out that these interests are antagonistic in many cases, and, in the case which he put, you could hardly adopt a rule of this kind without interfering with the interests of the shareholders. I am far from saying that you should not exercise the utmost vigilance in cases of this sort, so as to see that the public are really cared for in every way. But the present proposal is to adopt one rule for all cases. The honourable gentleman, the Chairman of Ways and Means, has shown us very clearly, from the precedents he has given, that there is a tendency in our present legislation to deal very strictly with gas companies. Why, then, should we not leave things to their course, and permit the matter to be dealt with by the Select Committees, who, in spite of all that has been said, show themselves alive to the question? (Cries of “Divide.”) Why not, after the House has legislated in a stringent manner upon the subject—why not leave the committees after hearing arguments and the opposition of local interests—to deal with the matter in the manner suggested by the honourable and learned member for Cambridgeshire? Sir, if this resolution goes to a division, I shall support the more equitable course proposed by that honourable and learned gentleman for dealing with these interests, rather than the course proposed by the Chairman of Ways and Means.

Mr. A. W. YOUNG, who rose amid calls for a division, said: I know the impatience of the House in questions affecting the discharge of private business, and therefore I will not trespass more than a short time upon its attention. My justification for trespassing at all is that this is something which is exceptional as well as important. As the House has already heard from the honourable and learned member for Cambridgeshire, there is a sum of money—I do not know how much, but the precise amount does not matter—there is an enormous sum of money interested in this decision. My honourable friend, the member for Birmingham, who spoke just now, said what is perfectly true, that it was a bargain between the gas companies and the public, as to the way in which the price of gas should be regulated. But one of the most important parts of that arrangement was, that where the gas companies shares were likely enough to be at a premium, they should be distributed, when new capital was required, among the then shareholders. That was one of the most important parts of the bargain, and that bargain ought not to be varied, at any rate in the way now proposed, by a mere decision of the House of Commons, after short notice. At any rate, it should not be done without having an Act of Parliament to do it—to do what I should consider a great injustice. There have been no private companies during the last few years against which so many raids have been made as the large gas companies. They have been treated as though they had done no good in the world, and as though they were public nuisances, instead of being great public benefits.

I think they are entitled to great consideration, because they have done a most useful work all over England. Some few people—comparatively few—have done very well by them; but the bulk of the people were not always ready to put out their hands to help them. Look at this Metropolis, what would it be without these gas companies? Would you like to revert to oil-lights at night? Would it even be economical to do it? Where would be your security for life and property? (Cries of "Question.") Sir, when Mr. Winsor first discovered this mode of lighting, there were not a hundred people in this town who would subscribe a shilling towards its development. These few people made the effort, and they succeeded. Gas has been found at last to be not only a useful, but a paying property. But it was not always a paying property. I know people who had shares, and no dividends year after year, year after year, though they were charging the public 14s., 15s., and 12s. per 1000 feet. Sir, is no reward to be given for these long and arduous services? (Cries of "Question.") I shall not be long, and I promised to say no more than I thought absolutely necessary; but I do want to draw attention to this fact, that it is now proposed to deal with an enormous interest in a way which is anything but satisfactory.

The CHANCELLOR of the EXCHEQUER: The House must bear in mind in connexion with this subject that this question of dealing with the gas companies is not a new matter. It is a subject which, from time to time, for the last 10 or 20 years, has been frequently before Parliament, and been the occasion of very important discussions which have led to a good deal of legislation, and to still more in the way of recommendations from committees and persons of authority; and we cannot help feeling that the subject is one which naturally excites very great interest, because, on the one hand, it undoubtedly touches the interests of a very large and, as the honourable member for Helstone (Mr. Young) says, very meritorious body of capitalists, and also raises questions which affect, more or less directly, the interests of other branches of industry; while, on the other hand, it does very seriously affect the interests of the public. Now Parliament has been for a considerable time endeavouring to find a solution which shall be fair to the gas companies, and at the same time shall be fair to the public who are the consumers of gas, and a great deal of legislation, not always entirely consistent with itself, has taken place, with a view to regulate this matter. Now there can be no doubt that the question of the issue of new capital in the manner proposed, either to the shareholders at a par price, or to other persons at such a price as they may think fit to give, is one of the most difficult questions connected with the subject. It is a question which has been solved apparently in a very great number of cases. It has been solved in a very large number of the companies connected with the Metropolis by the Acts which were passed last session and it has been solved in the case of a considerable number of companies to which my honourable friend, the Chairman of Ways and Means, referred just now, all which have been at the expense of putting up their new shares to auction. It does, therefore, appear that the means exist at present, in spite of general legislation, by means of private Bills, for meeting the case. Now comes the question whether we ought to go further, and, by a Standing Order, at once turn the balance entirely in favour of putting up the new shares to auction. Well, the Clause, or Standing Order, as originally proposed by my honourable friend, the Chairman of Ways and Means, was one of the most drastic character in every way. It makes no allowance whatever for peculiar circumstances, which would render such a mode of dealing inapplicable; and my honourable friend, I understand, is willing to modify that Standing Order by a provision which shall except the cases in which a Select Committee shall take another view. My honourable and learned friend the member for Cambridgeshire desires to meet that proceeding, and to say that the rule of putting up to auction shall only apply in cases where the Select Committee have expressed their approval, and that it shall be an instruction to them then to attend to the point. Now I very much doubt whether much would come of that, because the committees now have power to do as much, and they have availed themselves of it in certain cases. Nor would this, as I understand it, cover the whole ground, for it would not cover cases in which the Bills were unopposed before a committee, or cases in which Provisional Orders were to be issued. But there is an acknowledgment on both sides of the difficulties of the question, and of the difficulty in the way of dealing with it by a strict and stringent Order. But then there is started another point by the honourable and learned member for Dewsbury, which you, sir, have overruled, so far as it is technically concerned, and I apprehend that there can be no doubt that your ruling commends itself to the general sense of the House. Technically there is no overruling of an Act of Parliament by a Standing Order; but, although there is not that, this is dealing, by a single blow, and in the form of a resolution or Standing Order, with a subject which has been settled so far by Act of Parliament, and which has been the subject of frequent and serious consideration. And now, without wishing to express any positive opinion upon the merits of the different systems, I do feel, and the Government feel, that it is a rather stringent measure, by a Standing Order, to deal with this matter in this way. No doubt, when these matters have been before Parliament, you have had opportunities, on private Bills, of frequent discussion; you having the introduction of a Bill, the second reading, the committee, and other stages through which these matters pass, and honourable gentlemen are enabled to argue the question up and down, and to adopt their different views, and see in what manner the matter can fairly be disposed of. I think that to pass a Standing Order of this sort at the first moment of its being presented to us, without further consideration, considering that it deals with a matter which has been the subject of legislation, is taking a rather strong step. What I would suggest at the present position of affairs is, that we should adjourn this discussion, and have more time to consider what is the best mode of dealing with the matter. What has passed to-day has shown some difficulties in a clearer light, and has directed attention more fully to the subject, and perhaps when the honourable and learned member for Dewsbury has had more time to study his instructions, we may see our way to adopt some solution of the question. I have, therefore, risen to move—"That this debate be now adjourned."

Sir ANDREW LUSH: I beg to say that I have received no instructions to speak here on this matter this evening, and I hold no gas shares; but I thank my honourable friend, the Chairman of Ways and Means, for bringing forward this subject. It is all very well for honourable members who are gas shareholders, or connected with gas companies, to call for something else; but this is a serious matter for the public, when you have granted a monopoly, and I hope that when the public read this debate, and think it over, they will feel that it is right that where new capital is issued some limit should be put on the monopoly. I am very glad that the honourable gentleman has brought the matter forward, and I hope the public will support him. I feel sure they will if they know what is the point at stake.

Mr. RAIKES: Of course I could not think of resisting the motion made by my right honourable friend the Chancellor of the Exchequer, but I am anxious to point out that the proposed decision, which has brought down upon me the ire of the honourable and learned member for Dewsbury, is the only one which I could have brought forward. It is not competent for me to bring in a Bill and pass it through its various stages, and the only

way in which I could act in the matter is the one which I have adopted, and it appears to me to be the fittest way of dealing with it. I am, of course, alive to the great convenience which would result if the Government would take up the question, and deal with it by a Bill. I think the great interests involved may fairly ask for further consideration—say by a Bill—and I hope that the matter may come before Parliament in that shape. I have no opposition to offer to the proposal of the Chancellor of the Exchequer, but I may say that, if the debate is adjourned, I will put its resumption down for an early day, not in order that we may then continue it, but to give opportunities for further consultation with the Government, and with other members, as to what course the Government will adopt.

Mr. W. E. FORSTER: I will not detain the House more than a few minutes. I suppose it is the general feeling that the judgment of the Chancellor of the Exchequer be acceded to, but I do not quite understand, and I think we ought to be informed, whether that does really mean an adjournment for the consideration of the motion, or whether it means that the motion is dropped, and that he gives up the idea of a Standing Order, and prefers some general Act? Upon the general merits of the question I will not detain the House. Of course, if the question is to be adjourned it is of no use debating its merits, except to say this much, that the little experience gained last year and the year before would make me strongly in favour of the principle of the motion of the Chairman of Ways and Means. I should be prepared, if it came before the House again, to give my reasons for this view; but I will not trouble the House now, except to remark that the honourable member for Helston must allow me to say that his objection would apply just as much to the amendment as it does to the proposal. If he thinks that the vested interests of the companies are at stake and are threatened, and that the shareholders in all gas companies ought to have a premium upon new shares, I think it would be difficult to prove that proposition; and I may just mention that last year, when we had two of the most powerful companies in the kingdom before us, and auction clauses were put in, there was scarcely any opposition to them whatever on the ground stated—and, in fact, scarcely any opposition at all; and I am quite sure that such was the ability of the advocates, and such was the feeling of the directors that they ought to take care of their shareholders, that we should have heard a great deal about vested interests if the matter had been so clear as the honourable gentleman seems to suppose. I would only say further that I trust that if the question be postponed it will be with a clear understanding that on all gas Bills that come on this session there will be full powers given to the Select Committees which have to deal with them to insert these auction clauses if they think it advisable to do so, and that there is nothing in the declaration of the Chancellor of the Exchequer which will be supposed to interfere with their right to follow the course which was taken last year.

Mr. ROEBUCK: I only wish to make one observation. I myself feel very strongly as to what is the true and really constitutional mode of proceeding. I think the best way is to take a course which is without doubt constitutional and I appeal to the Government to do that of itself. What is proposed to be done may be very good, but the way of doing it is very dangerous, and that danger would be altogether avoided if the Government took the matter in hand. The House would then immediately understand the whole proceeding, and we should be able to do that constitutionally which, if we do now by a rule of this House, we should do most despotically, in a way which has not yet been adopted by the House of Commons, and which would lead in this country to a great feeling of alarm.

Serjeant SIMON: One word of explanation. I have had no instructions, any more than any other honourable member has had. It was from long professional habit that I used the phrase, but I really had no instructions. I had formed my opinion from reading the paper containing my honourable friend's notice of motion.

The CHANCELLOR of the EXCHEQUER: I hope the honourable and learned gentleman will not think I meant more than a joke.

The motion for the adjournment of the debate was then agreed to.

Mr. MARTEN gave notice that he would move, at the end of the proposed Standing Order, to add the words "unless the committee on the Bill shall report that such provision ought not to be required, with the reasons on which their opinion is founded."

WATER SUPPLY OF VILLAGES AND RURAL DISTRICTS.

On the order for going into committee of supply,

Mr. ALEXANDER BROWN, in rising to call attention to the state of the water supply for domestic purposes in the villages and rural parts of the country, and to move—"That in the opinion of this House it is desirable to confer upon the local authorities further powers in order to remedy the existing evils," said that the object was one of considerable difficulty and magnitude. The inquiry into the water supply had been relegated to the Rivers Pollution Commission, and he should quote evidence from their sixth report. The sources of the supply of drinking water were six in number—river water, surface water, well water, spring water, rain water, and shallow well water. The last three, in particular the last two, supplied the rural districts. About 12,000,000 of people drank shallow well water, which was invariably polluted with sewage and animal matters of the most disgusting character. The commissioners had fixed a standard of impurity of water, and the health of persons drinking it would be affected if that standard were exceeded. Yet in different parts of the country the standard had been greatly exceeded; in particular in the case of some cottages at Wokingham, in Berkshire, where the impurity in the water amounted to twelve times the standard. Of 55 samples of water only one was found to be safe to drink, and there was no doubt that water from these sources was of a disgusting and dangerous character. The commissioners had said that so far as cholera was concerned dirty water was the root of the evil, and the same was the case with typhoid fever. This subject, in his opinion, affected the food and milk supply of the country, and affected also the health of large towns, because many cases had been traced in which fever had broken out in consequence of milk-cans having been cleaned with impure water. The question was, how were they to grapple with these evils? He thought that one way of meeting the evil would be to say that no houses should be inhabited which had not a pure supply of water, that the responsibility should be thrown upon the local authority to see that the proper provision was made in this respect, and that all wells which were proved to be polluted should be closed, and the local authority in this case also should be held responsible to see that it was done. He thought that where there was no good public supply of water the owners of property should be obliged to provide it. The present water supply of this country was simply permissive, and he was of opinion that the legislation with reference to this subject should be made of a sterner character—and, in fact, to a certain extent, should be made compulsory. He concluded by moving the resolution.

Mr. WHITWELL said he was very glad that his honourable friend had brought the matter before the House, as it was a question of the greatest importance, and the evil undoubtedly in the rural districts was one which required a remedy. The present state of things could not be allowed to exist longer, and something ought certainly to be done. He thought that where the water was now exhausted by drainage, the local authorities

ought to see that it was properly stored and delivered as pure as possible. He trusted that full information with regard to the water supply would be placed in the possession of the Local Government Board through the rapidly multiplying local authorities, and that when this information was concentrated in London it would be followed by proper legislation.

Mr. COWEN said the House was under an obligation to his honourable friend for the able and interesting statement he had made on a highly important subject, which was well worthy of the attention of the Government. The sanitary condition of the large towns had been greatly improved during the last 20 years, although not yet so good as it ought to be, or as it might be had the local authorities done their duty. There were agencies at present at work which justified the expectation that the future would be as much in advance of the present as the present was in advance of the past. But he regretted to say that the sanitary condition of the rural districts had not been improved, but, if anything, was worse than it had been some years ago. The cottage homes of England had been gloriously described in the language of poetry, but in reality it was the language of fiction and not of fact. It would be far more true, parodying the words of the poet, to describe them thus:—

“The cottage homes of England,
How fearfully they smelt;
There’s fever in the cesspool,
And sewage in the well.”

This state of things was worse in the manufacturing and mining than it was in the rural districts, and the difficulty of dealing with the question in such places arose from the fact that the manufacturers, who were interested in providing for the comfort of their workpeople, were unable to interest a large area in the work of sanitary improvement. He knew a mining district in the north of England which was situated in two unions and three parishes, having several district local authorities, and conflicting interests which it would be difficult, if not impossible, to combine for one general object. The Artisans Dwelling Act had proved a success, and he hoped the Government would introduce other measures of the same character. These were quiet, steady, humdrum Conservative times and he thought the Government could not do better than commit themselves to this work, and if they dealt with it in a thorough and satisfactory manner they would earn for themselves contemporaneous renown and fame in succeeding years.

Mr. SCLATER-BOOTH did not complain of the manner in which the honourable member had brought this subject forward. No words he could use could exaggerate the importance of a pure and plentiful water supply, but he thought the mover of the resolution had scarcely done justice to the great efforts Parliament and the local authorities had made of late years in this direction. He did not think the House would do well to adopt a motion of this somewhat general character, as the honourable gentleman had not brought forward a specific plan to remedy the evils of which he complained. Mr. Alexander Brown had quoted, in support of his motion, from the sixth report of the commissioners who had inquired into the subject of river pollution; but he should have mentioned that, before that report had been printed and circulated, a great many of the evils pointed out had been dealt with, or were in process of being dealt with, by the local authorities. The honourable member thought greater powers of compulsion over local authorities should be given to the Local Government Board, but he thought he ought certainly to have been a little patient, seeing how energetically many of the local authorities were working to fulfil the duties which had been so recently cast upon them. He objected to the honourable member’s proposal that the Local Government Board should have power to issue a *mandamus* for the purpose of compelling local authorities to execute sanitary works. He should certainly not ask Parliament to confer on the office which he had the honour to hold, any compulsory powers other than those he at present possessed. He quite agreed with the last speaker (Mr. Cowen) that the manufacturing were in a worse condition than the rural districts; but he thought there ought not to be much difficulty in making a proper provision for the water supply of those places. It was reasonable that where the owners or occupiers of mines destroyed by their operation the water supply of a district, they should be under some obligation to replace that supply. He would like to state, for the information of the House, some of the observations which he made last year upon this subject. He then showed that this question of water supply, especially for rural districts, had been under the notice of the Government, and that it had received a great deal of attention during the past three years. The subject was also brought under his notice by an important and influential deputation in 1874, and he consulted his colleagues whether it would be desirable to issue a Royal Commission to inquire into the matter; and it was considered that it would not be expedient to do so, as the Pollution of Rivers Commission had gone very largely into the subject, and had procured much information in reference to it, and, therefore, it would be better to act upon the information they had obtained rather than relegate the question to another session. In 1875 Parliament passed an amended Sanitary Act, and it contained many provisions relating to a better and purer supply of water in rural districts. That was the existing law at this time. Again, in 1876, they passed the Pollution of Rivers Act, and he looked forward to its bringing about very considerable beneficial results. The passing of the Public Health Acts of 1872 and 1875 had drawn much attention to the subject throughout the country, and he would ask whether the local authorities had been negligent in exercising the powers which had been conferred upon them. In 1873 the total amount of money borrowed by those authorities was £1992, while in 1874 it was £16,628, and in 1875 as much as £31,274; and in 1876, though it was rather lower, yet it was within a fraction of £30,000. Now, although that was not a very large sum to borrow for such a purpose, yet it was distributed over 40 different unions, and that showed that the rural sanitary authorities had just the same obligations and powers to supply pure water as had the urban authorities; in short, they could authorize the digging of wells and the construction of reservoirs, the buying of water-works and the construction of new water-works; and they might require any water company to lay on water in their districts if it should be found necessary. It might be asked why did the cry for purer water come more from the rural districts than from the urban? The answer was plain. In urban districts, the population being large, it was easy to lay on a rate and make each occupier or owner contribute to the expenses, while it was very difficult to do that in rural districts where the population was sparse. However, the Government had every reason to believe that the rural authorities and the owners of property were becoming more and more alive to the necessity of giving tenants a better supply of pure water. It was now said that something further was required—that larger power should be granted—so that every house in a district, not at present furnished with a proper supply of water, should be included in the system and rated; but before that could be done there were many points to be considered. However, it showed that much attention was being given to the subject in country districts. He had shown the House that the rural sanitary authorities had all the powers of the urban authorities; and were they now to pass an abstract resolution which would commit Parliament to peremptory action, or wait until they could deal with the subject in a way which would cause no irritation, and yet

answer the purpose, for bringing about what was desired, without adopting the suggestions which had been made by the honourable member opposite? He had now stated what had been done by the present Government since they came into office, and what they proposed to do, as two things were proposed:—First, there was a committee of the House of Lords which would deal with a portion of this subject; and there was the Burials Bill now before the House, by which the Government had provided that a serious source of pollution of wells—viz., that arising from the neighbourhood of churchyards—should be removed. It was only that evening that he had heard of a very serious outbreak of fever from this cause. That being the state of the case, and the local authorities now being alive to the importance of the subject, he hoped that still further progress would be made, and that it would continue to be of a satisfactory character. Though the time had not, he thought, arrived for another amendment of the Public Health Act, yet attention would be constantly given to the subject, and he trusted that the honourable member would give the Government credit for not losing sight of the subject. He hoped that he would not, under these circumstances, press his resolution to a division.

Mr. STANSFELD was much obliged to the member for Wenlock (Mr. Alexander Brown) for bringing forward this question, and he thought that the House was greatly indebted to his honourable friend for the manner in which he had dealt with it, for he had lucidly shown the extent and danger of the evil which existed, and also a remedy for its removal. Further than that he had succeeded in discovering a most serious blot in the Public Health Act of 1875, and the right honourable gentleman had not pointed out how that difficulty could be removed. It had been clearly shown that the country water supply was injuriously affected, and that as a consequence the milk which was supplied to large towns was also affected. He had shown many instances of the pollution of water used for domestic purposes in various parts of the country, and he himself was confident that his statement had not been exaggerated. Mr. Sclater-Booth had complained of the severe comments upon the Pollution of Rivers Act of last year, but if he (Mr. Stansfeld) was at liberty on this occasion to discuss that measure, he should be still more severe upon its provisions, as the machinery of the Act was most imperfect. This proposition was unassailable—viz., that when the supply of water in any district was not fit for domestic use, the local authority should have power, not only to close a well or wells, but to provide a fresh supply of water, and to distribute the cost of so providing it in that way which might appear best to them. This question was becoming one of extreme national importance, and it might be considered advisable to impose upon all sanitary authorities the duty of providing a proper supply of pure water to all the inhabitants of the district and an effectual system of drainage. The member for Wenlock would do well to adopt the suggestion which had been offered to him as to exercising patience, and not press his amendment to a division.

Mr. Brown intimated his readiness to withdraw his amendment, but several members insisted on taking the sense of the House on the question.

The House divided, and the numbers were—

For the amendment	37
Against	64

Majority against 27

The motion was therefore rejected.

SATURDAY, APRIL 7.

The petitions were withdrawn of the Lancashire and Yorkshire Railway Company against the Ashton-under-Lyne Improvement Bill; and of the Lawfords Gate District Highway Board against the Bristol District Water Bill.

HOUSE OF COMMONS COMMITTEE.

FRIDAY, MARCH 16.

(Before Mr. ASHETON, Chairman; Messrs. SMITH, BELL, and DUNDAS; Mr. BONHAM-CARTER, Referee.)

RAMSGATE LOCAL BOARD BILL.

(Continued from page 498.)

Mr. E. Ellice-Clark, examined by Mr. BIDDER.

I am a civil engineer, and was appointed assistant surveyor to the Ramsgate Local Board in 1872. Shortly after my appointment I called the attention of the Sanitary Committee to the deficiency of the water supply to the smaller dwellings. That was in January, and in May of that year I again called the attention of the committee to the condition of the sewers, and also of the water-closets in the poorer parts of Ramsgate, and I said that unless there was a better supply of water to the closets, the sewerage system in Ramsgate would break down. I also pointed out that there was an utter absence of water from any cisterns in the water-closets to nine-tenths of the smaller dwellings in the town. In addition to that, a great number of the smaller houses were immediately connected with the sewers, and, therefore, the absence of a proper flush of water made them worse than an old garden privy. I have seen people waiting in a row, to take their turn to get water into their houses in jugs. That was a general thing in those parts of the town where the poor lived. The public drains were choked in consequence of there being an inadequate supply of water for the closets. At the time I was appointed, I should say 90 per cent. of the smaller houses in Ramsgate were without water to the closets; but it is not so bad as that now. When I left, about fifteen months ago, I should say about 50 per cent. were without cisterns, but I do not know what has been the case since. My attention has been called to the fact that at the police-station there has been no water to flush the closets with, even at four or five o’clock in the afternoon. At the time I was there no attention was paid to the fittings, to save waste, and so on; but, if the water-works had been in the hands of the local board, they would have seen that all the fittings were perfect, and that the people had fittings if they had an intermittent supply. As a sanitary authority, I should order closets to be provided, and cisterns in connexion with them; but, having made that order, I could do no more. Many of the water-closets were directly connected with the water-mains themselves, but that could not be done except with the consent of the company. In Ratcliffe Square especially, where the houses were supplied from a single tap, that was the case, and complaints were made by persons, who said that instead of getting water from the taps in their houses, they were getting sewage, and I went and found it was so; but if the water had been on for four or five hours in the day, or if there had been a constant supply, such a thing could not have happened. At Hardres Street, also, I found that the people were drawing tar water and ammoniacal liquor instead of drinking water, but I attribute that to connexion with the gas-works. I think the charges made by the water company for sanitary and general purposes are most exorbitant. The sewerage system at Ramsgate requires constant flushing, on account of the steep gradients and the partial rainfall; besides which the chalk is very absorbent. We have had the sewers stopped up for want of a proper water supply, and have been obliged to remove the soil by mechanical means. The system is one which is attended with considerable danger of contagion, if there is any disease or epidemic; but such a thing could not occur if there were a proper supply of water. The breaking up of the streets is also another matter of considerable importance. The

company used to cut off the water supply whenever a person left a house, and made a fresh connexion when another person came into the house, and they opened the streets for each purpose. I suppose it is continued in the same way now.

Mr. BIDDER: Supposing the water and gas were in the hands of the local board, as the streets are, would there be any difficulty in making arrangements by which the interruption to the traffic would be very greatly diminished?

Witness: I should think it would be very greatly facilitated, because the officers would know when they were going to lay a new main, or to alter the services, and also when they were going to make new sewers, and they would keep their road-repairing until all that was done. I know both the pumping-stations belonging to the company, and I considered they were capable of raising 750,000 gallons in ten hours, of which the Whitehall would produce 500,000 gallons; but I think one million gallons a day ought to be the minimum. I ascertained the dry weather flow of our sewers at their mouths, and the maximum quantity which I have ever gauged has been 250,000 and 300,000 gallons a day. Of course, that is not the same quantity as the water company have poured into the town, because there is a certain per centage taken up by evaporation, absorption into the soil, for watering the streets, and so on; but there is an approximate amount between the amount of supply and that which comes out of the sewers. In the height of the season about 20,000 gallons would be the utmost used for watering the streets. Supposing all the houses in the district were supplied with cisterns, I do not think it would be possible for the company to anything like fill them with their means of supply. They used to charge the cottages 6s. a year, which ought to have entitled them, I think, to 12,000 gallons a year, but they did not get anything like that quantity. I have seen the same deficiencies and found the same difficulties in St. Lawrence as at Ramsgate. Regarding the gas, when I first went to Ramsgate the supply to the lamps was in a very unsatisfactory state. At that time the gas company used to charge £3 10s. for permanent lamps, and £3 1s. for lamps which were not lighted when the moon was shining; but, in 1873, they advanced the prices to £5 and £4 12s. I did not consider the advance was justified by the rise in the price of coal; I should have thought 10s. a fair increase. I wrote to 18 towns similarly situated to Ramsgate, to ascertain what the same service cost, and also the price of gas to consumers, and the price of coal. If Maidstone is taken for comparison, that town is more unfavourably situated, because coal is more expensive to get there. In 1873 coal there cost 40s. per ton, and the price for the public lamps was £4 1s. 6d.; the private consumers were charged 4s. 3d. At the same time coal cost 30s. at Ramsgate, because we had the advantage of direct sea delivery. The standard for the gas at Maidstone was 14 candles. At a meeting in Ramsgate, in November, 1875, I stated that 1s. per 1000 gallons was too high, and there was no reason why the public authorities should not be supplied at 9d. per 1000 gallons. I think they have reduced the price to 9d. since I was there. If the Whitehall water can be obtained pure, I believe it is an admirable water.

Cross-examined by Mr. LEIGH: I believe there was a considerable enlargement of the original reservoir at Whitehall in 1873.

Mr. BIDDER: There is no reservoir at Whitehall.

Witness: At Southwood there is a reservoir, which is supplied from Whitehall. I think that larger reservoir is capable of holding 650,000 gallons. It is usual to have a covered reservoir when dealing with chalk water.

Mr. LEIGH: Was not the level raised from 6 to 8 feet, to give a better pressure in the high district round Southwood?

Witness: I think that the level was raised, but I do not know how much. The height they have now is not sufficient to supply the whole of the houses. The proposal of the local board is to give a constant supply from the Southwood works by gravitation.

Mr. LEIGH: Is it not the fact that the water company at present not only have the means by gravitation, but propose supplemental means as well?

Witness: A small supplemental means; but I do not think it will be adequate for long.

Mr. LEIGH: You mentioned one case where there was only one tap in the street. Did the Sanitary Authority ever interfere with that particular street?

Witness: The Sanitary Authority have since interfered.

Mr. LEIGH: But at that time did the Sanitary Authority interfere at all?

Witness: The Sanitary Authority were under the guidance of their surveyor, who was also a director of the water company, and it was his duty, I take it, to advise the Sanitary Authority to serve notices on all those people to give a proper supply of water to the houses; but he never did advise them so.

Mr. LEIGH: You deliberately make the charge that, because the surveyor was a director of the water company, he thereby so neglected his duty that he gave no information to the Sanitary Authority of this disgraceful state of affairs you have mentioned?

Witness: I do, deliberately. That state of things does not exist now to the same extent. In the particular case I mentioned, the evil has been remedied, to a certain extent, by there being more taps, and also by the water being on a much longer time.

Mr. LEIGH: With regard to the tank at the police station being without water, was not that because the tank was not large enough?

Witness: It held 700 gallons, and was not filled by the company. If it had been capable of holding 1000 gallons there would not have been any more water in it. Since that time the tank has not been enlarged, but the police cells have been moved, and therefore the cause of complaint ceases.

Mr. LEIGH: You made a complaint about the water-closet being in connexion with the drains. Do you mean to say that after that complaint there was no alteration?

Witness: I know, in one case, the water company allowed it to go on for a year; but it was out of my power to alter it, although I reported it, no doubt. I should think a written complaint was made to the water company about the state of things; but that would come from the clerk, and I cannot answer for him. If I were told that no such complaint had been made, I should very much doubt it. The local board have to look after the connexion of the water-closets with the sewers; but it is the duty of the company to supply water to the closets and houses. I am aware that the company are now asking powers for a constant supply; but that is the result of the agitation which has been going on for years, and which would never have been given without.

Mr. LEIGH: With regard to the supply in the height of the season, do you consider that if you have only a population of 50,000 for one month the water company are to have a sufficient supply for one-third only of the population all the year round, to be increased three times the amount for one or two months?

Witness: I think that the water company ought to have a sufficient supply for the population at any time of the year, certainly.

Mr. LEIGH: As a fact, some of the lodging-houses are overcrowded at one time, and people who go there do not require water for washing particularly, so long as they have the sea?

Witness: That is not so at all, and I think it is a great scandal upon the

people who go to Ramsgate. A large number of visitors do not go and wash in the sea, and the quantity of water for baths in towns like Ramsgate is very small. While I was at Ramsgate there was a discussion about stopping the flushing of the sewers, but the Sanitary Authority never ceased the flushing while I was there.

Mr. LEIGH: In your present Bill do you say that the minimum amount for the supply of water is to be 6s., that it is not to be lower?

Witness: Yes, I think so.

Mr. LEIGH: In your Bill occurs the following proviso:—"Provided always that the board shall not be compellable to afford a supply of water for domestic purposes for any less sum than 6s. in any one year, for every dwelling-house or part of a dwelling-house?"

Witness: Yes; and if they gave a constant supply, as they would do under this Bill, that would be a cheap rate; but it was not a cheap rate under the water company, because they were not giving 6s. worth of water in a year.

Mr. LEIGH: As you read that proviso, supposing you ascertain it is impossible to supply at 6s., there is no reason why you should not go on to charge 8s. or 10s. if it is a constant supply.

Witness: No.

Cross-examination continued: When the experiment of the oil lamps was tried in Ramsgate we were not proceeding under the Act of Parliament at all.

Mr. LEIGH: I have the Isle of Thanet Gas Act, in which there is this clause: "Provided always, and be it further enacted that in case the said company shall at any time hereafter contract with any person, &c., for lighting any of the public lamps in any of the public ways within the said towns or the suburbs, the said company shall, and they are hereby directed and required to supply such public lamps which they shall so contract to light with gas of such quality as shall at all times afford a cheaper and better light than could be obtained from oil lamps." In consequence of that, did you gentlemen connected with Ramsgate and the local board think that you would try the experiment of oil lamps to see whether they were as good as gas?

Witness: No; not in consequence of that, but we thought it would be cheaper, and that it would be practicable to burn oil.

Cross-examined by Mr. BROWNE: Since this agitation took place the companies have been doing their duty a little better, but that is the usual effect of agitation. None of the complaints which I made to the Local Board of Ramsgate had reference to St. Lawrence, but the complaints which I have brought against the company with reference to the water supply are also complaints from St. Lawrence.

Re-examined by Mr. O'HARA: One of my complaints against the gas company is that the illuminating power and quality of the gas is regulated by an Act passed as long ago as 1824, which, as compared with modern times, is quite absurd. When I first went to Ramsgate in 1872, I found an entire absence of complaints on the part of the surveyor as to the supply of water to the cottages. I felt it my duty to make complaints, and from time to time some of those complaints were remedied. During the time I was at Ramsgate the flushing of the sewers was increased very considerably, notwithstanding the heavy charges.

The COMMITTEE: You have told us you tested the outflow of the sewers with a view of ascertaining approximately the amount of water supplied—what proportion do you think there should be in a dry time between the water supply and the amount coming out of the sewers?

Witness: The only water you would have to deduct would be that used for watering gardens and streets. All the other water ought to pass into the sewers. If I found 300,000 gallons a day going into the sewers, I should infer that 400,000 gallons were being pumped.

The COMMITTEE: You say that the Whitehall works are capable of supplying 500,000 gallons in ten hours; if they pumped for 20 hours direct from the feed, they could get a million gallons?

Witness: Certainly, if they had the engine power.

The COMMITTEE: But it may be that they are pumping from an accumulation during the remaining 14 hours out of the 24?

Witness: Yes; I believe it does rise 7 feet or 8 feet in the adits, when they are standing still, and they pump that water into their reservoir.

The COMMITTEE: So that no additional pumping would enable them to get more than 500,000 gallons a day?

Witness: I do not say that; neither do I know it.

Sir J. Heron, examined by Sir E. BECKETT.

I am town-clerk of Manchester, the corporation of which city have had for many years the gas and water works in their own hands. They also supply a very large district both with gas and water beyond the limits of the corporation. I have made it my business, at various periods, to inquire into the condition of other corporations which have taken gas and water works.

Sir E. BECKETT: Has there been found any inconvenience to the districts outside Manchester, in consequence of the Manchester Corporation having taken the supply of gas and water into their own hands?

Witness: With regard to gas, first, I answer most unquestionably not; so far from that, it has been found of the greatest advantage to the outlying districts, and it cannot be better shown than by my stating two or three facts. In one township now supplied by Manchester, there were a gas company and a water company, but they preferred to put themselves into liquidation, and transfer the supply to the Corporation of Manchester, because they could obtain it from the corporation better than they could supply it for themselves. In another place, half the district is supplied from Manchester, and the other half, unfortunately, is in the hands of the company. We supply the one-half with gas for 3s. 8d., whereas the other half has to pay 4s. 8d.; however, it is in the hands of the company, and, therefore, we do not interfere. In other cases the very same result has arisen, so that it is proved, beyond all doubt, that the corporation can and do supply gas to these outlying districts at a much lower price than they can supply it themselves. We are something like the Ramsgate Company; we are not under any parliamentary restriction, either as to the price we charge, the profit we make, or the illuminating power. We give the best illuminating power we can, varying from 19 to 21 candles. We use partly cannel and partly coal. The high price of cannel has rather induced us to use a little more coal than formerly, and the effect is that the illuminating power is slightly diminished. It used to be 21, but by the last return it is something under 20 candles. As regards price, that is fixed, to a certain extent, by the price paid in other cases where competition sometimes exists. But this is the principle on which the corporation have acted from the very first, although they have no statutory limitation as to the profit which may be made by the consumption of gas, they have always found themselves under an obligation not to charge a price which would realize upon the capital employed in the works a larger profit or return than was ordinarily granted by Parliament to gas companies or corporations. We keep entirely distinct accounts, showing exactly the capital that is employed in the works, which capital is reduced every year by a very large sum—from £20,000 to £25,000. In the case of water, the same observations apply very much as those which I have already stated with reference to gas. The fact is, the Corporation of Manchester may be said to be almost the sole suppliers of water, not only to Manchester, but to an enormous dis-

trict all round; and what these districts would do without the corporation works I do not know, as the expense of obtaining water would be enormous. We have expended about £2,025,000 on our water-works, and we have expended a large amount of money, not only throughout the city, but a large amount outside the city. The maximum we can charge under the Act of Parliament is 5 per cent. to those who take the water out of the city, limited to £10 on any assessment—that is for a constant supply of the purest water (with the exception, perhaps, of Glasgow) that is supplied to any part of the kingdom. I cannot understand how Ramsgate can have existed with such a supply as has been proved demonstratively to be given. It is quite obvious, unless the supply is ample in the summer months, the prosperity of Ramsgate must necessarily be destroyed, because people will not go to a mere pleasure-place, if they are to be deprived of drinking-water and using it for other purposes.

Sir E. BECKETT: There has been an ingenious suggestion made this morning, that they did not want so much water inside, because they can take plenty of water outside?

Witness: They may not want so much for bathing, although probably they want water for household purposes of all kinds; but the quantity suggested is such that I never heard before to be proposed or to be defended. Most engineers recommend that no one should dream of establishing works that will not, at least, secure 20 gallons a head for the maximum population.

Sir E. BECKETT: I suppose that by a proper amount of pumping and different adits they could have got more water; is there any kind of excuse for their not having done it?

Witness: It is clear the company have been under the obligation for, I think, 40 years to give constant supply. The very foundation of the original Bill was that the works they proposed to create would enable them to give a constant supply. They have now got a Bill before Parliament with a similar preamble, some 35 years afterwards, so that it seems difficult to understand. The preamble of the old Act says, "And whereas a constant supply of water for the use of such inhabitants might be obtained"—but, first of all, it says that if a constant supply of water were provided it would be desirable, because "in cases of accidents, inconvenience and danger might be prevented, and the lives and property of the inhabitants of the said parish and neighbourhood better preserved and protected if a constant supply of water were provided." And then it goes on: "And whereas a constant supply of water for the use of such inhabitants might be obtained from divers springs and sources within the said parishes of Ramsgate, St. Lawrence, St. Peter the Apostle, and Minster, by raising and conducting the water from such springs and sources, or some or one of them, into a proper reservoir or reservoirs by means of engine cuts, drains, tunnels, pipes, conduits, feeds, and other aqueducts, and from thence by pipes to the houses and premises of the said inhabitants. And whereas the several persons hereinafter named are willing and desirous, at their own costs and charges, to effect the purposes aforesaid." I was engaged in the Glasgow case, in which there were two companies in pretended competition with each other, both seeking to enlarge their works, and a corporation Bill also, seeking to purchase them. After an inquiry which lasted a considerable time, the chairman intimated the opinion of the committee to be that a purchase should be made by the corporation, at a price equal substantially to their existing dividends. The committee then adjourned for a day or two, and when they met again all parties had agreed. The terms recommended by the committee were inserted in the Bill, the Purchase Bill was passed, and the two Bills of the companies were withdrawn. The terms were nothing like so extravagant as those offered here, they were 9 per cent. instead of 10 per cent., and 6½, or something like that, instead of 7½; but it was proved to the committee that the annuities which were to be granted by the Corporation of Glasgow would sell in the market for a sum of money which could, without any difficulty, be invested on indisputable security at 4 per cent. to realize to the shareholders their full maximum dividend. I have heard it given in evidence that the marketable price of the Ramsgate gas shares is something like £75, therefore it seems incredible that an offer of something like £146 should have been made.

Sir E. BECKETT: Supposing an arbitrator looks at the works, and finds them in good condition (as I dare say they are), and finds there has been spent this £72,000, which they say has been spent, all that £72,000, except £16,000, will have been paid by the consumers?

Witness: Yes, and will have to be valued and paid for again by the same consumers, including other inhabitants who are not consumers. I never heard of such a case, and it is quite certain, if there had been anything like a publication of accounts, or a public declaration of dividend, so that the consumers could really have seen that they were actually paying prices which realized such enormous per centage upon the capital—it is quite certain steps would have been taken long before this to have placed the company under parliamentary regulations, and have got rid of so crying an injustice.

Sir E. BECKETT: When they come and say they have given the public the benefit of the expenditure, they have done it by keeping out of Parliament, and by avoiding giving any accounts?

Witness: Yes, and not coming under restrictions; and now they only propose to come under restrictions provided they have their own way of dealing with the money.

Sir E. BECKETT: What proportion do your outsiders bear to your insiders?

Witness: A very large proportion; we are supplying with water from 700,000 to 800,000 outside the municipal boundaries; whereas, probably, we have only something under 400,000 within the municipal boundaries. As far as gas is concerned, the receipts will show this in the best way, the receipts within and the receipts without. I see within the city the private consumers pay £234,847; meter-rents, £3247; public lamps, £13,812 1s. Then, beyond the city, the private consumers £75,206 odd; meter-rents, £1291 odd; public lamps, £5925.

Sir E. BECKETT: Then, with regard to the parts which are outside, you have abundant temptation to keep up a high price?

Witness: Certainly; and we do keep up a higher price outside than within. The rates within the city are 3s. 4d. per 1000 feet; they were reduced from 3s. 6d. and 3s. 5d. to a uniform rate of 3s. 4d. per 1000 feet. The price within the city is 3s. 4d., a uniform rate. There formerly was a slight variation, which is done away with. Outside the city, except Morton, and beyond the river, uniformly it is 3s. 10d., instead of 4s. 2d. and 4s. 1d.; and in the distant districts it is reduced—in Cheadle, 4s. 10d. and 4s. 9d. to 4s. 6d., uniformly; in Northenden, which is a little further, from 5s. 4d. and 5s. 3d. to 4s. 6d., uniformly; in New Morton, from 5s. 10d. and 5s. 9d. to 4s. 6d., uniformly; in Droydsden, from 4s. 8d. to 3s. 10d., without any deduction for early payments. Those deductions, I may add, have been made without any suggestions from those places. We send gas for eight, nine, or ten miles, and we do not go anything like so far as people desire. We really are obliged to stop somewhere, but there is an old Act of Parliament authorizing us to supply Manchester and the neighbourhood.

Sir E. BECKETT: Is there, then, any kind of need for apprehension on

the part of these few ratepayers in St. Lawrence that they would be unfairly treated?

Witness: I cannot conceive of it. There is rather an extraordinary clause, which appears to be perfectly reasonable and just, which is an additional protection to all ratepayers, both outside and in. But one-half the profit is to be applied both in reduction of the gas rates and of the water-works charges. Seeing that these gas and water ratepayers have got a property, which they are now called upon to buy, it seems a very reasonable and proper clause to give them, at least, the benefit of one-half the profit that may be made when the works are in the hands of the local authorities.

Sir E. BECKETT: Among the cases you have inquired into, have you inquired into the results at Birmingham?

Witness: I know at Birmingham, where they gave a pretty full price for their works, they have been able to reduce their rates. I saw they had paid over £35,000 last year, in reduction of rates, out of profit. The transfer was only two years ago.

Cross-examined by Mr. LEIGH: I am not aware that at Birmingham the corporation have had complaints with reference to the present price.

Mr. LEIGH: Have they made the price as low as the companies used to furnish it at?

Witness: It will surprise me if it is not so. I know that in Glasgow, immediately after the transfer was made, they reduced their prices very considerably, although they were obliged, when coal went up to such an enormous price, to apply to the Board of Trade to increase the charge for gas. I do not think the Glasgow case was on all fours with the Birmingham case.

Mr. LEIGH: There was no case of compulsory purchase there?

Witness: It was entirely a case of compulsory purchase, because in the Glasgow case it was very similar to the case now before the committee. The Glasgow Corporation introduced a Bill to buy up the two companies, which companies had also Bills to provide further capital and further means for extension, and the whole question was whether the companies were to obtain their powers, or the works be transferred to the corporation, and the committee determined to transfer them.

Mr. LEIGH: In the Birmingham water case, when it was transferred to the corporation, there was some foundation to go upon for a compulsory purchase?

Witness: There was a clause in a very old Act of Parliament?

Sir E. BECKETT: There was an agreement, but the water company refused to perform that agreement, and, therefore, it was necessary to have a compulsory Act passed.

Mr. LEIGH said there was not a fight.

Sir E. BECKETT: No, for a very good reason. There was a declaration by the committee, upon which the opponents wisely surrendered.

Cross-examination resumed: There was considerable opposition on the part of some of the outlying districts to be dependent on the Corporation of Birmingham for their supply; and I stated then what I have stated to-day, that, so far as I could form an opinion from long experience, both in our own district and elsewhere, those outlying districts always get the benefit by being attached to, and deriving their supply from, a larger body. Those outlying districts are safe when at the mercy of a corporation, but very unsafe when at the mercy of a company. Regarding the gas and water supply at Ramsgate, the facts, as I understand, are these: As regards the gas, there are £20 paid on the shares, and there has also been a considerable sum of money spent out of surplus profits. The offer—although I can hardly believe it—is £146 per share. The position of the water company is that there has been £10 paid of capital, and an offer of £42 16s. 8d. per share, so that there is over 400 per cent. in one case, and over 700 per cent. in the other.

Mr. LEIGH: Assuming those shares to be sold, the purchaser would have to treat them as fully paid-up shares?

Witness: There is no doubt of that, but then "*caveat emptor*" is a motto purchasers usually consider, and it is quite clear that purchasers never dream of Parliament sanctioning £146 a share when they would only give £70 odd in the market.

Cross-examination continued: With respect to the water, there cannot be a doubt that a constant supply can be given as easily with a limited supply of water as an intermittent supply can. A constant supply, in my opinion, diminishes the consumption, because there is more waste in the intermittent system than when the supply is constant, and instead of increasing the demands upon the company it would lessen them, if a system of proper supply, with due regard to the fittings, were carried out. In Manchester we have one of the lowest averages of water taken for all purposes.

By Sir E. BECKETT: I believe, including everything—and we have an enormous trade consumption—our consumption is not more than from 21 to 22 gallons per head.

Cross-examination resumed: That is including the trade, and the income from trade is not much short of £100,000. In London the supply is 25 gallons on the average, and there the supply is intermittent.

Cross-examined by Mr. BROWNE: I heard Sir E. Beckett's speech, in which he pointed out that certain streets, occupied by influential people, had a preference, but I do not see how that shows that the supply could not be continuous.

Mr. BROWNE: If there was a short supply, certain streets and householders were to have the preference, as provided by the Act you have in your hand?

Witness: I cannot tell what the effect might be. There might be a clause to give all the water to one street.

Mr. BROWNE: With regard to the gas supply, the great advantage at Manchester is that you have large central works able to supply the whole outlying district?

Witness: Of course, that is one reason why we are able to supply gas cheaper than a small company, but that is only one of many considerations which make it desirable for a local authority to have the power of supplying gas.

Mr. BROWNE: Of course, there is no doubt that a large concern can be managed more cheaply than a great number of small concerns, and in that way it is a more economical thing that the great district of Manchester should be supplied by the corporation than by individual local authorities?

Witness: There is no doubt that would be a cause of economy, just in the same way that there is no question there is greater economy in the management of either gas or water works when they are in the hands of local authorities, who represent the ratepayers, than when they are in the hands of companies, who represent shareholders. I consider the price of gas at Manchester, relatively to the price at Ramsgate, is very low. At Manchester the price is 3s. 4d. for 20-candle gas over the bulk of the district. Outside the municipal boundaries the price is 3s. 10d., on account of the distance from the stations. No doubt we have certain advantages in the matter of coal, or else we could not supply gas at the price we do, but it is quite clear, from the profits the Ramsgate Gas Company have made, that they ought to have charged only half the price they have.

Mr. BROWNE: The people inside your municipal district are about 400,000, and there are 700,000 or 800,000 outside; therefore the question of profit belongs to those outside equally with those who are inside?

Witness : No, it does not.

The CHAIRMAN : Just answer one question, which may clear up matters. Is the town of Salford (which practically is related to Manchester as St. Lawrence is to Ramsgate) within the 8s. 4d.?

Witness : Salford is entirely independent. It is a separate municipality, it is a separate parliamentary borough, it both supplies its own gas, and supplies water to its inhabitants, although it does so happen that the water is supplied by an old parliamentary arrangement, when we took up the old Salford Company many years ago. We supply Salford with water in bulk at a price fixed many years ago, but the Salford people distribute it. The Salford people have their own gas-works, and they supply a very large district, both inside and outside their boundary. The two places are separated by a river, and are as distinct as London and Southwark.

Cross-examination resumed: I hardly know in what position St. Lawrence lies in relation to Ramsgate; but if it joins, there is no reason why they should not pay just the same.

Mr. LEIGH : There are no expensive mains to convey the gas from your own boundary to Cheadle?

Witness : You might have mentioned other places more to your purpose than Cheadle—Rusholme, for instance. There must be townships touching all round Manchester. The price is 8s. 4d. and 3s. 10d., and the difference begins as soon as you get out of the city. I have no hesitation in stating there is no ground on which the corporation can say they are not justified in charging to people outside rather a higher price for gas, because the works belong to the inhabitants, and they have a right, if there be any advantage, to obtain some benefit from it.

Mr. LEIGH : What do you do with the profits that accrue from your sale of water?

Witness : The payment for our water is obtained in a somewhat different manner to what exists in most other places. We have large water-works upon which we have expended about £2,500,000, from which we supply not only the corporation but a very large district all round. Within the municipal boundary, the only payment we can obtain for water is the amount we receive in the shape of water-rates. We make a public rate, which is payable by the owners of all property within the city, and we make a domestic rate, which is payable by the occupier of every dwelling-house within the city. We profess and intend to supply the inhabitants within the city with water at cost price; and, in order to determine what those rates are to be, we have to make an annual statement showing what the receipts are likely to be outside for water, which, of course, is taken voluntarily, and paid for according to the scale of charges prescribed in the Act; and those charges, as I said before, cannot be more than 5 per cent., with a limitation not to exceed £10 to any house, exclusive of charges for baths, and so on, but for which we have never charged. We take into account all we are likely to receive for trading purposes within and outside the city. Then, having ascertained the probable expenditure for the next year, we are authorized to make two rates to meet any deficiency—one, a public rate, and the other a domestic rate. The public rate at present is 3d. in the pound, and the domestic rate is 9d. in the pound, on the assessable value, not the gross rental. That would make 10d. in the pound on the gross annual value, adding the public rate and domestic rate together, one being paid by the owner, and the other by the occupier; whereas, outside, to those who take water from us voluntarily, we are authorized by the Act, and we do charge one shilling on the gross rental.

Mr. J. H. Etheridge, examined by Mr. O'HARA.

I am sanitary officer and road foreman at Ramsgate. I have had great difficulty in the discharge of my duties in respect to the sewers. In the summer time especially they get very much choked up by the insufficient supply of water to them. The rainfall at Ramsgate is very light, and consequently the sewers require frequent flushing. At times I have had six or seven men engaged in removing blocks in the sewers, which is a very offensive operation, detrimental to the public health, and objectionable to visitors. These blocks are caused by an insufficient supply of water where the closets are connected with the sewers. The sewers are blocked up mostly in the summer. I have endeavoured to remove this blocking by means of water, and have applied to the turncock to furnish a supply, but could not obtain it. His reason was that he could not supply me and the houses at the same time; and on one occasion he had to go and fill a ship with water. I have known visitors in summer leave in consequence of the roads being broken up and the offensive smell from the sewers. I have inspected about 800 houses in Ramsgate since last July and found the majority of them insufficiently supplied with water, especially the small dwellings. When I have complained of the condition of the closets I have been met with the reply that there was no water. I do not anticipate this state of things being improved if the supply of water is continued in the hands of the company. In my visits to the houses, as sanitary inspector, I have found the water actually deficient. Last August, during the epidemic of scarlatina, I went to one house and ordered the clothes to be taken from a child, who was in a very dirty state, and put into water, and I had the disinfectant fluid put on at the same time; but the woman said, "We have no water to put them in, and I have not had any since eight this morning." The water-mains, so far as I have seen, are very badly laid. On one occasion the roller I was using broke the water-main in two or three places, and when the company's men came and repaired it, we found it only lay 10 inches from the surface, whereas it ought to be 1 foot 10 inches. I have seen the service-pipes laid 3 inches from the surface, and have known the time when they have been frozen in winter; they ought to be laid at a depth of 9 inches. The late surveyor complained very much about the manner in which they emptied the mains, and he suggested a plan by which they could empty them by a cock into the gullies, so that it went direct into the sewer, but no notice was taken of that. They have to empty the main whenever they disconnect or reconnect a service.

Cross-examined by Mr. LEIGH : When the roads are broken up they are repaired by the local board, and the expense incurred charged to the gas or water company, as the case may be.

Cross-examined by Mr. BROWNE : I experienced more of the shortness of water last year than in previous years, in many of the smaller dwellings especially, for I have seen children actually standing at the tap waiting for the water to come on before they could get a drink. A great portion of the complaints would be removed if the constant supply is sanctioned by Parliament and made obligatory on the company.

Mr. E. Buss, examined by Mr. O'HARA.

I have been superintendent of police at Ramsgate since May 9, 1870. I have experienced great inconvenience from the breaking up of the streets. Last week the High Street was broken up to supply water, owing to a change of tenancy. I have here the lamp report book since 1874. The constables have frequently made complaints of the badness of the light in the public lamps. I have reported the matter to the company, but the lamps are about the same now as when I first went to Ramsgate. In the police station the light is especially deficient after eleven at night; the men have been obliged to use oil. The water supply to the new police station is very deficient. The tank there holds from 400 to 500 gallons, and that is very often not full.

Cross-examined by Mr. LEIGH : I have never been to the chairman of

the water company and said, "Things must be better;" it is not my duty. I have no wish to see the officials of the local board paramount over the company.

Mr. J. Austin, examined by Mr. O'HARA.

I am a retired naval surgeon, and have lived at Ramsgate about twelve years, where I have considerable practice. I think it highly necessary there should be a constant supply; in fact, I think there should not be any cisterns at all, except for supplying water-closets and such like purposes. I have received complaints from various people of the insufficiency of water. I have on several occasions examined the cisterns, and found them uncovered and in a very dirty state; in many houses one cistern has been doing double duty. I have very little to say about the gas, except that some time ago it was very bad and very dear. I gave up my own supply in the dining-room, and use a lamp, as I find it less deleterious to the atmosphere, and gives sufficient light for me to read by.

Cross-examined by Mr. LEIGH : The landlord puts up the cistern under the direction of the local board and sanitary authorities. The fittings should be kept in proper order by the householder, and I think, if the local board had the water, they would have full power to see to those things themselves.

Cross-examined by Mr. BROWNE : There has been a great improvement in the gas, both as to quality and price, and I do not think there is much to complain of now.

Mr. J. Veal, examined by Mr. O'HARA.

I am station-master at Ramsgate on the London, Chatham, and Dover Railway, and Margate is also under my management. The supply of gas to both these stations is from the Ramsgate Gas Company. The quality at Ramsgate used not to be good, but it has improved since this agitation. The pressure is bad, the station lying in the lowest part of the town. I am aware that Mr. Stride gave evidence last session in favour of the gas company. He is now general manager of the London, Tilbury, and Southend Railway; but he was formerly a district engineer of the London, Chatham, and Dover Railway. Mr. Stride was asked last year, "With reference to the pressure of gas in the station, did you yourself make any provision about it?" His answer was, "The waste of gas, and, as I thought, the consumption of gas, at the Ramsgate Station was excessive. I therefore instructed my gas inspector to put one of Tice's regulators on the meter, and to change the nipple of every burner at the station, so that they could not possibly consume more than 4 feet per hour." In reference to that, I have never heard of there being any complaint of waste of gas. With regard to the regulator and the changing the nipples, I can only say that if that order was given, it was never carried out in its entirety to my knowledge. Mr. Stride also said, "Never mind what pressure there would be on the main, they could not by any possibility get more than 4 feet an hour." That is not so, because it is quite dependent on the size of the burner and of the nipple what the consumption would be. We have a constant supply of water, our station being at the very lowest part of the town, and on a constant main. Mr. Stride stated last year that the whole of the leaden pipes had been taken up, and replaced with iron ones; but that is not the case, because there are some leaden pipes in use at the present time.

Cross-examined by Mr. LEIGH : I am perfectly satisfied with the supply of water. Mr. Stride stated last year that I implored him to take the regulator off, but I deny that statement.

Cross-examined by Mr. BROWNE : I do not know that the London, Chatham, and Dover Railway are to be exempt from two-thirds of the rates for gas and water purposes.

John Cooke, examined by Mr. O'HARA.

I am an engine-driver on the London, Chatham, and Dover Railway. The statement made by Mr. Stride last year, that the water at Ramsgate was so good that the drivers would run 30 miles to get it, is not true. The Faversham water is far superior to the Ramsgate water. The Ramsgate water is a little better than the Margate water; but I would get rid of both to get Faversham water. Our engines do not cost so much for repairs by using Faversham water that they do if we use Ramsgate water, which causes a priming in the boilers. The Ramsgate water is much worse in the summer than in the winter.

The CHAIRMAN said the committee would adjourn until the following Monday, when they hoped to hear that the parties had agreed among themselves.

(To be continued.)

ADVANCE IN THE PRICE OF GAS COAL.—We understand a general advance in the price of gas coal has taken place this year, and the demand which has just set in for the season is expected to be unusually brisk. This is a curious feature in the present crisis of the trade, and is supposed to be principally due to the large increase in the consumption of gas at home, and the rapid development of gas lighting abroad. As no other country in the world possesses such rich cannel coal as Scotland, and particularly Lanarkshire, the present advance is likely to prove welcome to those coal masters who are fortunate enough to have a cannel seam at their collieries. —*Glasgow Herald*.

PROPOSED PURCHASE OF THE LONGTON GAS-WORKS.—Want of space again compels us to defer the publication of proceedings in Parliament on the Longton Gas Bill, although the report has been in type for more than a week. We may state, however, that the Parliamentary Committee of the Corporation reported to a meeting of the Town Council on Thursday last the terms upon which the gas-works would be transferred to the Corporation; the maximum price of gas to be 3s. 6d. per 1000 feet in the borough, and within a radius of one mile outside the borough, from the gas-works; and outside the mile radius 7s. 6d., until 1880, when it would be reduced to 4s. per 1000 feet. After the Bill had passed the House of Commons, the same day it was taken before Lord Redesdale, and was satisfactorily passed, it being arranged that the repayment of the purchase-money should extend over a period of 70 years.

BURSTING OF A RESERVOIR.—Terrible destruction has been caused by the bursting of a reservoir dam at Staffordville, a manufacturing town in Providence, United States. The reservoir was a mile long by nearly half a mile wide, the water being used for milling purposes. Heavy rains had filled the dam, and about six o'clock on the evening of the 27th of March the water tore away the bank and flowed down the valley like a cataract, destroying everything in its course. Several bridges on the railroad and highway were swept away. The National Bank at Staffordville, the Congregational Church, and several stores and houses were destroyed. Two mills were damaged, and in all about 30 buildings were demolished, while several manufactories have been thrown idle. Fortunately, the people living in the village below the dam were forewarned of the danger, and had time to escape to a place of safety, but two men who remained behind were drowned. A portion of the railway was carried away, and two railway bridges, one 148 feet long. The actual loss caused by the disaster is set down at nearly half a million dollars. The water was 30 feet deep, and advanced through the gorge like a wall of water. Not a tree was left standing along its course, and the ground was furrowed to a depth of 35 feet.

Miscellaneous News.

THE GAS REFEREES AND THE BOARD OF TRADE.

CORRESPONDENCE IN REGARD TO PURIFICATION FROM SULPHUR.

(No. 1.)

R. 8720. Board of Trade (Railway Department), London, S.W.,
Dec. 11, 1876.

Gentlemen,—With reference to the enclosed correspondence which has been transmitted to this department by The Gaslight and Coke Company, I am directed by the Board of Trade to make the following observations:—

There appears to be no doubt, from the information contained in this correspondence, that a nuisance is created by the present system of the purification of gas by means of lime.

It is also clear from the terms of The Gaslight and Coke Company's Act, 1876, that the amount of freedom from sulphur impurity which the Gas Referees are to prescribe, is made subject to the condition that a nuisance is not created thereby. The only question, therefore, appears to the Board of Trade to be whether the company can restrict this impurity to the amount required by the Referees without creating a nuisance.

I am directed to request that the Referees will state whether, in their opinion, the maximum amount, as at present fixed, of sulphur impurity with which gas supplied by the company shall be allowed to be charged, can be maintained without creating a nuisance.

If, in their opinion, such a maximum cannot be so maintained, I am to suggest, for the consideration of the Referees, whether the maximum should not be increased.

The correspondence being in original, I am to request that you will be good enough to return it to the secretary to the company when you have done with it.

I am also to request that you will furnish the Board of Trade with a reply to this letter at your earliest possible convenience.

I am, &c.,

(Signed) HENRY G. CALCRAFT.

The Gas Referees, 17, Buckingham Street, Adelphi, W.C.

(No. 2.)

17, Buckingham Street, Adelphi, W.C., March 5, 1877.

Sir,—On the 11th of December last Mr. Calcrafft sent us, in a letter marked R. 8720, some correspondence transmitted to the Board of Trade by The Gaslight and Coke Company, respecting certain nuisances stated to be caused by the system of lime purification.

Mr. Calcrafft remarked that there could be no doubt that a nuisance was created, and, after referring to the Act of Parliament, requested us to state whether, in our opinion, "the maximum amount, as at present fixed, of sulphur impurity with which the gas supplied by the company shall be allowed to be charged, can be maintained without creating a nuisance."

In answering this question we wish first to call the attention of the Board of Trade to some facts in the history of the purification of gas from sulphur.

For nearly 30 years after gas was first used for illumination, the process universally and exclusively adopted to purify the gas from sulphur in all its forms consisted in bringing it into contact with lime, which was sometimes suspended in water, and sometimes in a solid state. The lime so used became fouled, and was liable, if exposed freely to the atmosphere, to give off offensive effluvia; but during this period, by the careful management of gas engineers, the manufacture appears to have gone on generally without impediment.

About 28 years ago another purifying agent was discovered—namely, oxide of iron. This had the advantage over lime that it was cheaper (as it could after being fouled be revived and used again), and that the effluvia when it was exposed to the air was less offensive than that from refuse lime. For this reason oxide of iron gradually came to be substituted for lime in many gas-works, particularly in those of large size.

In process of time, however, as the methods of testing gas improved, it was found that although oxide of iron completely removed from gas the most important sulphur impurity—namely, sulphuretted hydrogen, it still left an amount of sulphur in other forms, varying from 25 to 40 grains per 100 cubic feet of gas.

It will be recollected that the presence in gas of this amount of sulphur attracted considerable attention about the time that the Board of Gas Referees was first established, and formed the subject of several reports made by the Referees to the Board of Trade.

The present Referees were appointed in 1872. Our first step in the matter was to hold a meeting with the engineers of the Chartered Company and discuss the subject fully with them, after which, with their assent, we fixed, in our notification for September, 1872, a maximum for the works at Bow and Beckton "where lime could be freely used" of 20 grains, leaving the amount for other works still undetermined.

We carefully considered the question of possible nuisance from the use of lime in urban stations; we made ourselves acquainted with what was done elsewhere, and we found that the use of oxide was by no means common in the gas-works throughout the country. We were informed that in many large towns lime was still used; and in some which we visited we found that no nuisance was thereby caused.

We had at the same time abundant evidence that the public anxiety for a more complete removal of sulphur, which had found expression in the Acts under which we were appointed, had not abated. Accordingly, on March 31, 1873, we gave notice to the companies that on the 30th of June we should require gas from all works to conform to the standard of a maximum of 20 grains.

As the time approached, the companies represented to us that their arrangements for the use of lime were not perfected, and on the 30th of June we had an interview with Mr. Chubb, the secretary of the Imperial Gas Company, and we copy from our minute-book a statement formally made to us by him:—

Mr. Chubb stated that the Imperial Company had now become convinced (and they fully admitted the fact) that by means of lime purification the sulphur could be kept down, and that by clearing the gas of ammonia the nuisance could be prevented, so as to render the lime process practicable at any of their works. But they had difficulties from the limited extent and defective arrangements of their purifiers, and they asked an extension of time to enable them to make the necessary addition.

Mr. Chubb convinced us of the reasonableness of his appeal, and on the same day we issued the following notification, raising the maximum at urban works to 25 grains:—

17, Buckingham Street, Adelphi, W.C., June 30, 1873.

The Gas Referees have to make the following announcement as to the "sulphur maximum":—

For gas made at Beckton and Bow the maximum shall remain fixed at 20 grains.

But the Referees have determined, in consideration of various difficulties which the gas companies have encountered in attempting to reduce the amount of sulphur below 20 grains at works less favourably situated, to allow at these works, from this date until the 30th of September, a maximum of 25 grains.

During the winter half year it is the intention of the Referees, in further consideration of the increased quantity of gas which the companies have to make, to raise the maximum to 30 grains.

But the Referees wish it to be understood that they sanction these maxima for the periods named only because it appears that at several gas-works the purifying apparatus is on an insufficient scale, and in the hope that the time thus granted will be used by the companies in making such additions and improvements as will secure to the public a higher standard of purity for the future.

(Signed)

A. VERNON HARCOURT, WILLIAM POLE.

The Board will recollect, as an evidence of the public feeling on the subject, that this concession was complained of by the authorities of the City in strong terms.

After carefully watching the operation of the system of purification by lime, we were so satisfied with the results obtained that in the summer of 1875 we made a further reduction of the maximum. The companies made no earnest objection to this, but expressed an anxiety lest we should press them further, which we assured them, in the present state of knowledge and practice on the subject, it was not our intention to do.

The following table will show the maximum amounts fixed by us for all the works under our control during each half-yearly period since September, 1872. The increase for the winter months is on account of the larger make of gas and the consequently greater difficulty of effecting the purification.

Half-Yearly Periods.	Suburban Works.		Urban Works.	
	Grains.		Grains.	
Winter half year, 1872-3	20	..	—	..
March to June, 1873	20	..	—	..
June to September, 1873	20	..	25	..
Winter half year, 1873-4	20	..	30	..
Summer half year, 1874	20	..	25	..
Winter half year, 1874-5	20	..	25	..
Summer half year, 1875	15	..	20	..
Winter half year, 1875-6	20	..	25	..
Summer half year, 1876	15	..	20	..
Winter half year, 1876-7	20	..	25	..

During the first four years the complaints of nuisance were comparatively few and unimportant; but within the last half year they have become more serious and general.

The papers you have sent us contain four sets of complaints, in regard to the works at Shoreditch, Pimlico, Bromley, and Fulham, respectively. We knew nothing of the Pimlico and Bromley complaints till we received your letter; but we have now inquired into all, and have reported to you on each separately.

The Shoreditch complaint you will find reported on in our letter to you of Nov. 22, 1876. The principal complaint had arisen from an accidental and temporary cause, which had ceased; the inhabitants of the neighbourhood had no longer any grievance to urge, and although there was some bad smell given off, this was caused by the neglect of proper precautions.

In the Pimlico case, our report to you of the 4th of January last shows that there was reasonable ground of complaint, but that in this instance also the nuisance was clearly due to the company's imperfect arrangements for the removal of the foul lime.

A copy of our report on the Bromley case was sent you on the 22nd of January. The works are in a very open neighbourhood, but we found that no precautions were taken in emptying the purifiers, and thus the smell was probably carried to some distance.

On the Fulham case we reported to you on the 22nd of January. At this station various well-considered precautions were taken in the removal of the lime, and no doubt with good effect. But the actual process of emptying the purifiers we found less satisfactory; we suggested some improvements, and we saw no reason to doubt the possibility of avoiding nuisance if proper care were used throughout.

At each of these stations, except Pimlico, the purifiers stand in the open air, a position which must lead to the spreading by the wind of the dust and vapours evolved during the emptying of the purifiers. In works where the purifiers are enclosed in a covered building or shed this effect is almost entirely prevented.

We have reason to believe that in some instances the nuisance has been due to causes independent of the lime purification; and we need hardly point out how very easily, by relaxing the necessary care in any department of the manufacture, nuisance may arise.

We believe, moreover, that much more lime is used than is requisite for the purpose of removing sulphur. At least nine-tenths of the lime employed serves another useful but quite distinct purpose, that of removing carbonic acid and thus improving the illuminating power of the gas. If other means (such, for example, as are now in use at the South Metropolitan Gas-Works) should be found available for the removal of carbonic acid, the discharging of a lime purifier would be a much less frequent event, and might be conducted in a more leisurely and careful manner.

It is not to be denied, however, that the refuse lime is offensive, and that, if care be not taken, the offensive smell may be carried to some distance. But it is surely nothing new to have to deal with offensive materials in large gas-works. If great care were not used in regard to other products and other processes of gas manufacture, intolerable nuisances would be occurring continually. But it is part of the duty of intelligent engineers and managers to prevent these nuisances; as a rule they succeed in doing so; and the removal of refuse lime need form no exception, if proper skill and consideration were brought to bear.

But we ourselves look on the use of lime for the reduction of the sulphur compounds as only a temporary expedient. Other less objectionable processes have been proposed which give great promise, and which probably only require energetic and skilful trial to come into successful use. And no doubt others may be discovered if the attention of gas chemists and engineers is earnestly directed to the subject.

We believe The Gaslight and Coke Company are at a considerable disadvantage in regard to their engineering. It might naturally be expected that a gas company supplying more than half of London, and having about seven millions of capital, would have some eminent responsible and active head engineer to direct and control their scientific and manufacturing arrangements. But there is no such officer. Mr. Evans (whose great knowledge, ability, and experience are known to the Board of Trade as well as to ourselves) no longer occupies this position; and the management is in each case left to a local superintendent of the special place of manufacture.

We have no reason to doubt the competency of these gentlemen for the positions they hold; indeed, we know some of them to be men of ability. But we notice among them a singular diversity of opinion and practice, and some disinclination, perhaps natural, to cope with a problem new to their experience.

They have expressed their readiness to try any suggestions made by us; and we have pointed out some of the more obvious defects in the processes we have seen; but it is not our province to act as the company's engineers or chemical advisers. The absence of any well-qualified technical head with whom we could communicate on the general problem has been a source of continual inconvenience, and we are convinced that if the subject were earnestly taken in hand by a person so qualified, all the difficulties attending it would soon disappear.

It is clearly the intention of the Acts now in force that the gas companies shall be required to reduce the amount of sulphur in all forms, as

well as wholly to remove sulphuretted hydrogen. The question we have had to decide is how far this amount can be reduced, considering what is reasonable, and especially the necessity of avoiding nuisance.

It will be seen from the preceding statement that until the sudden outbreak of complaints of nuisance during the past half year, we had no reason to doubt the possibility of maintaining the standard of purity which we have prescribed. And now that we have inquired into the mode of working wherever complaints of nuisance have arisen, we are still of opinion that this standard may be maintained without injury to the neighbourhood of the works, if a reasonable amount of skill and care is employed.

By the Bill which The Gaslight and Coke Company have brought before Parliament, in order to free themselves from the obligation to remove sulphur compounds other than sulphuretted hydrogen, the question is raised whether the purification of gas to the extent now practised is worth the trouble it entails. It is a question of the balance of advantages between a more complete purification, attended by a greater risk of local nuisance and a somewhat greater cost, and, on the other hand, a less complete purification at less cost and with less risk of nuisance.

While admitting that there is much to be said in favour of the view that the presence in gas of the small amount of sulphur which lime purification removes, is of no great consequence to the consumer, we are still of opinion that it would be a measure of questionable expediency to relieve the companies altogether from the obligation to make and supply gas as pure as can reasonably be required, because the main inducement to invention and effort in this direction would thus be removed.

We have the honour to be, Sir, your obedient servants,
(Signed) A. G. VERNON HARCOURT.
WILLIAM POLE.
JOHN TYNDALL.

To the Assistant Secretary, Railway Department, Board of Trade.

(No. 3.)

[This letter relates to the complaints of nuisance at the Haggerston works, and was published in the JOURNAL of the 2nd of January last, page 17.]

(No. 4.)

17, Buckingham Street, W.C., Jan. 4, 1877.

Sir,—Among the papers which accompanied your letter to us of the 11th of December, were some complaints of a nuisance proceeding from the gas-works in Lupus Street, Pimlico.

We had previously heard nothing of these complaints, but on receiving your letter we thought it our duty to visit the works in question, and make inquiries on the spot.

We called at the office of Mr. Cubitt, who had made a complaint on behalf of his lessees living in the neighbourhood of the works, and from the report of Mr. Cubitt's agent, confirmed by our own observations, as well as from the memorial which you have forwarded to us, we have no doubt that at certain times a nuisance is occasioned.

On inspecting the processes in use for removing the refuse lime, we had no difficulty in tracing the nuisance to its source.

It does not arise within the works, the manager of which appears to succeed in performing all the necessary operations about the purifiers without causing any effluvia likely to be perceptible outside. It arises during the discharge of the refuse lime into barges lying on the river quay.

The works being separated from the river by the Grosvenor Road, the company cart the lime from the purifier to the river side, where it is thrown from the carts into the barges, generally lying at some depth below. This process, which is carried on in the open air, causes a great agitation of the lime, which naturally gives rise to an offensive smell.

We are somewhat surprised, considering that lime purification has been used at these works for some years, that the engineers to the company have not made arrangements for effecting the transfer of the lime from the carts to the barges in a quieter manner, and under such cover as would prevent any offensive effluvia from spreading about the neighbourhood. At the Fulham Gas-Works, which now belong to the same company, precautions of this nature are taken, and we believe with success.

We are devoting our best attention to the subject of your letter, and hope shortly to send you a more general answer.

We have, &c.,
(Signed) A. VERNON HARCOURT.
WILLIAM POLE.
JOHN TYNDALL.

To the Assistant Secretary, Railway Department, Board of Trade.

(No. 5.)

17, Buckingham Street, W.C., Jan. 11, 1877.

Dear Sir,—Having received, from your superintendent at Bromley station, a notice that he would open a lime purifier yesterday, we attended and witnessed the operation.

We found that the refuse lime was emptied by manual labour into open trucks, which were drawn away and discharged upon the waste land. In this process much agitation and exposure of the lime to the air were caused, and much dust was made; the consequence being, naturally, the production of an offensive smell, which, no doubt, would be carried away by the wind.

No precaution of any kind was taken to prevent this result, except by sprinkling a little coal or ash-dust on the surface of the lime in the purifier, which did no good, as the lime was immediately stirred up again by the shovels of the men.

The deposited lime was, we found, covered over with earth, and we do not think any nuisance arises therefrom.

The works are situated in a very open neighbourhood, the West Ham district, from which the complaints come, being two miles away.

If it is found that this situation of the works does not relieve you from the necessity of using such precautions as are adopted at other works in more crowded neighbourhoods, no doubt your directors will see the advisability of taking such precautions.

We are, &c.,
(Signed) A. VERNON HARCOURT.
WILLIAM POLE.

J. O. Phillips, Esq., The Gaslight and Coke Company.

(No. 6.)

[This letter refers to the alleged nuisance at the Fulham works, and was published in the JOURNAL of the 30th of January, page 159.]

(No. 7.)

The Gaslight and Coke Company, Horseferry Road, Westminster, S.W., Jan. 16, 1877.

Dear Sirs,—The observations on the statement of the vestry of the parish of Chelsea with reference to the alleged nuisance arising from the company's station at Fulham, which, in obedience to the request contained in your letter on the 18th of November last, I have to make, and with which I may couple those in connexion with other stations of

the company which have been the subject of public complaint, are very few.

Prior to the year 1860 gas companies were in the habit of purifying their gas from sulphur compounds by means of lime, which is no doubt the most effective agent for the purpose, but the annoyance to the public caused by its removal induced this and other companies to abandon it, and to adopt the somewhat less efficient, but also decidedly less offensive, process of purification by oxide of iron.

Subsequently to 1868 the higher standard of purity required by the Gas Referees appointed under the General Act passed in that year necessitated a return to the employment of lime, for the use of which this company has expended, and is now expending, very large sums of capital on the additional plant required; and wherever the purifiers have been adapted to the views of the Gas Referees, and brought into action there, as the evidence of the Chief Gas Examiner shows, the company has successfully and uniformly maintained the high degree of purity which the Gas Referees have enjoined.

I venture, however, to submit that section 36 of the City of London Gas Act, 1868, which is re-enacted by section 30 of The Gaslight and Coke Company Act, 1876, has been insufficiently regarded by the Gas Referees, because, although no question exists as to the ability of the company to obey the notification of the Referees, either theoretically or practically, it is manifest, from the complaints in the neighbourhood of those of the company's stations which are nearest to densely populated districts or to houses of a superior class, that the process necessitated by the present prescribed standard of purity is not without annoyance to the inhabitants, and of this fact, notwithstanding that it is disputed by the Gas Referees, the officers and servants of the company, as well as the public, have the evidence of their own senses. These complaints, as they have arisen, have been reported to the Gas Referees, who have made many suggestions which have been immediately acted upon by the company's engineers, with a view to check the exhalations which arise from foul lime in the course of removal from the purifiers, but they have in no instance tended either to remove or even to modify the evil, and it is now abundantly clear—

1. That the standard of purity required by the Gas Referees is practically unattainable except by the employment of lime as a purifying agent.

2. That the nuisance to the neighbourhood in which the works are situate is inseparable from its use.

The directors, therefore, renew their application to the Gas Referees to exercise the powers vested in them by the 31st clause of The Gaslight and Coke Company Act, 1876, and to fix such a maximum (say 40 grains) for sulphur, as is compatible with the use of an inoffensive purifying agent.

In the event of their declining to adopt this suggestion, the directors appeal to the Gas Referees to apply to this company the regulation now imposed upon the Commercial Gas Company—viz., that the amount of sulphur impurity to be found in the company's gas be simply recorded, pending the result of an application to Parliament on the subject in the ensuing session.

I am, &c.,
(Signed) J. O. PHILLIPS, Secretary.

To the Gas Referees, 17, Buckingham Street, Adelphi, W.C.

(No. 8.)

17, Buckingham Street, W.C., Jan. 23, 1877.

Dear Sir,—We have to acknowledge the receipt of your letter of the 16th of January.

We regret that we cannot concur in the opinion you express that "nuisance to the neighbourhood in which the works are situate is inseparable from the use of lime."

The reason why no maximum for sulphur has been imposed hitherto on the Commercial Gas Company, is simply that their preparations for lime purification are not yet completed.

We are, &c.,
(Signed) A. VERNON HARCOURT.
WILLIAM POLE.
JOHN TYNDALL.

J. O. Phillips, Esq., The Gaslight and Coke Company.

We have been favoured with a copy of a letter addressed by The Gaslight and Coke Company, on the 7th inst., to the Secretary of the Board of Trade, replying generally to the above correspondence between the Department and the Referees. It is as follows:—

The Gaslight and Coke Company, Horseferry Road, Westminster, S.W., April 7, 1877.

Sir,—I am instructed to acknowledge the receipt of your letter of the 19th ult., transmitting, for the information of the court of directors of this company, a printed copy of correspondence between the Board of Trade and the Gas Referees, relative to the removal of sulphur impurity from gas, in which correspondence is found your letter of Dec. 11, 1876, stating that "there appears to be no doubt that a nuisance is created by the present system of the purification of gas by means of lime," and as "it is also clear, from the terms of The Gaslight and Coke Company's Act, 1876, that the amount of freedom from sulphur impurity, which the Gas Referees are to prescribe, is made subject to the condition that a nuisance is not created thereby, the only question, therefore, appears to the Board of Trade to be, whether The Gaslight and Coke Company can restrict this impurity to the amount required by the Referees without creating a nuisance," inquiring also, "whether the maximum amount, as at present fixed, of sulphur impurity with which gas supplied by the company shall be allowed to be charged, can be maintained without creating a nuisance," and suggesting, for the consideration of the Referees, "if, in their opinion, such a maximum cannot be so maintained, whether the maximum should not be increased." The correspondence also includes the letter of the Gas Referees, dated the 5th ult., which is their reply to your letter.

It is desirable that I should state that on the 16th ult. the directors, unacquainted with the correspondence above alluded to, deputed three of their number—viz., the Hon. Richard Howe Browne, Governor; Mr. E. V. Richards, Q.C., Deputy-Governor; and Mr. Evans, late Gas Referee, and till recently the company's Engineer-in-Chief, to wait upon the Gas Referees, and discuss with them the sulphur question, taken in connexion with the 30th section of the company's Act of 1876, quoted by you, with a view to ascertain whether, by inducing the Referees to concede an increased maximum, it were possible to obviate the necessity for the very costly inquiry which must be entailed by the prosecution of the company's Bill now before Parliament bearing upon that subject.

The deputation, still ignorant of the communications above mentioned, by appointment attended the Gas Referees on Monday, the 19th ult., and propounded the views of the court, that the existing sulphur maximum should be extended. The Gas Referees met the proposition made to them by a reference to their letter of the 5th ult. to the Board of Trade, which was then read for the first time to the deputation.

The directors thereupon re-stated the object of their application, to which the Gas Referees have since expressed their indisposition to accede.

It is therefore, in the opinion of the court, desirable to examine some of the allegations contained in the Gas Referees' letter, and to communicate

to the Board of Trade the court's views on them; but inasmuch as the directors and their officers will shortly most probably find themselves face to face with the Gas Referees before either a parliamentary committee or a court of law, it is unnecessary at the present moment to trouble you with categorical replies to the whole of the charges brought against them by the Gas Referees, and they have therefore directed me in this letter to confine myself to points which will neither in one way nor the other materially affect the question at issue raised by the company's present Bill.

In passing to more particular matters, it is necessary, in few words only, to advert to the opening statements in the letter of the 5th ult., which the Gas Referees designate as *historical facts*, which statements serve at the outset to show the very limited knowledge of the subject possessed by the Gas Referees, and the small pains they have been at to acquaint themselves with the history of gas purification. The directors are no tyroes in the trade which they have undertaken, of gas suppliers to London. Guided by the constant study of the traditions of the past, as well as by the matured experience which the daily conduct of the oldest and the largest gas company in the world has given them, the directors, acting in the double capacity of trustees for their shareholders and servants of the public, have attained that "practical knowledge and experience in the manufacture and supply of gas" which is not to be acquired by the mere student, nor perfected by laboratory experiments alone, and which, though explicitly enjoined by the 29th section of the City of London Gas Act, 1868, as the qualification for at least one of the number, is, according to the thinking of the court, possessed by no one of the three Gas Referees.

The Gaslight and Coke Company Act, 1876, by the 30th section, previously recited, requires that "The Gas Referees shall, from time to time, ascertain with what degree of purity the company can reasonably be required to make and supply gas continuously without occasioning a nuisance to the neighbourhood in which the works are situate, and shall thereupon prescribe and certify the maximum amount of impurity in each form with which gas supplied by the company shall be allowed to be charged," and acting in pursuance of that clause, and upon the best judgment which they possess in the matter, the Gas Referees have fixed such a standard of purity as is practically unattainable, except by the employment of lime as a purifying agent; and the directors now assert, and will at the proper time be prepared to prove, that "nuisance to the neighbourhood in which the works are situate," is, in the present state of scientific knowledge, unavoidable, if the requirements of the Gas Referees are to be carried out.

The Board of Trade will, therefore, observe that while the company are liable, under the general law of the land, to an indictment for nuisance, and to consequent penalties if they do obey the injunctions of the Gas Referees, they are, under the 51st section of the company's Act of last year, liable to a penalty of £100 a week for every one of their nine manufacturing stations if they do not. The inconsistency of such a position is at once apparent.

Up to the present time, the company have implicitly obeyed the instructions of the Gas Referees, and the result has, at times, been an amount of annoyance to the public, which the directors do not feel justified in disregarding. Since the complaints of nuisance first arose, the Gas Referees have, very properly, and in the exercise of their duty, repeatedly, and at all hours, with and without notice, visited several of the company's stations, and investigated the processes of manufacture and purification, with a view to detect, if possible, any error in manipulation to which nuisance might be attributed. They have, in every instance, received from the company's engineers the very fullest information and co-operation. They have, from time to time, made their own suggestions for the abatement of the evil. Those suggestions have, to the very last letter, and by the express injunctions of the court, been acted upon by the company's engineers; and not in the spirit, as insinuated by the Gas Referees, of a wish to frustrate them, but with the honest and sincere desire to render even the most unpromising suggestion a success. In no one instance has success resulted, and the Gas Referees, unable themselves to cure the evil for which they alone are responsible, are, therefore, driven to the course of laying at the door of the company's engineers a want of "proper skill and consideration."

"Other processes" than the use of lime purifiers, say the Gas Referees, have been proposed, "which give great promise, and which probably only require energetic and skilful trial to come into successful use." Notably and pre-eminently among these "other processes" stands the process which, in deference to the expressed wish of the Board of Trade, the directors permitted one of the existing Gas Referees to make the subject of experiment at this station in the years 1874 and 1875. This experiment, which had the benefit of trial, under the sole control, supported by all the "energy" and "skill," of the gentleman in question, underwent a variety of changes, chiefly from bad to worse, lasted during

a period of nearly 18 months, cost this company, at whose expense it was carried out, nearly £3000, and terminated in signal failure.

The directors would willingly have refrained from entering upon personal questions, but they cannot but remark the inimical spirit which characterizes the letter of the Gas Referees, and its general inaccuracy of statement, as well as the personality indulged in by them at the expense of the company's engineers. The directors have, therefore, no alternative but to defend their own management and the ability of their scientific officers as they best may.

The Gas Referees know little of the constitution of the court of directors, upon whose management they cast imputations, or they would be aware that Mr. Evans, the company's late engineer-in-chief, "whose great knowledge, ability, and experience are known to the Board of Trade as well as to themselves," now occupies a seat at the court, of which he is the trusted adviser, and who, from his additional experience as a former Gas Referee, is able to weigh the edicts of the present body of Referees, and estimate them at their full value.

The Gas Referees (although in dealing with this question they have not visited the whole of the company's stations, and have therefore had no sufficient, if any, opportunity for testing the attainments of some of the engineers whom they disparage) express their belief that "the company are at a considerable disadvantage in regard to their engineering." The company's engineers frankly and warmly confirm all that the Gas Referees say in praise of their former colleague, Mr. Evans; but the directors are bound, in justice to those gentlemen who are still in charge of their works, to state that they are not sensible of the disadvantage alluded to, nor has the engineering of the company in any way suffered since Mr. Evans accepted his well-earned seat at the court as a director of the company, and they accordingly challenge the Gas Referees to show results of working in any other company, metropolitan or provincial, superior to those which are achieved by the engineers of this company. The Gas Referees are surprised "that a gas company supplying more than half of London has not some eminent responsible and active head engineer to direct and control their scientific and manufacturing arrangements, Mr. Evans no longer occupying this position," and they go on to lament "the absence among the company's existing engineers of any well-qualified technical head with whom they could communicate on the general problem." The directors are of opinion that in working out this principle they, on their part, may very fairly urge the advantage which would arise were the number of Gas Referees limited to one instead of three, care being taken that that one should be "competent" and "practical." In effect, the complaint of the Gas Referees amounts to this, that of the nine thoroughly practical, experienced, and well-qualified gentlemen who act as engineers of the company's stations, those with whom the Gas Referees have taken the trouble to communicate at all on this subject are found to hold opinions of their own, which, although cordially endorsed by the directors, including Mr. Evans, unfortunately do not always coincide with those of the Gas Referees. It is possible that, from the great and increasing magnitude of the company's operations, the appointment of an engineer-in-chief may one day become matter of expediency; but the directors (who deem themselves the best judges of the proper mode of conducting their own affairs), after more than once giving the question due consideration, have thought it well to refrain, for the present, from making such an appointment. It has not, however, occurred to them that any inconvenience, either to the company or to the public, can possibly result, notwithstanding the fact that, as the Gas Referees very justly observe, "it is not their province to act as the company's engineers or chemical advisers."

As before stated, it is not the intention of the directors in this letter to occupy your time in the discussion of specific points of manufacture, &c., which will ere long be fully argued elsewhere. They will now only draw the attention of the Board of Trade to the following facts:—That in Paris, and, so far as they are aware, in every other city of the Continent, testing for sulphur compounds other than sulphuretted hydrogen is unknown; that out of the many corporations or local boards which are now supplying gas in England and Scotland, one only is subjected to any additional restriction, and (which is most significant) that a reference to the draft Bill introduced in the session of 1875 by the Metropolitan Board of Works and Corporation of London jointly for themselves, undertaking the supply of gas to London in competition with the existing gas companies, will show that the restrictions as to purity, which they so labour to impose and enforce upon this company, are, when they themselves are in the case, conspicuous by their absence.

I am, Sir, your most obedient servant,
(Signed) J. O. PHILLIPS, Secretary.
The Assistant Secretary, Railway Department, Board of Trade.

LONDON GASLIGHT COMPANY.

The Ordinary Half-Yearly Meeting of Proprietors was held at the Freemason's Tavern, Great Queen Street, on Wednesday, the 4th inst.—MAJOR ROHDE HAWKINS, Esq., the Governor, in the chair.

The SECRETARY (Mr. A. J. Dove) read the notice of meeting, and the share register having been sealed, the following report and statements of account were presented:—

Annexed to this report your directors submit the half-yearly accounts, which show the result of the manufacture and distribution of gas to Dec. 31, 1876.

In comparing the accounts now submitted to the meeting with those of the corresponding period of the previous year, it is satisfactory to find that, although the reductions in the charge made to the public for gas have amounted to nearly £7000, the actual decrease in the gas-rental is only £1670. There has been a diminished revenue from the sale of coke, but this has been met by the advantageous sales of the other products.

It will be seen that the profits of the half year under review will leave, after providing for dividends on preference capital, the sum of £30,517 6s. 11d. applicable to dividend on the ordinary capital. The directors recommend that the usual dividends be declared; viz., on all classes of preference stocks and shares at their respective rates, and at the rate of 10 per cent. per annum on the ordinary stock. Such dividends to be paid on April 16, 1877.

In accordance with the resolution of the extraordinary meeting of proprietors held on Oct. 13, 1875, for the purpose of creating a debenture stock, your directors have issued a circular to the holders of ordinary stock, offering a *pro rata* allotment of the debenture stock for requirements of the company in paying off the bonds. The amount will become payable before the 15th of April by those who accept the allotment. The rate of interest has been fixed at 4½ per cent. per annum.

Three directors—namely, Robert Rawlinson, Esq., C.B., the Honourable Henry Noel, and William Irving Hare, Esq.—retire by rotation; and, being eligible, offer themselves for re-election.

One auditor—namely, George Pearson, Esq.—also retires by rotation; and, being eligible, offers himself for re-election.

No. 1.—STATEMENT OF STOCK AND SHARE CAPITAL, on Dec. 31, 1876.

Acts of Parliament relating to the Raising of Capital.	Description of Capital.	Maximum Dividend authorized.	Number of Shares issued.	Nominal Amount of Shares.	Called up per Share.	Total paid up.	Arrears of Calls.	Remaining to be called up and unissued.	Total Amount authorized.
15 Vict., cap. 82	Ordinary stock.	10 per cent.	Stock	Stock	Stock	£384,260	..	..	£384,260
	2nd pref. " "	6 ditto.*	Do.	Do.	Do.	10,500	..	..	10,500
	3rd ditto " "	6 ditto.	Do.	Do.	Do.	2,450	..	..	2,450
	1st ditto " "	6 ditto.	Do.	Do.	Do.	150,000	..	..	150,000
29 Vict., cap. 55.	A ditto shares.	6 ditto.	11,878	£25 0 0	£20 and £1 5s.	185,085	£250	£111,615 & £3,050	300,000
20 & 21 Vict., cap. 73	Debenture stks. 5 & 6 ditto.	..	Stock	Stock	Stock	26,692	..	..	26,692

* With option of conversion.

No. 2.—STATEMENT OF LOAN CAPITAL.

Acts of Parliament authorizing the Loan Capital.	Description of Loan.	RATES PER CENT. OF INTEREST.		Total Amount borrowed.	Remaining to be borrowed.	Total Amount authorized.
		4½ per Cent.	5 per Cent.			
15 Vict., cap. 82	Bond, &c.	£63,900	£14,502	£78,402	£101,122	{ £91,667 100,000
29 Vict., cap. 55	Ditto					

Dr.		No. 3—CAPITAL ACCOUNT.				Cr.	
			Description of Capital.	Certified Receipts to June 30, 1876.	Received since that date.	Total Receipts to Dec. 31, 1876.	
To Expenditure to June 30, 1876		£330,171 6 11	By Ordinary stock	£383,700 0 0	*£500 0 0	£384,200 0 0	
Do. during half year to Dec. 31, 1876, viz.—			2nd Preference ditto.	11,000 0 0	+	10,500 0 0	
New and additional mains and services . . . £538 1 9			3rd ditto ditto.	2,450 0 0	..	2,450 0 0	
New and additional meters 825 15 2		1,363 16 11	1st ditto ditto.	150,000 0 0	..	150,000 0 0	
			A ditto shares, £25 each, including amount received in anticipation of calls	184,975 0 0	110 0 0	185,085 0 0	
			Debenture stocks, under 20 & 21 Vict., cap. 73	26,692 12 6	..	26,692 12 6	
			Bonds and other loans	88,412 0 0	+	78,402 0 0	
				£847,229 12. 6		£837,329 12 6	
Balance		£831,535 3 10	Balance. . . . .	..	..	4,948 3 10
		10,642 12 6	Note " } £500 converted into ord. stock				
Total expenditure.		£842,177 16 4	+ } £10,010 paid off.			£842,177 16 4	

		No. 4.—REVENUE ACCOUNT.			
To Manufacture of gas—			By Sale of gas—		
Coals, including dues, carriage, unloading, and trimming (see Statement No. 8)		£47,681 3 1	Common gas, per meter, at 3s. 6d. per 1000 cubic feet	£89,876 13 7	
Salaries of engineers, superintendents, and other officers at works		2,310 9 3	Cannel gas, per meter, at 4s. 8d. per 1000 cubic feet	5,762 11 3	
Wages (carbonizing)		9,487 6 11	Public lighting, and under contracts—		
Purification, labour		832 13 3	Common gas	9,202 16 11	
Repairs and maintenance of works and plant, materials, and labour, less £122 8s. 11d. received for old materials		13,971 8 9	Cannel gas	1,328 14 0	
		£79,283 1 3	(See Statement No. 10.)	106,170 15 9	
The Gaslight and Coke Company, for cannel gas		5,913 9 4	Rental of meters.	2,013 8 6	£108,184 4 3
Distribution of gas—			Residual products—		
Salaries and wages of officers (including rental clerks)		2,107 4 4	Coke, less £1564 7s. 2d. for labour and cartage	20,500 15 1	
Repairs, maintenance, and renewals of mains and service-pipes, including labour		6,197 6 2	Breeze, less £227 2s. 11d..	762 13 2	
Repairs and renewals of meters		1,492 7 10	Tar, less £30 5s.	8,054 15 3	
Public lamps—			Ammoniacal liquor, less £11.	4,459 0 0	33,777 3 6
Lighting and repairing		9,706 13 4	Rents receivable		1,584 9 0
Rents, rates, and taxes—		1,806 17 8	Transfer fees		9 0 0
Rents payable		932 9 6			
Rates and taxes		3,249 4 8			
Management—		4,181 14 2			
Directors allowance.		900 0 0			
Company's auditors.		75 0 0			
Salaries of secretary, accountant, and clerks		1,216 15 3			
Collectors commission		1,125 6 5			
Stationery and printing		335 7 6			
General charges		271 8 5			
		3,923 18 0			
Law charges		59 9 4			
Parliamentary charges (oppositions).		41 12 11			
Bad debts		505 2 11			
Depreciation-fund for works on leasehold land		100 0 0			
Superannuations, sick allowances, and gratuities		502 5 0			
Repairs of houses		42 10 8			
Total expenditure		£106,156 19 7			
Balance carried to net revenue account, No. 5		37,397 17 2			
		£143,554 16 9			£143,554 16 9

		No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).		No. 6.—RESERVE-FUND.	
Interest on bonds to Dec. 31, 1876.		£1,836 17 0	Balance from last account . £26,282 6 6	Balance on Dec. 31, 1876. . £36,126 11 5	Balance on June 30, 1876. . £35,741 0 4
Dividends on preference capital		11,191 8 0	Less dividend on ordinary capital for the half year ending June 30, 1876		Interest on amount invested. . 385 11 1
				£36,126 11 5	£36,126 11 5
Interest on temporary loans		£13,078 5 0	Amount from revenue account, No. 4		
Redemption-fund, reserve per London Gaslight Act, 1857.		149 11 9			
Balance applicable to dividend on ordinary capital		750 0 0			
		30,517 6 11			
		£44,495 3 8		£1,600 0 0	£1,600 0 0

No. 8.—STATEMENT OF COALS.						No. 9.—STATEMENT OF RESIDUAL PRODUCTS.					
Description of Coal.	In Store, June 30, 1876.	Received during the Half Year.	Carbonized during the Half Year.	Used for Sundries during the Half Year.	In Store, Dec. 31, 1876.	Description of Residual.	In Store, June 30, 1876.	Made during the Half Year (estimated).	Used during the Half Year (estimated).	Sold during the Half Year.	In Store, Dec. 31, 1876.
	Tons.	Tons.	Tons.	Tons.	Tons.						
Common	5767	66,608	58,329	40	14,006	Coke, chaldrons of 36 bush.	3,056	59,160	17,672	40,164	4,380
Cannel	879	1,867	1,908	..	838	Breeze, " " "	878	6,080	..	5,546	1,412
						Tar, gallons	124,000	572,729	..	518,729	178,000
						Am. liq., butts of 103 gals.	2,092	11,287	..	10,824	2,555

		No. 10.—STATEMENT OF GAS MADE, SOLD, &c.			
Description of Gas.	QUANTITY (measured by Station Meters).		QUANTITY SOLD.		Number of Public Lamps.
	Made.	Purchased.	Public Lights and under Contracts (estimated).	Private Lights (per Meter).	
Common	Thousands. 596,378	Thousands. 31,538	Thousands. 49,059	Thousands. 513,331	Thousands. 562,390
Cannel . . . . .	..	..	4,717	24,696	7,023

		BALANCE-SHEET.			
To Net revenue—			By Capital—		
For balance, per account No. 5		£30,517 6 11	For balance, per account No. 3	£4,348 3 10	
Reserve-fund—			Cash at bankers, and in hand	9,204 4 11	
For balance, per account No. 6		36,126 11 5	Amount invested—		
Depreciation-fund (for works on leasehold land)—			Reserve-fund	35,741 0 4	
For balance, per account No. 7		1,600 0 0	Stores on hand, viz.—		
Redemption-fund		4,118 10 6	Coals	£12,757 12 0	
Interest on bonds and other loans, for amount due to Dec. 31, 1876		1,898 6 11	Coke and breeze	2,348 16 3	
Preference dividends, ditto.		11,191 8 0	Tar and ammoniacal liquor	2,503 2 6	
Unclaimed dividends		4,475 1 1	Sundry stores	2,857 19 6	20,497 10 3
Sundry tradesmen and others, for amount due for coals, stores, and sundries.		62,327 5 1	Accounts due to the company—		
			Gas and meter rental, quarter ending Dec. 31, 1876	£62,206 15 2	
			Ditto ditto, arrears outstanding	3,545 8 3	
				£65,752 3 5	
			For coke and other residual products	13,794 19 11	
			Sundries	1,946 7 3	81,493 10 7
					£151,754 9 11

The GOVERNOR: Gentlemen, it is now my business to move that the report and accounts be adopted; and, in doing so, I have very little to say. With regard to the affairs of our own company, the report, which is in your hands, tells you, I think, everything there is to be told. We are working in a very satisfactory manner, and, as you will see from the accounts, we have made a good profit during the half year; so that, after paying the dividends on all classes of stocks and shares, we shall be able to carry a very substantial sum to the credit of the reserve-fund, which will make us more secure should bad times, like those of 1873, come upon us again. The works are in a very excellent condition, and Mr. Dove and Mr. Morton, in their respective departments, keep a careful eye upon all our transactions. I can assure you that there is no invention or method by which our operations could be improved or more satisfactory results obtained, which they do not take care to bring under our notice, and which the board are not always willing to adopt, if it comes before them on the recommendation of such good authority. Having said this, I should now sit down, as I do not know that the affairs of our own company call for further observation; but it has only recently been brought to our notice, that the Chairman of Committees of the House of Commons proposes to introduce a new Standing Order relative to Private Bill legislation, under which it will be made compulsory upon every gas and water company requiring powers to raise new capital, that their shares shall be offered by public auction or tender, instead of being, as heretofore, allotted among the existing proprietors *pro rata*. Now this is a proposition which we think ought to be opposed to the utmost, as it is an exceedingly unfair step to take with regard to gas companies. Why should we be subjected to exceptional legislation of this kind? If the Legislature should see fit to make a universal rule in the matter, then, however unwise we might think it, we should willingly bow to it; but to single out gas and water companies for exceptional legislation is most unfair. And we think, although there may be some little profit, or apparent profit, at first, if this rule is adopted, it will tend practically rather to increase than diminish the cost of shares. A person investing money in a gas company does not look merely to the moderate interest on the money which he put into the concern; there are the prospective advantages which he considers. But if this Standing Order be adopted, he will in future have nothing further to look to than the amount of the interest which the dividends on the shares he buys in the first instance will pay. It may be that, as in the case of our own proprietors, the business of the company may yield no dividends for some years, and then, after bearing the burden and heat of the day, and the concern becomes remunerative, Parliament steps in and says that the shareholder shall be limited to a certain maximum dividend upon the money he has invested, and shall have no prospective advantage from the growing prosperity of the undertaking. I believe the effect of such a regulation would be that in adverse times companies would find it very difficult to raise money at all. And there is another point. The present system is to issue a quantity of shares when new capital is required, and to make a moderate call upon those shares, keeping the balance in reserve in case of accident, or when further capital is wanted. But under such a provision as is proposed, we must put the shares into the market, and raise all the money upon them at once, leaving nothing for us to fall back upon. Under the present system the public are in reality benefited and not injured, and as the proposed new Standing Order must act injuriously to companies, and would not benefit the public, I trust it will not be allowed to pass.

Hon. A. KINNAIRD (deputy-governor) seconded the motion.
Mr. DOANE: Do I understand that the new Standing Order will affect the metropolitan companies only?
The GOVERNOR: It will apply to all companies going to Parliament for fresh capital.
Mr. HOBSON said the directors of a company with which he was con-

nected in Yorkshire had had the question under their consideration, and had determined to do all in their power to oppose it. The question, however, with them was whether it was a matter upon which they could present a petition. It being only a proposal for the regulation of the business of the House, it appeared doubtful whether a petition was the right way to meet it. At the same time it was deemed expedient that all persons connected with gas companies should endeavour, as far as possible, to influence individual members of Parliament, and induce them to vote against the proposed new Standing Order. He did not exactly see how it would operate in relation to the issue of new capital, but he did not agree with the governor that it would be necessary that the shares should be all paid up at once. Still he objected strongly to the proposal, which, if applied to gas and water companies, must in fairness be extended to railways, canals, and all joint-stock enterprise. It ought, he thought, to have been explained more clearly by the governor that it was only intended to apply to new Bills brought before Parliament, which rather qualified the matter.
The GOVERNOR: No doubt; you are quite right. It is only to apply to future Bills; but then in London future Bills are a necessity. We are not like persons carrying on an ordinary trade, who might rest content when they have reached a certain standard, and say, "We will spend no more in extensions." Parliament has required of the gas companies that they shall be ready to furnish a supply, throughout their respective districts, to every person who applies for it; and, as London is continually extending, we must from time to time go before Parliament and ask for more capital. Why, if placed under such conditions, should we be deprived of the benefits which the investment of further capital may bring? There is no question that existing shareholders invested in these undertakings, knowing that the business must increase, and have stood upon the contingent advantages of their investments.
The motion was then put and carried.
The GOVERNOR moved—"That the following dividends be now declared—viz., the fixed dividends upon all classes of preference stocks and shares, and a dividend at the rate of 10 per cent. per annum upon the ordinary stock, such dividends to be payable on the 16th inst."
The DEPUTY-GOVERNOR seconded the motion, which was put and carried.
The retiring directors and auditor were re-elected.
Mr. PRICE proposed that an addition of £700 per annum be made to the remuneration of the directors, making the total sum divisible amongst the eight members of the board £2500.
The motion having been seconded, it was suggested by a PROPRIETOR (who quite concurred in the proposed increase) that such a resolution should not be adopted without previous notice having been given.
Mr. PRICE had no hesitation in accepting the suggestion, and withdrew the motion, giving notice that he would re-introduce it at the next half-yearly meeting.
The GOVERNOR said the directors were exceedingly obliged to Mr. Price for his proposal, and to the meeting for the cordiality with which it was received; but it would be much more satisfactory to them that due notice be given before any decision was come to on the point.
A PROPRIETOR said he thought the debenture stock created might as well have been issued at 5 per cent. as at 4½.
The GOVERNOR observed that when the matter was discussed at a former meeting, the opinion seemed to be that the rate of interest should be fixed at 4 per cent. The directors acted to the best of their judgment, believing that they could float it at 4½ per cent. The fact that the stock had fetched a satisfactory premium was the best proof that they had taken the right course.
A vote of thanks to the directors terminated the proceedings.

COMMERCIAL GAS COMPANY.

The Half-Yearly Ordinary Meeting of Shareholders was held at the City Terminus Hotel, Cannon Street, on Friday, April 6—RICHARD BRADSHAW, Esq., in the chair.
The SECRETARY (Mr. E. J. Southwell) read the advertisement convening the meeting. The seal was affixed to the register of shareholders, and the minutes of the last meeting were read and approved.
The following report and statements of account were submitted:—
The directors report that they have now completed a year's working of the amalgamated company under the new conditions of supply imposed by the Act of 1875.
During the past half year important alterations and extensions of the purifying plant, at both works of the company, have been carried out, to meet the more stringent requirements in respect of purity.

The whole of the cost of these exceptional and abnormal works has been carried against revenue, the directors considering it more prudent to relieve the capital permanently, though at the risk of heavily taxing the revenue account of this and the preceding half year.
The new works have made considerable progress, and it is fully expected they will be brought into partial operation next winter.
The accounts for the half year ended Dec. 31, 1876, show a balance of £35,368 9s. 6d. applicable to dividend. The directors accordingly recommend dividends after the following rates—viz., 10 per cent. per annum on the original stock, and 7 per cent. per annum on the new stock, in both cases less income-tax.
In pursuance of the 120th section of the company's Act of 1875, the five auditors will go out of office, and it will be for the meeting to elect three in their stead; Messrs. Ilsley, Marsh, and Webb, being eligible, offer themselves for re-election.

No. 1.—STATEMENT OF CAPITAL (Stock) on Dec. 31, 1876.					No. 2.—STATEMENT OF LOAN CAPITAL on Dec. 31, 1876.					
Acts of Parliament relating to the Raising of Capital.	Dividend Authorized with Gas at an Initial Price of 3s. 9d.	Paid up.	Remaining to be Paid up and Unissued.	Total Amount Authorized.	Acts of Parliament Authorizing the Loan Capital.	Description of Loan.	Rate per Cent. of Interest.	Total Amount Borrowed.	Remaining to be Borrowed.	Total Amts. Authorized.
Commercial Gas Act, 15 & 16 Vict., cap. 155	10 per cent.	£450,000	..	£450,000	Ratcliff Gas Act, 4 Geo. IV., cap. 98	Bonds.	5 per cent.	£15,670	£4,330	£20,000
Ratcliff Gas Act, 4 Geo. IV., cap. 98					Commercial Gas Act, 38 & 39 Vict., cap. 200					
Commercial Gas Act, 38 & 39 Vict., cap. 200	7 per cent.	61,638	£218,362	280,000		Debentures.	Not exceeding 5 per cent.	..	280,000	280,000
		£611,638	£218,362	£830,000				£15,670	£284,330	£300,000
Total share capital paid up (see No. 1)									£611,638	
Total loan capital borrowed (see No. 2)									15,670	
									£627,308	

No. 3.—CAPITAL ACCOUNT.					Cr.	
Dr.				Total Expenditure to Dec. 31, 1876.	Total Receipts to Dec. 31, 1876.	
To Expenditure to June 30, 1876				£548,084 16 10	By Stock, as on June 30, 1876	£550,000 0 0
Expenditure since—					New stock	61,638 0 0
Freehold land	£2,574 12 6				Bonds	15,670 0 0
Extension of works	13,884 13 2					
Ditto mains	414 2 0					
Ditto services	296 15 5					
New and additional meters.	902 4 0			18,072 7 1		
				£566,157 3 11		
				61,150 16 1		
Balance of capital account				£627,308 0 0		£627,308 0 0

Dr.			No. 4.—REVENUE ACCOUNT.			Cr.		
To Manufacture of gas—						By Sale of gas—		
Coals, including dues, carriage, unloading, and trimming (see Account No. 7)	£53,189	2 7				Common gas, per meter, at 3s. 9d. per 1000 cubic feet (see Statement No. 9)	£99,448	10 1
Salaries of engineers, superintendents, and other officers at works	1,582	14 0				Public lighting and under contracts, common gas (ditto)	10,014	11 6
Wages (carbonizing)	11,507	19 0					£109,463	1 7
Purification, including £860 14s. 4d. for labour	2,906	6 2					349	9 0
Repairs and maintenance of plant and works, materials, labour, and enlarging works, less £258 5s. 3d. received for old materials	26,950	6 6				Meter-rental		
			£96,136	8 3		Residual products—		
Distribution of gas—						Coke, less for labour £1036 18s. 10d.	£19,948	2 10
Salaries and wages of officers (including rental clerks)	1,673	7 3				Tar	5,187	4 5
Repairs, maintenance, and renewals of mains and service-pipes, including labour	4,704	4 9				Ammoniacal liquor, less for labour £8 18s.	4,689	19 5
Repairs and renewals of meters	676	0 9					£29,825	6 8
			7,053	12 9		Less loss on breeze	5 14 6	
Public Lamps—							29,819	12 2
Lighting and repairing			1,791	18 8		Miscellaneous receipts—		
Rents, rates, and taxes			2,743	4 2		Rents	£106	5 0
						Wharfage	3	0 0
Management—						Interest	369	2 9
Directors allowance	1,600	0 0				Transfer fees	30	10 0
Company's auditors	80	15 0						
Salaries of secretary, accountant, and clerks	694	4 0						
Collectors commission	752	14 11						
Stationery and printing	412	12 3						
General charges	293	19 7						
			3,844	5 9				
Bad debts			525	10 2				
Law and parliamentary charges			60	10 6				
Superannuations, allowances, &c.			1,658	6 8				
Official officers			111	0 3				
Total expenditure			£113,926	17 2				
Balance carried to net revenue account (No. 5)			26,214	3 4				
			£140,141	0 6				
				</				

we are charging meter-rents in one part of our district and not in another. I know of no reason why consumers should not pay a rental for the hire of the meters employed by them; and, therefore, while we are making a reduction to them in the price of gas from 3s. 9d. to 3s. 5d., we mean, at the same time, to make a universal charge for meter-rent. We think this is an equitable arrangement, and we believe the course we are taking will meet with your approval. Now, this reduction in the price of gas will, of course, as I need hardly point out, cause a reduction in the earnings of the company; but we have the assurance of our engineers that the reduction can be made without loss to the divisible profits, and without in any way endangering your statutory dividends. And I may say this, that the experience of all companies has been that the reduction of price leads to an increased consumption of gas, and therefore you must not conclude that the whole of this 4d. which we propose to take off the price will be a loss to the company. Only within the last two or three days, I have seen a report of the meeting of a London gas company, at which it was stated that although the reduction made in the charge for gas was estimated to amount to nearly £7000, the actual decrease in the gas-rental was only about £1600. No doubt that which was true in the experience of that company will be true in our own case. Well, gentlemen, the next matter I have to mention to you has reference to our new works at the Bromley station. Those works are going on very satisfactorily, and though their progress has been somewhat retarded by the bad weather of the last four or five months, our engineers are convinced that they will be quite ready to be put in operation by next winter, and they will then come in aid of our power to supply our consumers. Perhaps it would interest you to know something about the new capital. I think I may say that the £70,000 of borrowed money, which will be the next mode in which we shall have to increase our capital, will be offered to the proprietors very shortly, and that probably the time for paying up the amount of that debenture stock will be the 1st of July. The stock will be offered to the proprietors according to their present holdings in the company, and the rate of interest will be $\frac{4}{5}$ per cent., which is the rate mentioned at the meeting last October, and which I think met the cordial approval of the shareholders then present. Gentlemen, I think that is all I have to say with reference to the report and accounts; but there is one matter which you will have to consider, and that is with regard to the auditors of the company. There were, as probably you are aware, three auditors of the Commercial Company, and two auditors of the Ratcliff Company. Now our Act of 1875 says this upon the subject: Clause 120 enacts that—"The auditors of the two companies in office at the time of amalgamation may continue in office until the first general meeting held after the expiration of one year from that time, and at that meeting the shareholders of the amalgamated company shall elect not less than two nor more than three auditors, and thenceforth the number of the auditors of the amalgamated company shall be not less than two nor more than three, and the maximum amount payable in each year as the remuneration of any auditor shall be £50; and any person being an auditor of either of the two companies at the time of amalgamation, who is not elected an auditor of the amalgamated company, shall be entitled to receive a gratuity not exceeding one year's salary, if at any time the amalgamated company in general meeting so resolve." Under that clause the whole of the five auditors go out of office, and of these five gentlemen, three—viz., Mr. Ilsley, Mr. Marsh, and Mr. Webb—offer themselves for re-election. I need not tell you that they are eligible, and very eligible. With these remarks I leave the matter in your hands, and now move the resolution I read to you at the first.

Mr. SAMUDA, M.P., seconded the motion.

A SHAREHOLDER: What has become of the balance of the new stock?

The CHAIRMAN: You shall have the opportunity of taking it up in a very few days. A form of tender will be sent to you and other shareholders, and it will be allotted to the highest bidder.

A SHAREHOLDER: Are the bonds of the old Ratcliff Company to be permanent, or will they be paid off?

The CHAIRMAN: The £15,670 will, no doubt, be paid off when the bonds become due; but I dare say there would be no difficulty in renewing them at the same rate of interest. Depend upon it we shall do our best to take care of you.

Mr. LONDON: I do not know whether I shall be in order in making a few remarks with reference to the proposed charge for meters. I think if the directors were not to reduce the price of gas so low, and were to continue to supply meters free, as hitherto, it would give much more general satisfaction to the consumers. As the consumers in the Commercial Company have always had meters free, I am sure they will be dissatisfied at now being made to pay for them. People will forget all about the reduction in the price of gas, while they will be constantly reminded of the meter-rent, which they did not expect to have to pay. I have no doubt the directors have considered the matter carefully, and have used a sound discretion, but that is my opinion.

Mr. SAMUDA: Perhaps I may be allowed to explain that the directors have considered the matter, and there were very particular reasons why the change should be made in the form in which it is proposed to be made. Let me inform you that the effect of the charge for meters represents, roughly speaking, 1d. per 1000, while the proposed reduction in the price of gas is 4d., therefore the public get a clear benefit of 3d.

The motion for the adoption of the report was put and carried.

The CHAIRMAN: The next resolution is—"That pursuant to the recommendation of the board of directors a dividend be and is hereby declared for the half year ending Dec. 31, 1876, after the several rates of £10 per centum per annum upon the old stock, and £7 per centum per annum upon the new stock, in both cases less income-tax, and that warrants for the same be forwarded to the proprietors." I beg to move that, and to state, as it will be interesting to you, that the warrants are already prepared, and will be posted this afternoon, and I hope will reach you this evening.

Mr. SAMUDA seconded the motion, which was put and carried.

Dr. LITTLE: I beg to move—"That the three retiring auditors—Messrs. Webb, Ilsley, and Marsh—be re-elected auditors of the company." I have no doubt the resolution will be carried unanimously. I am much pleased to find the other two auditors have retired, as it leaves us perfectly free to make that choice which will be acceptable to all in the meeting. I do not know whether I shall be in order when I say that I should like to see a proper remuneration given to the retiring auditors. I know what the Act of Parliament says, but I think the auditors retiring upon the amalgamation should be put upon the same footing as the others. I shall, therefore, move, if it is agreeable, that the retiring allowance of the two auditors be £50, instead merely of a year's salary.

The CHAIRMAN: I think the better way would be to separate the terms of your motion, and let the re-election of auditors be carried first.

Dr. LITTLE agreed.

Mr. BLACKMAN: As one of the old auditors, I should like to have the pleasure of seconding the motion. In doing so, I would just explain that my colleague, Mr. Sander, as well as myself, felt it right that, as two of the late auditors were to be eliminated this day, it would be better that they should resign beforehand, and, taking into consideration the long services of the gentlemen whose names have just been mentioned, we thought that we could not conscientiously oppose them. They have been

your auditors for many years longer than we have, and have always performed their duties most efficiently, and, therefore, to avoid giving you useless trouble, we resolved to retire. I may, however, say that, when a future vacancy occurs, we shall be happy to offer our services again. In taking my official leave of the company, I can only express my best thanks to all the officers, by whom we have always been treated with the greatest courtesy, and from whom we have always received every assistance in the discharge of our duties.

The motion was put and carried.

Mr. LISLEY returned thanks for himself and colleagues.

The CHAIRMAN moved that a gratuity be paid to each of the retiring auditors equal to one year's salary. This was the provision made in the clause of the Act he had read, and he thought the shareholders should not go beyond that.

Dr. LITTLE seconded the motion, which was put and carried.

Mr. HOLLINGTON: There seems to be a diversity of opinion amongst shareholders as to when we can begin to pay a larger amount of dividend—whether it will be when the price of gas is reduced below 3s. 9d., or whether we must wait till it is below 3s.

The CHAIRMAN: There is no manner of doubt on that point. Our Act provides that, so long as we charge 3s. 9d. per 1000 for gas, the maximum dividend we can divide is 10 per cent. For every 1d. reduction we make below 3s. 9d. we are entitled, if we earn it, to pay our proprietors one-quarter per cent. additional dividend. On the other hand, if we are obliged to raise the price of gas beyond 3s. 9d., then for every 1d. increase in price we must submit to a diminution of dividend to the extent of one-quarter per cent. If you work it out, therefore, you will see that, by reducing the price of gas, as we intend to do, 4d. per 1000, we shall be entitled to divide 11 per cent. instead of 10 per cent.—i.e., the dividend will go up on both classes of stock, the present 10 per cent. will pay 11, and the 7 per cent. will pay 8. But let me tell you that the Act provides that the additional one per cent. to which we are entitled may be dealt with as the proprietors think right. They may place it to a reserve-fund to meet future contingencies, or in the payment of an extra rate of dividend.

Mr. HOLLINGTON: The only reason why I asked the question was that one of our largest proprietors just told me that we could not pay a larger dividend than 10 per cent. till the price of gas was reduced below 3s.

The CHAIRMAN: He left out the 9d.

Dr. LITTLE: The business of the meeting being at an end, I think we cannot separate without passing a vote of thanks to the chairman and directors for the care they have taken of our interests during the past six months. It appears that we have not only received the full dividend to which we are at present entitled, but that there is a prospect of our receiving a larger dividend in future. These facts indicate the great and constant attention paid to our affairs by the board, and entitle them to receive our very cordial thanks, which I have great pleasure in asking the shareholders to vote them.

Mr. NUTTER seconded the motion, which was at once agreed to.

The CHAIRMAN: Gentlemen, on behalf of my colleagues and myself, I beg to thank you for this very cordial expression of your satisfaction with our management. You may depend upon it that what we have done in the past we shall continue to do in the future. I claim for my colleagues and for myself that we have always devoted our best energies to promote the interests of the company, and I repeat that what we have done hitherto we are willing to do again. Well, now, gentlemen, before we separate there is another vote of thanks which I think we ought to pass. You know that in companies of all kinds, but especially in gas companies, prosperity depends to a considerable extent upon the efforts of the officers. I am quite sure that such is the case with us, and that you will not like to close the present meeting without expressing to our officers your sense of obligation to them for their services. I shall, therefore, move a vote of thanks to Mr. Robert Jones, our own engineer—as I may call him—also to Mr. H. Jones, who is also now our own engineer, and to our secretary, Mr. Southwell, as well as to all our other officers, for the very faithful way in which they have discharged their duties, and thus contributed so largely to the prosperity of the company.

Mr. LAPORT seconded the motion, which was carried unanimously.

Mr. R. JONES: The secretary has just intimated to me his wish that, while acknowledging this vote on my own account, I should also respond on his behalf for the other officers of the company. I have great pleasure in doing so, and in assuring the shareholders that it is always an encouragement to those holding responsible positions in a company, to receive the thanks of their boards, and also of the proprietors. If there is one thing more than another that could stimulate us to greater exertion in your service, it is to know that we enjoy your confidence, and have met with your approbation.

The proceedings then terminated.

BARTON DISTRICT LOCAL BOARD GAS SUPPLY.—At the monthly meeting of the Eccles and Barton Local Board, on the 26th ult., a communication was read from the Corporation of Salford with respect to the supply of gas in the district. It stated that the council had approved the recommendations of the committee that the price of gas, at the expiration of the June quarter, should be reduced. The Gas Committee had no difficulty whatever in assuring the Board that they could continue a satisfactory supply to the district. The expenditure which the council had resolved to undertake in connexion with the existing works would at no distant date complete the work which was undertaken by them more than three years ago—and, in fact, this additional expenditure was necessary in order to make the extensions undertaken as complete and successful as possible. That additional outlay had, in fact, contributed to enable the committee to effect the present reduction in the price of gas. With reference to the complaint as to impurity of gas and defective light, the committee stated that no complaints had reached them from the board nor from individual consumers, and therefore it was assumed they were not of a serious character. With regard to the complaint of deficient purity, the council had accepted a tender, at a cost of nearly £7000, for additional purifying apparatus at the Regent Road works, which when completed would doubly secure uniformity of purity in the gas supplied. The Gas Committee of the council had very carefully considered the suggestions as to the provision of a gasholder in the district, the disconnection of the supply-mains with the higher portions of the district, and the supply of gas in bulk on terms to be arranged. The committee assured the board that there were really no physical difficulties in the way of a constant and adequate supply of gas to all parts of the district, and that for that purpose the provision of a local gasholder was really not required. They, therefore, could not recommend the council to go to such an unnecessary expense, nor could they, under the circumstances of the case, either undertake to supply gas to the board in bulk, or to give their consent to the introduction of a Bill to enable the Board to supply their own district. After reading the letter a conversation ensued, in which the course recently taken by the consumers of gas at Wigan was mentioned, and it was resolved to communicate with the committee of consumers in that town for fuller information, and to ascertain the terms upon which the engineer was engaged by them.

No. 10.—STATEMENT OF GAS MADE, SOLD, &c.

Description of Gas.	Quantity made, partly measured in Gasholders.	QUANTITY SOLD.			Quantity used on Works, &c., partly estimated.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity sold.				
Common	Thousands. 469,199	Thousands. 40,730	Thousands. 389,742	Thousands. 430,472	Thousands. 4,000	Thousands. 434,472	Thousands. 34,727	3,879

No. 11.—BALANCE-SHEET.

To Capital—		By Cash at bankers		£2,644 14 2
For balance, per account No. 2	£32,629 9 6	Amount invested in Three per Cent. Consols—		
Reserve-fund, per account No. 5	20,000 0 0	Reserve-fund	£20,000 0 0	
Renewal-fund, per account No. 6	9,918 2 6	Renewal-fund	9,918 2 6	
Insurance-fund, per account No. 7	3,023 11 6	Insurance-fund	1,523 11 6	
Net revenue account, for balance, per account No. 4	26,230 16 0			31,441 14 0
Sundry tradesmen, for amount due for coals, stores, and sundries	9,348 3 6	Cash in hand for freight, accounts, &c.		1,000 0 0
Deposits by consumers	4,283 3 11	Stores in hand—		
Property-tax account	518 13 4	Coals	£12,485 7 5	
Dividend account (outstanding)	16 16 9	Coke and breeze	871 7 0	
		Tar and ammoniacal liquor	1,349 0 3	
		Sundry stores	2,893 12 3	17,599 6 11
		Accounts due to the company—		
		Gas and meter rental, quarter ending Dec. 31, 1876	£46,658 12 5	
		Arrears outstanding	629 13 9	47,288 6 2
		For coke and other residual products		5,265 8 8
		Sundries		411 7 9
		Interest		318 2 4
				£105,969 0 0
	£105,969 0 0			

The CHAIRMAN briefly moved—"That the report and accounts be received and entered upon the minutes."

Mr. JULIAN HILL seconded the motion.

Mr. HOBSON said he observed that, before setting out the amount of net revenue applicable to the payment of dividends, the directors had carried to the credit of the insurance-fund the sum of £1500. The balance was therefore left very much the same as in the previous half year. Then it was £26,187, as against £26,230 on the present occasion, the difference being only £40 or £50. Only about £1500, therefore, the revenue had improved during the past six months, although during one-half of that time the price of gas had been raised 2d. per 1000 cubic feet, and a meter-rent had been charged to the consumers. Taking those matters into consideration, he would have expected to find the increase in the revenue something like £3000.

The SECRETARY: Not so much as that.

Mr. HOBSON said it should be pretty nearly that. But the actual increase was only about equal to the sum added to the insurance-fund, and, considering the low price of coal, this was not satisfactory to him. The South Metropolitan Company made their honourable position by selling gas at 3s. per 1000 when coals were at a higher rate than they had been during the last half year, and, therefore, though he was not finding fault with the management, he could not help remarking that he was disappointed at the result shown in the accounts.

Mr. ROSTRON said, at the first glance, the accounts produced on that occasion appeared rather unfavourable; but when compared with previous accounts, that impression would be removed. He had gone carefully over the figures, comparing them with those of the corresponding period of 1875, and, with the exception of finding the amount realized by the sales of coke less, the comparison was favourable to the last half year.

Mr. MAY remarked that if anything more was necessary to satisfy the first speaker on this point, he might remind him that for the half year ending December, 1875, the company were selling gas at a loss of 4d. per 1000 cubic feet; whereas it was certain, during the last half year, they had not only not sold at a loss, but had actually carried forward a balance of £1500, which had been placed to the credit of the insurance-fund.

Mr. FOSTER said it must also not be forgotten that the company were now under obligation to supply a higher quality of gas. If they charged 3s. 2d. instead of 3s., they were bound to supply 16 instead of 14-candle gas.

The CHAIRMAN said the secretary would have given an answer to Mr. Hobson's remarks, but that he had been somewhat anticipated by the observations of subsequent speakers.

Mr. HOBSON said he did not like to hear it said that the company were losing 4d. per 1000 on their gas a year or so ago.

The SECRETARY said in the days of the high price of coal the company did lose 4d. per 1000—i.e., for one half year they sold gas at 4d. per 1000 less than it cost them.

The CHAIRMAN said the report which the directors had submitted to the meeting was so full and detailed that it left him little to say, and unless the shareholders had any further inquiries to make, he would put the motion for its adoption.

Mr. HOBSON said he should like to know whether there was a prospect of a better balance on the next occasion.

The CHAIRMAN said he thought the company had very fair prospects. The directors flattered themselves that it was so.

Mr. FOSTER said the whole question rested upon the cost of cannel. He saw that the cost last half year was £1000 more than previously.

The SECRETARY said the cannel cost them £2000 more than during the corresponding half, and the receipts for coke were £3000 less, while the profit was £2600 more.

The CHAIRMAN remarked that at the present moment there was no question affecting the supply of gas before the public. The only point of interest to gas companies themselves was the sulphur question, which he hoped would be settled in the present session. It was a very difficult and a very important question for gas companies, and he earnestly trusted that some measures would be taken to relieve them of their heavy responsibilities in the matter. There was one question affecting the South Metropolitan Company in which those present would be interested, and that was the question of the prospect of a call. He might, therefore, inform them that in October next it would be necessary to make a further call, but what the amount would be—whether £1 or £2 per share—he was hardly in a position to state. Of course, the directors would do without the money as long as they could, and would not call it up unless they saw that they could comfortably pay the dividends upon it.

The motion was then put and carried.

The CHAIRMAN moved—"That a dividend at the rate of 10 per cent. per annum be now declared, and made payable, the warrants to be transmitted to the proprietors on the 6th inst."

Captain HEATHORN seconded the motion, which was put and carried.

Mr. ROSTRON moved, and Mr. GARNER seconded, the re-election of Mr. Simpson as a director of the company, which was at once agreed to.

Mr. HOBSON moved, and Mr. FILER seconded, the election of Mr. R. Foster as an auditor of the company, in the place of Mr. Paull, resigned.

The motion was put and carried.

The CHAIRMAN: Gentlemen, it is now my duty to return thanks for the compliment you have paid me by my re-election. I assure you I feel very highly the honour thus done to me. I can look back for a period of nearly 40 years during which I have been a director of this company. I believe I am now the oldest gas director in London. From a document in have now in my possession, I find that the first dividend declared by this company was in the year 1836, when we paid 1½ per cent. For the two previous years of their existence the company paid no dividend at all, and it was 25 years from the date of their establishment before they reached their maximum.

Mr. JULIAN HILL: *Nous avons changé tout cela.*

The CHAIRMAN: I have, therefore, seen the company in their times of adversity and prosperity; and with reference to the gentleman who has just been elected an auditor, and who is the largest shareholder in the concern, I can hardly speak too highly of the services which his family have rendered to us. It was his uncle who saved us from being ruined by putting his hands deeply into his pocket to preserve our position and keep us on our feet. Without him we certainly should not have gone on, and therefore I always feel the highest respect for his memory. Gentlemen, I again say that I am much complimented by my re-election, and will endeavour to serve you to the best of my ability.

Mr. FOSTER: Sir, allow me to thank you for the way in which you have referred, not only to myself, but also to my uncle. In this company I must say that one generation has worked for the succeeding generation. When I came into business in 1836, this company were surrounded by lawsuits, and my uncle, who took an active part in the management at that time, had his hands pretty full. His efforts to assist the company were highly successful, and the present generation are reaping the fruits of his labours.

Mr. HOBSON moved a vote of thanks to the chairman and directors for their services, which, having been seconded, was put and carried, and the chairman acknowledged the same.

Mr. ROSTRON moved, and Mr. FOSTER seconded, a vote of thanks to the secretary and engineer, which was cordially responded to.

Mr. LIVESY: Mr. Chairman and gentlemen, I am very much obliged to you for the cordial manner in which you have carried this vote of thanks to me, and I can assure you I appreciate your kindness very highly. My connexion with this company dates back nearly 30 years. I was in the employ of the company before 1850, and since that time I have seen great changes in our affairs. About ten years before my father's death, the directors appointed me to the office of engineer, and from that period until his decease the entire charge of the works, the management of the men, and all new constructions, devolved upon me. At my father's death you kindly elected me to his office in addition, and I can assure you that since then I have had very hard work to do. It seems to me that troubles came directly afterwards. In the first place, we had the stokers strike, which threatened to put the whole of London in darkness. In most of the works the men turned out; in ours they did not. Then came the coal panic, during the whole of which we did all in our power to keep the price of gas down to 3s., so as to serve the public. I do not think, however, that the public have been very grateful to us; at any rate, our efforts during that period have placed this company in the foremost position of gas companies, not only in the Metropolis, but in the whole of England. The fact that the South Metropolitan Company continued to supply gas at 3s., whilst the other companies went up to 5s., has stamped us with a character for good management which none of the others possess, and I think it is to this circumstance that the prominent position of our shares in the market is due. Then we had the agitation, resulting in parliamentary action, of 1875; and for that I contend this company are not responsible. That agitation was induced and brought on entirely by the high price charged for gas by other companies, which made the authorities very angry, and resulted in the adoption of the sliding scale. As far as the sliding scale itself is concerned, I think I can claim the right to be considered as its author. I suggested it, in the first place, in the year 1874, in my address to the British Association of Gas Managers. The Metropolitan Board took it up in 1875 in a half sort of way, their intention being that it should only tell against the companies, and never in their favour. I gave evidence upon it before Mr. Forster's committee, and I believe my evidence had a great deal to do with the conclusion at which the committee arrived on the question. I do not at all regret what I did in that matter, for I believe it has resulted in an improvement in the value of this company's property to the extent of at least £100,000. It has added very largely to the market value of our shares. Still I had "more kicks than ha'pence" for what I did, and was accused of having sold the birthright of the shareholders. I had one consolation, however, for, when I came out of the committee-room, Mr. Hill seized me by the hand, and said, "I am delighted with the evidence you have given, and I approve of it entirely." Since then we have gone on smoothly so far as this company are concerned, but for the unfortunate restrictions that have been put upon us in reference to the purity of our gas. Those restrictions have become so intolerable that I very often say to myself, "What a fool I am to go on with it; why not throw it up altogether, and let things take their chance." The Act appointing the Referees has imposed such restrictions that it has made my life, and the lives of other managers, a perfect misery,

in our attempts to comply with the requirements. This has caused the Chartered Company to take action, and to endeavour, by a Bill in Parliament, to rid themselves of this bugbear, and I believe they stand a very good chance of success. With reference to this company, I may say that since my respected father's death our business has increased 60 per cent. We had then £300,000 capital paid up; we have now £460,000, and the business has increased in rather greater proportion. We have really built new works, also, during the last five years, so that no one who knew them then would know them now. Well, gentlemen, while acknowledging your vote of thanks, which I do most sincerely on

my own account, I should not be doing right if I did not add that I think the shareholders are very much indebted to the other officers of the company, who I know have done their best to promote your prosperity. The directors some years ago appointed my brother as assistant engineer, and but for the help which he rendered last year during the parliamentary struggle, when I was so much occupied, the management of the works would have been neglected altogether. He, however, ably took my place, and managed the business as well as I could have done it myself. The proceedings then terminated.

PHENIX GASLIGHT AND COKE COMPANY.

The Adjourned Half-Yearly General Meeting of Proprietors was held at the Bridge House Hotel, Southwark, on Wednesday, April 4—EDWARD HORNER, Esq., in the chair. The SECRETARY (Mr. I. A. Crookenden) read the notice convening the meeting, the seal was affixed to the shareholders register, and the minutes of the last general and special meetings read and approved. The following report and statements of account were presented:— The directors submit herewith trade account and balance-sheet to the 31st of December last. In their last report the directors stated that it was necessary to restore the largest gasholder. Since then they have come to the conclusion that the ground can be more advantageously used by erecting a gasholder on a much larger scale, and have made a contract to erect one to contain 3 million cubic feet, in lieu of the one intended, containing only 600,000 cubic feet. This latter gasholder they will probably propose to

erect on the same increased scale, which, with other available space, will afford sufficient accommodation for the largest supply of gas that can be made at the London stations. Hydraulic lifting apparatus has been erected at the Greenwich station, which will afford an improved and economical mode of raising the coals. The board regret to announce the decease of Mr. Downs, who discharged the duties of auditor for many years. Mr. S. T. Fisher has been elected to fill the vacancy. The balance of net revenue account for the half year is £43,705 17s. 4d. Your directors recommend that dividends be declared as follows:— On the £20 shares, 10 per cent. per annum £27,000 On the £20 new stock, 7½ per cent. per annum 8,100 On the £20 capitalized stock, 5 per cent. per annum 3,600 Total £38,700 Less income-tax, leaving a sum of £5005 17s. 4d. to be carried to the reserve-fund.

No. 1.—STATEMENT OF STOCK AND SHARE CAPITAL, on Dec. 31, 1876.

Acts of Parliament relating to the Raising of Capital.	Description of Capital.	Maximum Dividend Authorized.	Number of Shares Issued.	Nominal Amount of Shares.	Called up per Share.	Total paid up.	Arrears of Calls.	Remaining to be Called up	Total Amount Authorized.
5 Geo. IV., cap. 78.	Shares.	10 per cent.	27,000	£20	All.	£540,000	..	..	£540,000
27 & 28 Vict., cap. 159	Stock.	5 ditto.	..	..	All.	144,000	..	..	144,000
Ditto ditto	Ditto.	7½ ditto.	..	..	60 per cent.	216,000	..	£144,000	360,000
						£900,000			£1,044,000

No. 2.—STATEMENT OF LOAN CAPITAL.

Act of Parliament authorizing the Loan Capital.	Description of Loan.	Rate per Cent. of Interest.	Total Amount Borrowed.	Remaining to be Borrowed.	Total Amount Authorized.
27 & 28 Vict., cap. 159.	Bonds	5 per cent.	£155,000	£45,000	£200,000

No. 3.—CAPITAL ACCOUNT.

Dr.	Description of Capital.	Certified Receipts to June 30, 1876.	Received or Paid off since that Date.	Total Receipts to Dec. 31, 1876.	Cr.
To Expenditure to June 30, 1876.					£1,015,453 2 2
Ditto during half year to Dec. 31, 1876, viz.—					
New buildings and machinery in extension of works	£11,572 18 0				
New and additional mains and services	2,514 7 10				
Ditto meters	1,069 13 10				
Total expenditure	£1,030,610 1 10				
Balance	24,389 18 2				
	£1,055,000 0 0				
		By Shares of £20 each	£540,000 0 0	£540,000 0 0	
		Capitalized stock	144,000 0 0	144,000 0 0	
		New stock	216,000 0 0	216,000 0 0	
		Bonds	155,000 0 0	155,000 0 0	
			£1,055,000 0 0	£1,055,000 0 0	

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—	By Sale of gas—
Coals, including dues, carriage, unloading, and trimming (see Account No. 7)	Common gas, per meter, at 3s. 6d. per 1000 cubic feet
Salaries of engineers, superintendents, and other officers at works	Public lighting (common gas)
Wages (carbonizing)	
Sundries used in carbonizing	Rental of meters
Purification, including £741 5s. 7d. for labour.	Residual products—
Repairs and maintenance of works and plant, materials and labour, less £743 16s. 4d. received for old materials	Coke
Distribution of gas—	Breeze
Salaries and wages of officers (including rental clerks)	Tar
Repairs, maintenance, and renewals of mains and service-pipes, including labour	Ammoniacal liquor
Repairs and renewals of meters	Rents
Public lamps—	
Lighting and repairing	
Rents, rates, and taxes—	
Rents payable	
Rates and taxes	
Management—	
Directors allowance	
Company's auditors	
Salaries of secretary, accountant, and clerks	
Collectors commissions	
Sundry expenses relating to collection	
Stationery and printing	
General charges	
Gas examiner	
Law and parliamentary charges	
Bad debts	
Superannuation allowances	
Insurance	
Total expenditure	
Balance, carried to net revenue account (No. 5)	

No. 5.—PROFIT AND LOSS (NET REVENUE) ACCOUNT.

Interest on bonds to Dec. 31, 1876.	£3,875 0 0	Balance from last account	£40,483 4 0
Interest on loans and consumers deposits	212 2 5	Amount from revenue account, No. 4	45,965 2 7
Dividend for half year to June 30, 1876.	38,700 0 0	Interest on moneys on deposit	44 13 2
Balance applicable to dividends	43,705 17 4		
	£86,492 19 9		£86,492 19 9

No. 6.—RESERVE-FUND.

Balance on Dec. 31, 1876.	£92,648 17 3	Balance on June 30, 1876.	£90,712 0 7
		Interest on amount invested.	1,936 16 8
	£92,648 17 3		£92,648 17 3

No. 7.—STATEMENT OF COALS.

Description of Coal.	In Store on June 30, 1876.	Received during the Half Year ending Dec. 31, 1876.	Carbonized and Used during Half Year ending Dec. 31, 1876.	In Store on Dec. 31, 1876.
Newcastle	Tons. 6,670	Tons. 86,664	Tons. 79,201	Tons. 14,133
Cannel	554	1,235	1,488	301
	7,224	87,899	80,689	14,434

No. 8.—STATEMENT OF RESIDUAL PRODUCTS.

	In Store on June 30, 1876.	Made during the Half Year ended Dec. 31, 1876 (estimated).	Used during the Half Year (estimated).	Sold during the Half Year ended Dec. 31, 1876.	In Store on Dec. 31, 1876.
Coke, chaldrons of 36 bush.	190	80,689	17,452	59,731	3,696
Breeze, ditto ditto	110	5,738	..	5,515	333
Tar, gallons	67,431	724,103	..	693,514	98,020
Am. liqr., butts of 198 gals.	966	20,357	..	19,732	1,591

No. 9.—STATEMENT OF GAS MADE, SOLD, &c., IN CUBIC FEET.

Description of Gas.	Quantity Made.	QUANTITY SOLD.			Quantity used on Works, &c.	Total Quantity accounted for.]	Quantity not accounted for.	Number of Public Lamps.
		Public Lights and under Contracts (estimated.)	Private Lights (per Meter).	Total Quantity sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	869,937	62,656	680,537	743,193	8,233	751,426	58,511	5,696

No. 10.—BALANCE-SHEET.

To Capital—		By Cash at bankers	£6,710 8 9
For balance, per Account No. 3	£24,389 18 2	Amount invested—	
Net revenue—		Reserve-fund	92,648 17 2
For balance, per Account No. 5	43,705 17 4	Stores on hand, viz.—	
Reserve-fund—		Coals	£11,199 6 4
For balance, per Account No. 6	92,648 17 3	Coke and breeze	1,788 18 0
Unclaimed dividends	119 4 3	Tar and ammoniacal liquor	1,690 6 5
Sundry tradesmen and others for amounts due for coals, stores, and sundries	44,108 6 4	Sundry stores	2,215 14 3
Temporary loan	25,000 0 0	Accounts due to the company—	16,894 5 0
		Gas and meter rental, for quarter ended Dec. 31, 1876	£88,028 2 10
		Gas and meter rental—arrears outstanding	462 10 2
			88,490 13 0
		Coke and other residual products	22,671 5 6
		Sundries	2,556 13 10
	£229,972 3 4		£229,972 3 4

The CHAIRMAN: Gentlemen, I have to move—"That the report and accounts be received and entered on the minutes." The accounts laid before you to-day present some rather different features to those which have been submitted upon former occasions, inasmuch as we have got the cost of our coal reduced to something like the prices we paid for it several years ago. The average price of coal used by us during the last half year was 15s. 10d. per ton, and if we had used no cannel, it would only have cost us 14s. 10d., so that we have increased the cost by 1s. per ton in adding to the illuminating power of our gas. I am rather inclined to hope—in fact, I know there will be some further saving in the current half year upon the expenditure for coal, as we have concluded our contracts for the ensuing year upon more favourable terms. We have, therefore, something to look forward to, to the good. The amount of money saved last half year in coal was £4227, as compared with the corresponding period of 1875—a very considerable item. The charges for the manufacture and distribution of gas have a little increased; they are somewhat larger than we have been accustomed to; but that arises from the fact that it has been thought advisable, in the present favourable circumstances of the company, to do our best to put our house in such good order that, if in the future adverse times should come, we may be fully able to meet them. I think, by the course we have pursued, we may say that the dividends of the proprietors are well assured to them. One of the worst items in the accounts, and one that we have no control over, is the item of "rates and taxes." I see that we have actually paid, in the last six months, £1014 more than we did in the previous year under this head. Unfortunately this is a permanent charge, and one that we can get nothing out of, and I think it behoves every one of us to pay some attention to the way in which rates are levied upon us in our respective districts. On the other side of the revenue account you will see that the rental for gas has increased £6873 as compared with the half year ending December, 1875. The receipts for residual products are not so favourable. We have had, as you all know, a very mild winter, and I believe it is generally understood that coke has been a difficult material to sell. Although we have made more coke, we have not realized so much from the sale of it, by £3565, as we did in the corresponding half of the previous year. On the other hand, we have had a favourable contract for our tar, which has yielded us £4136 more than in 1875, which amount more than counterbalances what we have lost on our coke. I am sorry to say that this contract ran out on the 31st of March, and we, in common with other companies, have been obliged to suffer some reduction in the new tar contract for the next twelve months. This will diminish our receipts £2000 or £3000. On the other hand, however, we have made a new contract for our ammoniacal liquor, which will give us an improved result, and I think the loss on one residual will be made up by the other, so that as far as our receipts are concerned there is not much to fear. I now come to the prospects of the company, and I have to inform you that, in consequence of the very large increase which is taking place in the concern, it will be necessary to lay out a considerable amount of capital to provide for our requirements. In our last report we told you that it would be necessary to renew the largest gasholder at Kennington containing 1,200,000 cubic feet. Since then we have reconsidered the plan to obliterate the smallest holder at that station, which had a capacity of 600,000 feet, and to erect in its place a holder capable of containing 3 million cubic feet. After that we propose to do the same with the 1,200,000 feet holder, making that of a capacity of 3 million feet. We shall then, we believe, with other available space, have provided ample gasholder room for the whole of our London district, even supposing that we have to give up our Wellington Street station. I think this is a grand thing to know, and to feel that we shall be able to keep out of the fangs of Parliament for some time to come. At Greenwich we also require to erect another gasholder. There have been no extensions made at those works for the last twelve years, and the proportion of gasholder room to the make of gas has now become rather close, and it would not do to delay adding to our storage there any longer. I may say that these contemplated works, from their magnitude, will take a long time in erection. It will be necessary to make the tank a year before the holder is made, so that you see it will be two years before the whole will be completed. Now the consequence of all this will be that we shall require more money, and, although the directors have not arrived at a conclusion as to the exact amount that will be necessary, I think I may shadow forth that a call of 10 per cent. will probably be made about the 1st of September next. I have no doubt the call will be readily responded to, and it is well that the shareholders should have due notice, so as to make their arrangements accordingly. I am happy to state that there are very few questions agitating the public mind respecting gas companies at the present moment. We are spared this year the disagreeable task of a parliamentary contest upon any subject. The only thing which concerns us is a notice of motion given by Mr. Raikes, the Chairman of Committees in the House of Commons, involving a principle which we think is rather unfair. It is proposed to make a Standing Order to the effect that existing gas companies going to Parliament for more capital shall be required to offer all new shares to the public by auction. To me, it appears a strange idea that a Standing Order of that kind should be adopted, which will prevent any consideration being given by the Legislature to the peculiar circumstances of each company. It is not at all likely that every company all over the country will be in precisely the same position, and this rule, if adopted, would take out of the hands of the parliamentary committees who sit on Gas Bills the power to insert such provisions as each case requires. They would be bound by

the Standing Order to treat all alike, and therefore it seems to me that this is an attempt to carry a most monstrous proposition. I mention the matter here in the hope of inducing any of our shareholders who may be able to influence members of Parliament to ask them to oppose the motion when it comes before the House. The only other public question before us is the sulphur question. The leviathan company on the other side of the water, and one company on this side, are going to try, before a parliamentary committee, to see if they cannot get some alteration or amelioration of the present regulations under which they are laid, in reference to the purity of their gas. I can only say I wish they may be successful, for whatever may happen to them will some day or other be made to apply to us. With these observations, and again congratulating the proprietors upon the present healthy state of our affairs, I move—"That the report and accounts be received and entered on the minutes."

Mr. HOBSON seconded the motion, which was put and carried.

The DEPUTY-CHAIRMAN (Mr. Shand): You will have seen by the account No. 5, that there is a sum of £43,705 accruing from the profits of the company to Christmas last, which is available for dividend. The full dividends authorized by Parliament upon the various classes of stock (averaging about 8 per cent. on the whole) will absorb £38,700, leaving a balance of £5000 to be carried to the reserve-fund. It must be satisfactory to the shareholders to know that while thus doing well for ourselves, we have been able to do something for the consumers in our districts. This profit has been earned with gas at 3s. 6d., which is a very low price, but yet one that I hope we may be able to continue, and even at some distant day to make a reduction upon. Some shareholders, perhaps, may think it a great pity that we are not under the new regulations, so that we might be allowed to pay a little higher dividend. But I think the majority will agree with me, that though we are prohibited from paying a higher rate of dividend, we are in a more fortunate position, inasmuch as if the price of coals should rise, which I think there is no doubt it will, we are in a position to raise the price of gas beyond 3s. 9d., within reasonable limits, without being obliged to reduce the rate of dividend below 10 per cent. Having made these remarks, I now move—"That dividends for the half year ending Dec. 31 last be, and the same are hereby declared and made out of the profits of the undertaking, at the following rates, viz.:—On the original shares at the rate of 10 per cent. per annum, on the capitalized stock at the rate of 5 per cent. per annum, and on the amount paid up on the new stock at the rate of 7½ per cent. per annum, less income-tax in each case, and that the warrants for the same be posted to the registered addresses of the proprietors." The latter part of the resolution is a deviation from our custom to make the warrants payable to the bankers of the proprietors. It has been found in some cases that the names of the holders of shares have, in the course of time, changed altogether, and we shall, therefore, in future, adopt the practice of posting the warrants to all shareholders.

Mr. HARRIS seconded the motion, which was put and carried.

The retiring directors and auditors were severally re-elected.

Mr. YOUNG, M.P.: I should like to say one word upon a point to which the chairman has alluded—viz., the insidious attempt which is to be made to pass a resolution, consisting only of a few words, in the House of Commons, which will be equal in authority to an Act of Parliament, and which will seriously affect the rights of gas companies, or what they at least have been in the habit of considering as their rights. Not that the matter affects the proprietors of this company at the present moment, as it will do some of the country companies. The proprietors of gas shares have generally looked upon the issue of new capital as a *bonne bouche* for themselves, and it has been, as a matter of fact, in many cases, the only way in which they could obtain a due return for the investment they have already made, and upon which for years perhaps they received no dividend. If the proposed new Standing Order is adopted, it will act most detrimentally to gas interests generally. We are not at present going to Parliament for new capital, and therefore we are not immediately concerned in the matter, but I think we ought to show a little sympathy for those who are under the necessity of seeking further legislative powers, and therefore I would ask every proprietor to represent the matter to the member for his borough, and point out that it would really be an act of dishonesty to attempt to pass a Standing Order requiring that all new capital should be raised by offering shares for sale at public auction. It is proposed that this should be made compulsory by the House of Commons upon all companies, without the matter coming before the House of Lords for consideration at all. Of course, if the Government support Mr. Raikes in the matter, the Order will be adopted; but the more members of the House who can be induced to attend and vote against it, the less likely is it to be done.

On the motion of Mr. WHITE, a vote of thanks was presented to the directors for their able management of the affairs of the company.

The CHAIRMAN acknowledged the compliment, and the proceedings, terminated.

QUALITY OF THE BIRMINGHAM GAS.—The reports of Mr. Thomas Jackson the gas examiner, show that during the month of March, at the four gas-making stations of the corporation, 18 examinations of the illuminating power of the gas supplied to the borough were made. The maximum light in sperm candles was 18.11; minimum, 16.25; average, 17.28. The parliamentary standard is 15 candles, with Sugg's No. 1 "London" burner.

ALLIANCE AND DUBLIN CONSUMERS GAS COMPANY.

The Half-Yearly General Meeting of Shareholders was held at the Offices, Grafton Street, Dublin, on Saturday, March 31—EDWARD FOTTRELL, Esq., in the chair.

The SECRETARY (Mr. W. F. Cotton) read the following report of the directors:—

The directors herewith submit for the consideration of the proprietors the annexed balance-sheet and statement of accounts, for the half year ended the 31st of December last, duly examined and certified by the company's auditors, and the official auditor of the Board of Trade.

The gross revenue derived from all sources, including interest, amounts to £120,414 7s. 1d., the expenditure, including bond interest, being £85,712 11s. 7d., leaving a net gain on the half year's working of £34,701 15s. 6d., from which the directors recommend the payment of dividend at the rate of 10 per cent. per annum, free of income-tax. The adoption of this recommendation will absorb a sum of £29,500, leaving a balance of £5201 15s. 6d. to be carried forward to next half year's account.

There is nothing very special to report with reference to the condition of the several stations. The works and plant of the company are in an efficient state, having been well maintained; they are now capable of meeting a further development of the company's business, and, with one exception, the improvements and reconstruction may be deemed complete, the exception being a new roof in course of construction over the retort-house, No. 1 station, to replace one lately taken down, it having been pronounced dangerous from long continued oxidation, being the remains of the oldest structure connected with that station.

With respect to the Bill promoted by the company, to acquire additional land at Bray, and for the protection of the company's works and land from damage by the action of the sea, the directors are happy to say that the corporation have withdrawn all opposition to the Bill, which now awaits the sanction of Parliament, and they hope before long to be in a position to carry out at a comparatively trifling expense, the works necessary for giving an ample supply of gas to the consumers in that district (for want of which considerable inconvenience has been experienced during the past three winters), and thereby render that station more profitable.

The directors who got out of office by rotation on the 31st inst. are Edward Fottrell, J.P., and David Drimmie, Esqrs., who, being eligible, offer themselves for re-election. One of the auditors, Francis Asken, Esq., also retires by rotation, and offers himself for re-election.

Dr.—Capital Account, for the Half Year ended Dec. 31, 1876.

	Expended this Half Year.	Total to Dec. 31, 1876.
Expenditure to June 30, 1876	..	£690,161 15 1
Expenditure on manufacturing plant, machines, storage works, and other structures connected with manufacture (not in place of old ones)	£2,268 6 1	
New mains and service-pipes (not being in place of old ones), including laying same, paving, and other works connected with distribution	1,621 19 8	
New meters (not in place of old ones), including fixings, &c.	1,669 19 1	
Horses, carts, &c.	197 10 0	
Parliamentary expenses.	38 8 0	
		5,796 2 10
Total expenditure	..	£695,957 17 11
Balance of capital account	..	41,434 12 1
		£737,392 10 0

Cr.—Capital Account.

	Certified Receipts to June 30, 1876.	Received during Half Year.	Total Receipts to Dec. 31, 1876.
Share capital	£589,892 10 0	..	£589,892 10 0
Bonds.	147,500 0 0	..	147,500 0 0
	£737,392 10 0	..	£737,392 10 0

Dr. Revenue Account. Cr.

Manufacture of gas— Coals, including dues, carriage, unloading, and all expenses of depositing same on works	£48,334 13 0	Sale of gas— Gas (377,866,600 cubic feet), at 5s. per 1000 cubic feet.	£94,466 13 0
Purifying materials, oil, water, and sundries at works	697 5 1	Public lighting & under contracts	5,747 0 3
Salaries of engineers, including chief engineer, superintendents, and officers at works.	1,399 13 1	Rental of meters	2,655 1 4
Wages at works	6,990 16 4	Residual products— Coke, &c., less labour and cartage	11,277 2 5
Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials, and labour	11,202 9 10	Breeze	622 14 7
	£68,624 17 4	Tar	3,105 9 8
Less old material sold.	512 7 7	Ammoniacal liquor	1,958 5 0
	£68,112 9 9	Rents	207 1 4
		Transfer fees	50 12 6
		Ship Dispatch, money received	317 17 11
Distribution of gas— Salaries of surveyor, chief inspector, inspectors, assistant inspectors, and clerks in light office	1,195 0 1		
Repair, maintenance, and renewal of mains and of service-pipes, including materials, laying and paving, and labour	2,016 3 8		
Repairing, renewing, and refixing meters	1,504 0 5		
Public lamps— Lighting and repairing	848 0 4		
Rents, rates, and taxes— Rents	723 0 4		
Rates and taxes	2,549 10 4		
Management— Directors' fees	525 0 0		
Salaries of secretary, accountant, clerks, &c.	996 14 8		
Collectors' commission	957 2 11		
Stationery and printing	217 8 5		
General establishment charges and incidentals	596 12 7		
Company's auditors	15 0 0		
Law charges	192 11 9		
Bad debts	999 8 10		
Abatements and allowances, &c.	411 11 9		
Annuity account	514 2 8		
Total expenditure	£82,373 18 6		
Balance carried to profit and loss account	38,033 19 6		
	£120,407 18 0		£120,407 18 0

The CHAIRMAN moved the adoption of the report and statement of accounts, and said he did so with a great deal of satisfaction, because the half year had turned out extremely well. Besides being able to give a dividend of 10 per cent., the directors had £5201 15s. 6d. to carry over, which would be available for another time. Thus this company had advanced with strides which he did not think were paralleled by those of

any other. The gas sold during the past half year exceeded the quantity sold in the corresponding half of 1875 by 13,488,300 feet. The revenue, however, unfortunately showed a decrease of £2887. Of course, the reduction in the price of gas from 5s. 4d. to 5s. per 1000 feet accounted for that; but they would not have been able to show the profit they had done were it not for the fact that their coal had cost £7054 less in the past half year than in the corresponding half of 1875. The residuals were nearly down in proportion, showing a loss of £4474. Coke had rather a dragging sale during the last three or four months; and, of course, in order to keep their accounts in proper order, they valued the coke on hand at the selling price, deducting 20 per cent. A large amount had been laid out under the head of "Wear and tear," so that the works were now in splendid condition; in fact, it would be worth the while of any shareholder to go and look through them. The outlay on "Wear and tear" during the half year had been £11,202, as compared with £9669 for the half year ending Christmas, 1875. Another drawback to their profits was that their taxes had increased. However, perhaps shareholders would not complain of that when he told them that the increase arose from their having had to pay income-tax on their profits. The contingent-fund to credit amounted to £5992. That sum, in his mind, ought to be increased. When they had a working capital amounting to £41,000, he thought the time was come when they ought to raise the contingent-fund to a substantial amount, to meet any fatality that might occur, although he did not anticipate anything of the kind, having regard to the great care which was taken in every department. The leakage, or quantity of gas unaccounted-for, amounted to 16 and a fraction per cent. on what had been paid for, which was highly satisfactory. At No. 1 station they were roofing No. 1 retort-house. The roof in question was about the oldest structure in their establishment, and was in a dangerous condition; and the opportunity was being taken of putting all the retorts in that house in first-rate order. As had been mentioned in the report, a reduction in the price of gas had again taken place in the present year. The price to private consumers had been reduced in the borough by 6d. per 1000 feet; but, on the other hand, the corporation had agreed to pay for public lighting at the same rate as was charged to private consumers—namely, 4s. 6d., instead of 3s. 11d. for the lamps, as before. He had again to congratulate the shareholders on the state of the concern, and the dividend they were able to pay, which now amounted to the maximum they were permitted to pay by their Act of Parliament; and he assured them that the directors would continue their exertions in order to work the concern in the best possible manner, so as to be enabled at some time to make further concessions to the public at large. When one company occupied the whole of the city, the directors should be jealously careful to do so; and accordingly, he assured them that on this point the directors would not fail to work for the public as well as for the shareholders. He thought he might go the length of saying, from his own experience, and from having closely looked into their accounts with their respected secretary and manager, that he did not doubt that they would be able to continue the present dividend. He did not pledge himself on the subject; but he saw no reason to doubt their being able to do so.

Sir JOHN BARRINGTON seconded the motion, remarking that, after the chairman's admirable statement, which showed how thoroughly sound was the financial position of the company, there could not be a dissentient voice as to the propriety of adopting the report. He considered that the shareholders were greatly indebted, not only to the directors, but also to the secretary and all the officials for the sound position of the company. He did not believe there was in the United Kingdom a better investment for any man's capital than this company. Some parties had attempted to get up an opposition to them, for what purpose he did not know; however, it had collapsed, as all oppositions would which were got up for futile reasons. He was glad to find that the directors had been able to carry their Bill through Parliament for the improvement of the company's work at Bray, and that they had met the corporation in such a spirit as to avoid the unnecessary expenditure of money in London. Having regard to the progress which was being made in building all round the city, he felt sure that they would not only be able to keep up the 10 per cent. dividend, but also to make sufficient profits to enable them hereafter to reduce the price to consumers.

After some conversation, on a suggestion of Mr. Kennedy, that the meetings might be held earlier after the close of the half year than at present, to which the chairman and secretary replied, pointing out that it would be impracticable to do so, the resolution for the adoption of the report and statement of accounts was then put and carried *nem. con.*

The CHAIRMAN moved—"That a dividend at the rate of 10 per cent. per annum, free of income-tax, be now and is hereby declared, the same to be payable on and after Monday, the 9th of April."

Mr. THOMAS SYNNOTT seconded the resolution, which was adopted.

On the motion of the CHAIRMAN, seconded by Mr. KENNY, the retiring directors, Messrs. E. Fottrell and D. Drimmie, were re-elected. Mr. F. Asken was also re-elected an auditor of the company.

The meeting was then made special, and

The CHAIRMAN moved—"That the directors be and are hereby at liberty to raise, from time to time, the money which the company have raised on bond by the creation and issue, at such times, in such amounts and manner, and on such terms, subject to such conditions, and with such rights and privileges as they may think fit, of stock, to be called debenture stock, instead and in lieu of, and the same amount as the whole or any part of the money which is now owed by the company on bond." The object of the resolution was that the company had a debt of £147,500 in bonds, which as they became due, every five or seven years, had to be renewed. That was an operation of trouble and expense, the bonds having to be reprinted, and it might also happen that the state of the Money Market at the time the bonds fell due would raise sound difficulties in the way of renewing them on favourable terms. But by issuing debenture stock these disadvantages would be got rid of, and in addition the new stock could be held by trustees, which was an advantage; the old bonds, with coupons attached, requiring a personal trust. He might mention that since that time twelve months there fell due £25,900 of these bonds, which were issued at 4½ per cent., and which the directors had been able to re-issue at 4 per cent. That, he thought, would be deemed highly satisfactory.

Mr. DRIMMIE seconded the resolution.

Mr. KENNEY thought the rate of interest upon the new debenture stock should have been stated, and suggested that the maximum should be 5 per cent.

The CHAIRMAN said the shareholders must have sufficient confidence in the Board to leave this matter in their hands. There were just two matters which he omitted mentioning in his few opening remarks. The first was, that in last half year they had had about 600 new customers, and the second was that they were making preparations for applying to Parliament, pursuant to the notice already given, about the Bray works. They did not intend expending any large amount on these new works. They purposed taking out a spare gasholder from the station in Dublin, and while they would endeavour to provide for the wants of the residents of Bray they would be cautious in their expenditure.

The motion was put and carried.

The LORD MAYOR having been moved to the second chair,

Mr. Brooks, M.P., moved that the cordial thanks of the proprietors be given to their excellent chairman for his unwearied exertions at all times to promote the interests of the company, and especially for his able conduct in the chair that day.

Mr. MacCREADY had great pleasure in seconding the motion.

The LORD MAYOR, in putting the motion, said it was a proof of the esteem in which Mr. Fottrell was held that two members of his board were found to propose and second a vote of thanks to him. He was eminently deserving of such a marked compliment, for he had paid unceasing attention to the affairs of the company from their very inception up to the present moment. They all recollected the position in which the concern was five or six years ago, and must all agree that a system of management which transformed it into a gigantic success, paying a dividend of 10 per cent., was one to be approved of and applauded. He (the Lord Mayor) had taken a deep interest in the undertaking for several years past. He had watched its progress in later years, and, having studied the question deeply, he could assure the shareholders that they need not be one bit alarmed that the reduction in the price of gas would lead to a reduction of dividend. He might also state that the 16-candle gas supplied by them could not be excelled by any company. It was as good as the London 18-candle gas, so that the consumers were getting a good article at a low figure. He put the motion, that the chairman be accorded their cordial thanks, with great pleasure.

The vote was passed with acclamation.

The CHAIRMAN briefly returned thanks. He could assure the meeting that all his colleagues on the board of direction had worked as diligently as he had done to promote the prosperity of the undertaking.

Mr. BRUNKER moved a vote of thanks to Mr. Cotton, the able and indefatigable secretary and manager of the company, to whose exertions and abilities so much of their prosperity was due.

Mr. Brooks seconded the motion, which, he believed, met the cordial assent of the meeting.

Mr. W. F. COTTON, acknowledging the compliment, said it was marks of approbation such as these that induced officers of a company to greater exertions in the interests of proprietors.

The proceedings then terminated.

BRISTOL WATER-WORKS COMPANY.

The Annual General Meeting of Shareholders was held on Saturday, the 31st ult.—Mr. F. Fry in the chair.

The SECRETARY (Mr. A. J. Alexander) read the following report:—

The revenue from water-rates for the year 1876 was £56,775 12s. 6d., being an increase of £2674 1s. 7d. over that of the previous year.

The sum shown by the revenue account annexed to be applicable for dividend is £18,897 9s. 6d., and the directors recommend that a dividend of 5 per cent. on the £25 and £20 ordinary shares (£8 paid) be now declared. This, with the intermediate dividend of 5 per cent., will make the dividend for the year 10 per cent., and, after carrying £2000 to the reserve-fund, leave a balance of £4245 12s. 10d., out of which the directors recommend the payment to the proprietors of the £25 ordinary shares of 7s. 6d. per share on account of arrears of dividend, absorbing £3200, and leaving £1245 12s. 10d. to be carried forward.

The increase of the revenue for 1876 was fully equal to, and the number of houses supplied largely in excess of, the average of recent years. It may, therefore, be fairly anticipated that the future rate of annual increase will be augmented.

It is probably known to most of the proprietors that the tendency of recent legislation has been to encourage the transfer of the undertakings of water companies to local authorities, and that in Birmingham, Manchester, Liverpool, Bath, and many other towns, the water supply is in the hands of the corporation. Your directors have to report that the Town Council of Bristol, acting upon a principle already widely established, resolved, at a meeting held on the 1st of January last—"That it will be for the interest of the city to acquire the undertaking of the company, provided the purchase can be effected on equitable terms." At the same time a committee was appointed to treat with the board. The negotiations which have since taken place between the committee and the board have not yet arrived at a stage to which reference could be advantageously made at this date.

The additional supply-main was in July last completed between Flax Bourton and Bristol, and has since been in constant use. The second section from Bourton to Chelvey is now being laid. A contract has been entered into for two pumping-engines of 100-horse power each, to be erected at the Chelvey pumping-station. These are designed to pump from a well now in course of sinking, and from the Chelvey springs, a quantity of water which will considerably more than double the present delivery from this source of supply. A high-level service-main has been carried from the Durdham Down reservoir to the Bristol Lunatic Asylum at Stapleton, and branch mains in connexion therewith have been laid for the supply of that neighbourhood and the district of St. George.

To meet the increased demand upon the high-level service, and in view of the possible extension of your mains to the Avonmouth Dock, tenders have been invited for the supply of two engines of 80-horse power each, to be erected at the Victoria pumping-station. An additional main of 18 inches diameter will immediately be laid to the Durdham Down reservoir, and an arrangement made, by pumping over a stand-pipe, to add to the efficiency of the supply at the highest points of your district.

All the works referred to will be completed early in 1878, when the whole of the extension works contemplated under your Act of 1872, and designed by your consulting engineer, Mr. John Taylor, C.E., to meet the future requirements of your district, will have been carried out.

Messrs. Alexander Brogden and Son, who are interested in a recently abandoned iron mine at Frampton Cotterell, have this session promoted in Parliament a Bill seeking power to supply to some of the inhabitants of Bristol and Clifton water to be pumped from the mine shaft. Your directors are fully prepared to meet this speculative attempt to establish a competing water-works company with the most determined opposition.

The capital expended during the past year was £27,207 13s. 3d., and the length of mains laid about 12½ miles. The engineer, Mr. H. W. Pearson, reports that the works are in good condition.

The retiring directors are Mr. Fudge, Mr. Leech, and Mr. Jones, who are eligible, and offer themselves for re-election. The retiring auditor is Mr. Curtis, who offers himself for re-election.

The CHAIRMAN, in moving the adoption of the report, referred to the fact that the usual increase in the company's business had been maintained, and said that, though the working expenses had been higher than in some previous years, they were not, upon an average of years, greater than usual. Having alluded to the extensions rendered necessary to meet the demands of the city, he proceeded to remark upon the proposed sale of the undertaking to the corporation, although, as he said, the directors did not intend to ask the shareholders for any expression of opinion thereon at this meeting.

The SECRETARY, at the request of the CHAIRMAN, read the terms which had been arrived at between the sub-committee of the corporation and the directors, as follows:—

1. The corporation to assume the responsibility of the preference and debenture stocks of the company on the terms on which these stocks are now held by the proprietors, and to guarantee to them the respective interest and dividends thereon on the security of the city.
2. To guarantee a dividend of 10 per cent. per annum to the holders of the £200,000 £25 ordinary share capital.
3. To guarantee a dividend of 10 per cent. to the holders of £20 ordinary share capital. These shares to be fully called up at intervals, to be agreed on between the corporation and the company.
4. To guarantee to the proprietors of the £25 ordinary shares an annual payment of 10s. per share, in consideration of their right to arrears of dividend. Such payment to be postponed for five years.
5. The claims (if any) of the proprietors of the 5 per cent. preference stock to dividend

based 5 per cent. per annum, if not previously settled, to be satisfied by the corporation in the event of their recognition being thought proper by Parliament.

6. Proper provisions to be made for all the officers of the company.

7. The various points of detail not covered by the various resolutions to be settled by a joint committee of both sides.

The CHAIRMAN said these resolutions contained the outline of the terms that had so far been arrived at by the board of directors and the committee of the corporation, and the board were prepared, of course, to recommend them for the shareholders adoption some day, but the negotiations were now in a preliminary state, and the directors did not purpose to ask the opinion of the shareholders on the subject at present, but they thought it right to inform them of the state of the negotiations. He knew that there were meetings being held in the city, where many things which were irrelevant were stated. He would not stop to discuss these, but there were one or two points he should like to allude to. One of the things said was that the price of the water was a high one. But no one told them that the water company got spring water out of the bowels of the Mendip; no one told them that they had expended thousands of pounds in getting it from the hills; no one told them that the water was brought down in covered aqueducts in the purest possible state; and that no company gave better water than did the Bristol Water Company. At Clifton, to the very top, they supplied every house. Neither did they tell them what was the cost of the water, and what had to be expended on the works. He reminded them that it was not a manufactured article. They could not get it like beer or porter, but yet it was talked of out of doors as though it were manufactured. The cost of the water depended on the cost of the works that were necessary to obtain it. They must find from whence the water was to be obtained, and the remuneration they were likely to obtain depended on the extent of the supply in the town. And it might cost in one town ten times as much as it did in another. Bristol, he might say, was very badly situated in this respect, because the water had to be brought down from the Mendip Hills. It must, therefore, be expensive; but it was good and pure water. Let them look at other towns. At Exeter they had a water-wheel, three miles from the city, which pumped the water into it. So at Cardiff and in other towns there were difficulties in obtaining the water. It was a great fallacy to compare the water with which they supplied Bristol with other towns in the kingdom. Then it was said the company were indebted to the corporation for allowing them to obtain consent from Parliament to create new shares at 10 per cent. That was an entire mistake. They obtained that power because it was just and fair; they showed they had a very small amount of capital. It was the custom now to have one-third borrowed money and two-thirds share capital. The Bristol Water Company were not in that position by £100,000. If they divided their whole capital, their new shares and old would not amount to two-thirds of the total capital by £100,000, and therefore Parliament had said that it was just and fair they should increase their share capital. The corporation might have opposed the company's Bill, but they did not do that. Beyond that they were not indebted to them.

Mr. C. J. THOMAS seconded the motion, which was put, and unanimously carried.

The CHAIRMAN then moved—"That a dividend of 5 per cent. on the £25 and £20 (£8 paid) ordinary shares for the half year to Dec. 31, 1876, be paid on the 17th of April next to the proprietors now on the register." He omitted one point in his speech. They were all, no doubt, aware of the Bristol District Water Bill that was promoted, and of what was passing in the city. He could assure the shareholders that the directors were offering that company every possible opposition, and that they had not the least idea of allowing such a Bill to pass without the most strenuous opposition. He might say that a second water-works company for a town had not been sanctioned by Parliament for more than 20 years. Legislation as regarded water-works was very different from that of a railway. Any new water-works company would have to compensate the existing one. This company paid £39,000 for the goodwill of their present undertaking, and it had been the rule of Parliament that compensation should be paid to existing owners. The directors felt very confident that that would continue to be the principle followed by Parliament. This company were now paying £2000 a year on account of having to buy up small private affairs. Parliament always took the line that he had shadowed forth; whether it would alter it now or not he could not say, but at all events the directors had every confidence, and they would offer the proposed Bill every opposition in their power.

Mr. C. J. THOMAS seconded the motion, which was agreed to.

Mr. H. NASH said he thought there was a little misapprehension in the minds of the public with reference to what interest the company were really paying. He had taken some pains to ascertain and calculate what the interest would be supposing they had exercised the whole of their borrowing powers, and the whole of their capital had been called up. Supposing they borrowed £40,000 at 4 per cent., and called up the whole of their capital stock, paying 10 per cent. on the new shares and 12 per cent. on the £200,000, and then averaged the per centage over the whole of the capital of £800,000, they would find that the interest would be a little over 7½ per cent. He thought that might remove a little misapprehension, for people ran away with the idea that the company were paying 10 per cent. on some of their capital stock, and 12½ on another portion. Such was not the case.

The CHAIRMAN said the secretary informed him that if they paid 10 per cent. on their share capital of £360,000, and took the remainder of the capital, which was borrowed, making £800,000, the average would be 7½ per cent. If they had raised more share capital the interest to be paid would have been still greater, but the directors had kept it down by borrowing money, and that had been an advantage to the consumer.

The motion was put and carried.

The CHAIRMAN then moved—"That a further dividend of 7s. 6d. per share on the £25 ordinary shares, towards making up the deficiency of previous dividends, be paid on 17th of April."

Mr. C. J. THOMAS seconded this, and congratulated his fellow-shareholders upon the fact that, after 30 years of arduous work, they had reached a point when they were beginning to pick up some of their back interest.

A SHAREHOLDER: Some citizens want to knock that off.

The CHAIRMAN said those men apparently wanted their concern for nothing. It was the common law of the land as regarded water-works that they should have the power to pay up back interest. He knew one that had paid up every shilling, and Parliament always allowed it. There was one thing the public did not seem to take into account, and that was that this company did not wish or ask the city to purchase their works.

The resolution was put and carried unanimously, and, on the motion of the CHAIRMAN, seconded by Mr. THOMAS, it was agreed to add £100 a year to the salary of the secretary, in consideration of his long and valuable services to the company.

The SECRETARY, in thanking the shareholders for so kindly adopting the resolution, said there was a possibility that the company might not much longer require his services; but be that as it might, he could assure the proprietors that so long as he was their secretary there would be no relaxation in his endeavours to promote their interests.

The retiring directors and auditor were re-elected, and a cordial vote of

SHEPPY GAS COMPANY.

The Annual Ordinary General Meeting of Shareholders was held at the Offices, Trinity Road, Sheerness, on Tuesday, the 27th ult.—Mr. J. COLE in the chair.

The SECRETARY (Mr. A. W. Marks) read the following report of the directors:—

The works and plant have been carefully maintained in a thoroughly efficient state, all repairs having been attended to as soon as the necessity for them became evident. The only addition of any note, beyond new mains and services where required, is that of a weigh-table for coals, the use of which, it is believed, will be of considerable advantage to the company.

There has been a steady increase in the gas-rental, and fair prices have been realized for residuals.

Considerable complaint having been made by small consumers, of the disproportionate charge to them for meter-rents, the directors have judged it proper to reduce the charges for 2 and 3 light meters to 6d. and 9d. per quarter respectively, instead of 1s. per quarter, as was previously charged indiscriminately for 2, 3, and 5 light meters.

An improved arrangement of retorts, by which a great saving of manual labour is anticipated, having been patented by the manager, Mr. W. T. Carpenter, the directors have sanctioned the erection on the works of one experimental bed, on the terms that, if the new process of gas-generating be found successful, this company are to enjoy the right of using the patent hereafter in their works, without the payment of any royalty or other consideration.

The fact of having withdrawn certain sums in recent years from the reserve-fund account, which money forms part of the working capital, and the new arrangements for purchasing coal at short credit which have been made, necessitate the calling-up of some additional capital. The temporary loans, which appear in the accounts, have since been paid off, but the amount will be again required later in the year. As a permanent arrangement, the directors propose calling up £2 per share on the 419 B* shares, and they believe this amount of capital may now be profitably employed.

The profits of the year have been satisfactory. The dividends for the first half year were paid on Nov. 1, 1876, at the usual rates, and the directors recommend the declaration of similar dividends for the second half of the year, to be paid by warrants on the 1st of May next. These together will make up dividends for the year at the rates of 4 per cent. on the A shares, and 10 per cent. on the B and B* shares. The balance of profit it is proposed to add to the reserve-fund account.

The directors have to mention with sincere regret the decease of Mr. James Urquhart, who was a large shareholder, and whose services as a director, from his professional experience, were of great value to the company. The vacancy thus caused has been filled by the election of Mr. George Booth, of Rochester.

The directors who retire by rotation this year are Messrs. G. Lockyer, H. G. Clarkson, and A. J. Hearn, who, being eligible, with the auditor, Mr. E. W. Brightman, offer themselves for re-election accordingly.

Dr.	Trade Account for the Year 1876.		Cr.		
Coals carbonized	£3,741	4 9	Gas-rental	£6,302	11 10
Purifying	33	3 0	Meters, fittings, and stove hire	222	11 5
Wages on manufacture and distribution	767	17 6	Coke, tar, and liquor produced	£1,753	9 4
Manager's salary	192	10 0	Less cartage paid	72	5 2
Auditor's salary	15	0 0			
Secretary's commission	258	12 6	Coals sold at works	1,681	4 2
Directors' fees	60	0 0	Water sold at works	151	14 0
Rent, rates, taxes, &c.	181	15 9	Gas-fittings	189	13 6
Stationery, stamps, and incidentals	62	6 8	Transfer fees	3	2 6
Repairs, renewals, tools, and stores	177	15 7	Rent charges	11	15 0
Retort account	125	0 0	Rent of garden plots	17	15 8
Bad debts	50	0 0	Miscellaneous sales	4	8 7
Deterioration account	175	0 0			
Coals for sale	125	7 0			
Gas-fitting, and labour thereon	137	10 3			
Repair of roads and river wall	10	0 0			
Interest	170	4 2			
Profit on first half year	1,077	5 7			
Profit on second half year	1,227	11 9			
	£8,588	4 6		£8,588	4 6

The CHAIRMAN moved the adoption of the report, and in doing so congratulated the shareholders on the present position of the company, that they were in such a prosperous state as to pay a dividend out of the profits of the year without touching the reserve-fund. In fact, after paying the dividends, they would be able to carry a balance to that reserve account. Two or three years since, when coals were at so high a figure, they had to draw on the reserve-fund to help the dividends, but now he was happy to say they were reimbursing it. He was pleased to direct attention to the improved arrangements in reference to the retorts, by a process patented by their manager (Mr. Carpenter), and he hoped it would not only be a benefit to the company, but also be profitable to the patentee. There was one other matter in the report he regretted to have to refer to—viz., the decease of Mr. Urquhart, who was one of the large shareholders. From his practical experience and professional ability as an engineer, his services were of immense value to the company, and it was impossible to find another to fill his place.

Mr. G. ELLIOTT seconded the motion.

Mr. JACOBS said he could not understand what was meant by reserve-fund account and the suspense accounts. He thought the amounts shown were only on paper, and had no real existence. Where was the £1400 represented as a reserve-fund?

The CHAIRMAN explained that this amount was not idle—it was doing better service than it could be even “out at interest”—it was employed in working the business of the company; and Mr. Jacobs must know that no business could be worked without capital.

The SECRETARY explained, with reference to the retort suspense account, that it was usual in all gas companies to write off a sum, according to the amount of gas manufactured, from this fund for the renewal of retorts, and the amount stated in the accounts was the value of the retorts in use at the present time.

Mr. BRETT said he was surprised to see the recent vacancies in the directorate filled up by non-residents. He had great respect for the people of Chatham, but he thought the directors might have found suitable men in Sheerness for the offices.

The CHAIRMAN, in reply, said that the greater portion of the capital of the company (about four-fifths) was subscribed by gentlemen residing out of the town, and it was only fair to them, as they had a large stake in the company, that they should also have a voice in the management. The shares were offered to the people of Sheerness, and if they did not like to take them up, they must not complain that strangers who purchased them should also have a share in the direction of the company's affairs. Who, he asked, were so likely to take a great interest in the welfare of the company as those who held the largest number of shares?

Mr. SHRUBSOLE moved, and Mr. BOOTH seconded, the declaration of the dividends recommended in the report, which was agreed to.

The retiring directors and auditor were re-elected.

The thanks of the shareholders having been given to the directors, the manager, and the secretary, and the same having been responded to, the proceedings terminated.

SOUTHWOLD GAS COMPANY.—An extraordinary meeting of this company was held on the 4th inst., to authorize an increase in the capital by issuing shares to the value of £420 for the purpose of redeeming the leasehold, and for the erection of additional works to meet the increased demand for gas.

REDUCTIONS IN THE PRICE OF GAS.—The Commercial Gas Company will reduce the price of gas throughout their district, on the 1st of July next, from 3s. 9d. to 3s. 5d. per 1000 cubic feet.

KEYNSHAM GAS COMPANY.—The annual meeting was held on the 26th ult.—Mr. J. N. Brown presiding. The report, recommending a dividend of 5 per cent., free of income-tax for the past year, was unanimously adopted. A resolution was passed to increase the capital of the company £1000 for a new gasholder, pipes, &c.

DARLINGTON CORPORATION GAS SUPPLY.—At the meeting of the Town Council of Darlington, on the 5th inst., the chairman of the Gas Committee (Mr. Kitching) stated that last half year there was an increase in the consumption of gas over the corresponding half of 1875 of above 3 million cubic feet. The price of coals in the last half year of 1876 was 13s. 2d., and in the corresponding half of 1875, 14s. 7d. The unaccounted-for gas had been only 6 per cent. Though the price of gas had been lowered, there had been a decrease in expenditure of something like £200.

PROPOSED PURCHASE OF THE BLACKBURN GAS-WORKS.—The *Preston Guardian* says: “A report of the meeting of the Blackburn Town Council, on the 5th inst., will be found in another column, and on reference thereto it will be seen that the council, after transacting the ordinary business of the meeting, resolved itself into a committee to consider the negotiations that have taken place between the corporation and the Blackburn Gaslight Company, for the purchase by the corporation of the undertaking and works of the said company, and to act in the matter as may seem to the committee advisable. It will be remembered that, by the Bill now before Parliament, the corporation first sought for compulsory powers to purchase the gas-works, and that on the Bill coming up for argument before a committee of the Lords, an arrangement was entered into between the representatives of the corporation and the directors of the gas company, for the withdrawal from the Bill of all compulsory clauses, and for the insertion in their stead of clauses enabling the corporation to treat privately, and to purchase upon an agreement on terms. Before the measure came before Parliament, an effort had been made to effect an agreement between the town council and the gas company, but in vain. When before the Lords Committee, however, fresh proposals were made on behalf of the corporation. There are three classes of share stock in the company, “A,” “B,” and “C.” The two first classes are paid up, but on the last named stock the whole of the share capital has not been called up. The difference between the directors of the company and the representatives of the corporation hinged chiefly on the question whether the whole of the capital on “C” should be called up, as the maximum dividend on that class of stock is 7½ per cent., and in the event of a purchase being effected, 7½ per cent. would have to be paid in perpetuity upon such capital called up, or that may be called up, together with a maximum dividend of 10 per cent. on the share capital in “A” and “B” stock. As the uncalled-up capital in “C” stock amounts to a considerable sum, the corporation are unwilling to agree to a proposal to call up this capital, since they could borrow money at 4 or 4½ per cent., whilst they would have to pay, as stated, 7½ per cent. were the capital called in from the shareholders. The last proposal of the corporation was to pay a bonus of £2 per share and to pay a maximum dividend of 10 per cent. on shares in “A” and “B” stock, and a bonus of £3 per share on “C” stock, in compensation for the cancelling of one-half of the shares, the full value being £10 per share, and the amount actually called up £5 per share. “A” and “B” stock consists of 6000 shares each, consequently the bonus in this instance would amount to £24,000. In “C” stock there are 11,607 shares, and the bonus at the rate of £3 per share would be in the aggregate £34,821, making a total bonus of £58,821. The gas company asked £78,166, but intimated that they might be induced to accept £70,428 so that the difference actually subsisting between the corporation and the gas company has been and is £11,607. These facts the council had to consider in committee on Thursday, as presented to it by the Parliamentary Committee. After some consideration, the council expressed its willingness to confirm the action of the Parliamentary Committee, but decided that no advance should be made to the offer of the committee. Should the gas company agree to the conditions stipulated, power was given to effect a purchase.”

PROPOSED NEW STANDING ORDER.—Writing to *The Times*, *à propos* of the debate of last Friday, Mr. Rodwell, M.P., says: “You would imply that I was guilty of an inconsistency in having, in the first instance, protested against the principle of the Standing Order proposed by the Chairman of Ways and Means, and having afterwards embodied the same principle in my amendment. I really did no such thing; I throughout contended that while, on the one hand, it was unfair to deprive the holders of gas property of rights secured to them by public or private Acts, behind their backs, by a hard and fast rule, it was, on the other hand, the clear right of Parliament to review, to the fullest extent, the position of any company coming before it for fresh powers, and the duty of the committee disposing of the Bill to vary the old terms, or impose new conditions, as the special circumstances might require, after full inquiry. This was the course adopted in dealing with the metropolitan and other companies referred to, and of this no one could complain; and, in each of those cases, some element of compensation was introduced to meet the loss which the proprietors sustained in surrendering their rights to new shares. The distinction between the application of the Standing Order and my amendment is obvious; the principle of each is essentially different, but, at the same time, it is probable that, in many instances, the same results would follow.” Mr. James Henderson writes from 31, Maryon Road, Charlton: “Will you allow me, being one of the directors of one of the gas companies now applying to Parliament for new capital, to make a few observations on the above topic? I have read your article, also the speeches of members in the House, and it appears to me that both you and they fail to present the whole case. Your argument is based upon the hypothesis that gas companies are guaranteed by Parliament a dividend of 10 per cent., and also that they are secured against competition. As regards the metropolitan companies, this is so to a large extent, and in all such cases your argument may be sound and reasonable, but in the case of my company it is far otherwise. Our district is outside the Metropolitan Gas Act; our capital is £60,000, £12,000 only of which is allowed to pay 10 per cent., the remaining £48,000 paying only 7½ per cent.; also, we have no monopoly of supply, Parliament having sanctioned two companies in the same district, and in our present application we are not asking for 10 per cent., but 7½ only, so that, if our application is granted, only one-tenth of our whole capital will bear 10 per cent., the remaining nine-tenths, 7½. Our district is a large one, embracing three parishes. We have been in existence 34 years; during that time we have made two previous applications for more capital, amounting in the aggregate to the modest sum of £60,000. Surely I may point to this fact as a proof that we, at least, are not fairly chargeable with reckless expenditure, although our district is thin compared with the metropolitan companies, sometimes running a main hundreds of yards, at the call of the parish, to supply one street light, yet we are supplying a gas that will bear comparison with any of the metropolitan companies, at 3s. 9d. per 1000 feet. I trust you will see that our case is different from that supposed by you, and that you will admit that what we ask for comes fairly within the four corners of commercial enterprise.”

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1272.—PAWSON, W., Grantham, Lincoln, "Improvements in valve and ball-cocks or taps." March 31, 1877.
 1287.—WOTHERSPOON, J., Glasgow, "An improvement in the construction of cocks or taps." April 3, 1877.
 1308.—LAKE, W. R., Southampton Buildings, London, "Improved apparatus for raising liquids." A communication. April 4, 1877.
 1309.—BONNEVILLE, H. A., Paris, "A new or improved hydraulic press for separating the water and other liquids from solid matters in suspension therein." A communication. (Complete specification.) April 4, 1877.
 1313.—JUSTICE, P. M., Southampton Buildings, London, "Improvements in exhaust nozzles for discharging steam and gases under pressure." A communication. April 4, 1877.
 1334.—CARR, A., Paterson, and ARTHUR, J., Jersey, U.S.A., "Improvements in pumping-engines." April 5, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3582.—M'KENDRICK, J., BALL, H. W., Glasgow, and WATSON, R. G., Kilmarnock, Ayr, "A new or improved fluid motor pump or meter, and valves and valve-gearing therefor." Oct. 7, 1876.
 3914.—AHRBECKER, H. C., Stamford Street, London, "Improvements in fluid-meters." Oct. 10, 1876.
 3916.—SHAND, J., Upper Ground Street, London, "Improvements in hydrants or fire-cocks, and an auxiliary valve in connexion with the same." Oct. 10, 1876.
 4015.—REYNOLDS, E., Sheffield, "Improvements in centrifugal pumps and fans." Oct. 18, 1876.
 4526.—SYMES, G., Stepney, London, "Improvements in apparatus for manufacturing, purifying, and economizing gas, parts of which improvements are applicable for other purposes." Nov. 22, 1876.
 663.—NEWMAN, J., and DRESBURY, W., Derby, "Improvements in apparatus for transmitting gas from the retorts to the hydraulic main." Feb. 17, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

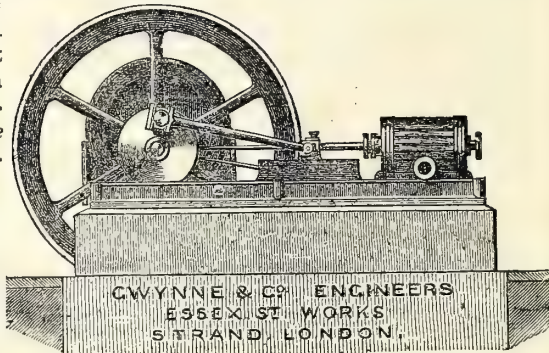
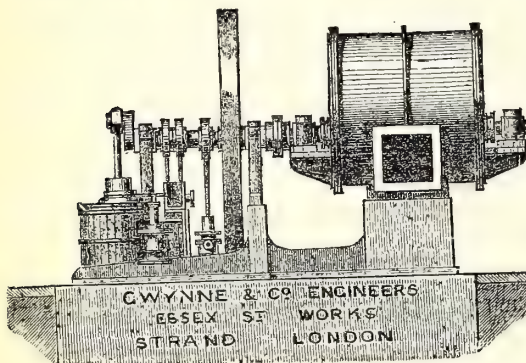
- 840.—COOK, H. W., "Improved apparatus for pumping or forcing water, air, gas, or other liquids or fluids." March 7, 1874.
 848.—GOODALL, R., "Improvements in the means or method of purifying foul water or sewage, and in the apparatus employed in connexion therewith." March 7, 1874.
 873.—NEWTON, A. V., "An improvement in pumps." March 10, 1874.
 897.—BAYLEY, H. D., and BAYLEY, G. H., "Improvements in the construction of taps or valves, which improvements are also applicable to the fixing of glass tubes in water-gauges." March 12, 1874.
 907.—HUNTER, A. G., "New and improved apparatus for carburetting atmospheric air, and improvements in other apparatus connected therewith." March 13, 1874.
 935.—HOLLAND, H., "New or improved apparatus for charging atmospheric air with the vapour of hydrocarbon liquid." March 14, 1874.
 949.—GEORGE, R., "Improvements in taps, valves, and stopcocks." March 17, 1874.
 991.—HOWARD, J., "A new self-acting apparatus for regulating the supply of water, and disinfectant for flushing and disinfecting water-closets." March 21, 1874.
 993.—LOCKWOOD, W., "Improvements in valves for regulating the pressure of steam, air, water, or other fluid." March 21, 1874.
 1002.—SMITH, A., "Improvements in the means for purifying water; also applicable for preventing incrustation in steam-boilers, and for detergent purposes." March 23, 1874.
 1052.—JENSEN, P., "Improvements in the manufacture of gas and apparatus therefor." March 25, 1874.
 1055.—NIELD, T. A., "Improvements in taps or valves, adapted for use in controlling the flow or discharge of fluids." March 26, 1874.
 1079.—NUTTALL, F. D., "Improvements applicable to regenerative and other gas-furnaces." March 28, 1874.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS;
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The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



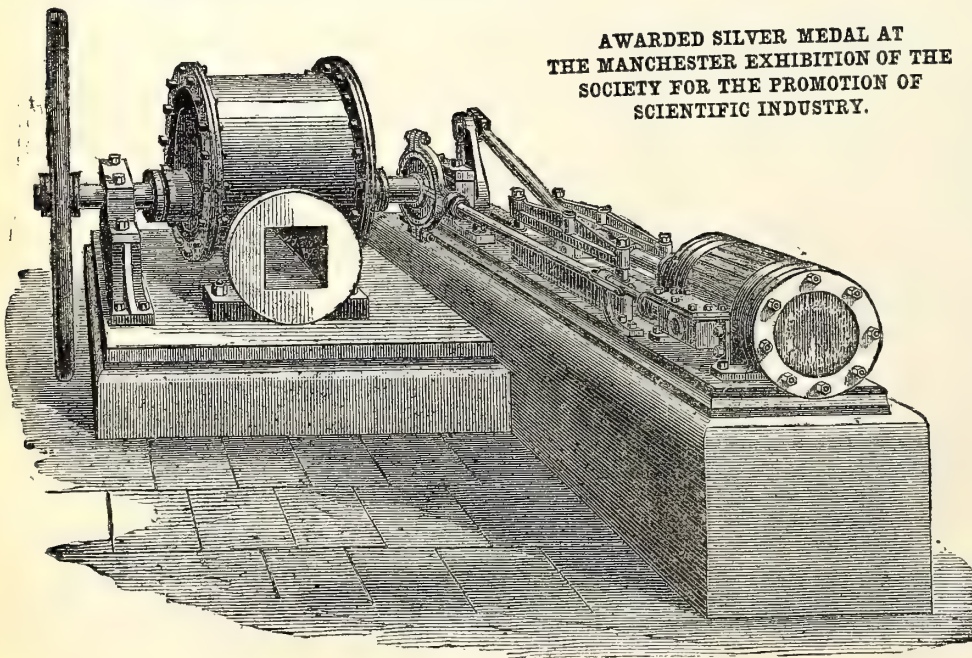
EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

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BEALE'S Improved Patent GAS-EXHAUSTERS WITH ENGINES COMBINED.

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ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, and other PUMPS,
SCRUBBERS and PURIFIERS,
CONDENSERS, BOILERS, &c.

PHOENIX ENGINEERING WORKS,
HOLLAND STREET, S.E.,
AND
STROUD, GLOUCESTERSHIRE.

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TO CORRESPONDENTS.

RECEIVED.—A. P., Lima; H. Greene and Sons, Cannon Street; N. H. Humphrys, Westbury; H. G., Preston.
TREATISE ON GAS LIGHTING.—The publication of these chapters will be resumed in our next number.
SECRETARY.—Ammoniacal liquor used in the scrubber removes a part, both of the carbonic acid and the sulphuretted hydrogen, and thus saves some amount of other purifying agents. Weak liquor also extracts ammonia.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 17, 1877.

Circular to Gas Companies.

As far as our industry is specially concerned, the all-absorbing question of the hour is Mr. Raikes's proposed new Standing Order for the House of Commons. Whether or not it will be adopted, will probably have been decided before these lines meet the eyes of the majority of our readers; but that need not prevent us from giving a *résumé* of gas legislation, so far as auction clauses are concerned, since 1856, before which period, we believe, such clauses were never embodied in a Gas Act. Since, and including, the year 1856, three hundred and sixty Acts, incorporating or extending the powers of Gas Companies, have been passed, and in forty-five of these, or exactly one-eighth of the whole, auction clauses, either peremptory or permissive, have been included. A detailed account of these enactments will be found in another column; but we here briefly summarize the information. In twenty-six Acts, now operative, the sales by auction are peremptorily ordered, with, in some cases, peculiar reservations, which will presently be noticed. In the other nineteen cases, the sale of shares by auction is allowed under circumstances which are specified in the enactments. It may be said, we believe, with truth, that in all these cases, except the most recent, the auction clauses were introduced voluntarily by the promoters of the Bills. The fact was, at all events, in years gone by, that the profits of Gas Companies were uncertain, and it was doubtful how far original proprietors could be relied upon to introduce the capital necessary for requisite extensions of undertakings. Under such circumstances, auction clauses invited outsiders to come into the concern, and share the risk of the venture.

Taking, first, the Acts in which the sale of all, or of only a portion, of new issues were directed to be made by auction, we find the Gainsborough Gas Act of 1856, which prescribes that one-half of the new issue shall be thus offered to the public. It is significant of the uncertainty of profit which at that date was entertained, that the Act directed that any premiums realized should be added to capital (entitled to dividend), and that discounts should be deducted from capital. We may pass over several Acts which compel sales by auction, and in general prescribe that any premiums realized shall be considered capital not entitled to dividend, noticing only the Portsea Island Gas

Act, 1860, which enacted that only one-half of the new shares should be offered to the public, the other half being reserved for existing proprietors.

We come now to a period subsequent to the passing of the Companies Clauses Act, 1863, which Act we regard as the sheet-anchor of shareholders. The Salisbury Gas Act of 1864 contained auction clauses, but it prescribed that premiums realized should be expended on extensions or improvements of works. The Chesterfield Act of the following year directed that any premiums realized on public sales should be added to the reserve-fund of the Company. The same appropriation of premiums was made by the Exeter Gas Act, which directed that one-half of the new shares should be allotted to existing holders, and the rest disposed of as the directors thought fit.

In the same year, 1865, the Fareham Gas Act, containing peremptory auction clauses, was passed, and, in this instance, we find that Parliament enacted that the premiums should be deemed profits of the Company. The Aldrington and Brighton Gas Act, of the next year, directed that one-half of the shares should be offered by auction, and the other moiety disposed of as the Directors thought fit, the premiums to go to form a reserve-fund. This was an altogether abortive undertaking, not a share having been issued, and we only quote it as an illustration of the practice of Parliament. We may pass over a good many other Acts containing compulsory auction clauses, only noticing the Whitby Gas Act, 1871, which directed that the reserve price put upon shares offered by public auction should be neither more nor less than the nominal value of such shares.

We come next to the Acts which give Companies a permissive power to offer shares for sale by auction. This power is to be exercised in two different ways; the shares may be disposed of in the mode the Directors think fit, or a resolution passed at a general meeting of shareholders may ordain the sale of new issues by public auction. A pretty general similarity exists in all these enactments. They allow by implication a first claim to the new issues by existing holders, and then permit the sale of unallotted shares by auction as Directors or Proprietors think fit. In all cases it is provided that the premiums realized shall be considered as capital not entitled to dividend. But several of the Acts regulate the amount of calls to be made on the shares, and it seems clear that a share sold by auction only a small amount on which was to be called up immediately, and the rest at remote and indefinite intervals, would command but a very small premium, whatever expectations as to dividends might be entertained. In the most recent Acts, giving permissive power to sell new shares by auction—take, for example, the Gloucester Gas Act, 1871, and the Lincoln Act, 1873—it is specifically enacted they shall first be offered to existing holders at par.

There are two Acts which deserve special mention, on account of certain peculiarities in the enactments. The first is the Sowerby Bridge Gas Act, 1861, which directs that one-half of the new capital authorized shall first be offered to large consumers in the district, and if not taken up by them may be sold by auction. The second is the Worthing Gas Act, 1868, which prescribes that new capital issued by the Company shall be offered to ratepaying inhabitants before existing proprietors, and, if not taken up within a month, may be allotted to shareholders, or disposed of in any way the Directors think fit.

We have not alluded to the cases of the two Metropolitan Gas Companies whose most recent Acts contain auction clauses. In these instances, the compulsory sale of new shares by auction is accompanied by two novel provisions—first, the sliding scale of dividend; and next, the enactment that one-half of all new capital required shall be raised by way of loan, at the lowest possible rate of interest. It is probable that the first sales of new shares by these companies will realize premiums of more than one hundred per cent., which, being profitably employed as capital not entitled to dividend, must, unquestionably, tend to make the dividend on the real share capital more secure. A large proportion of loan capital, at a low rate of interest, must also have a decided effect in the same direction, and hopes are entertained that dividends will be raised far above the maximum rates formerly allowed. Coupled with such provisions, therefore, it might appear that auction clauses could fairly be made compulsory. Mr. Raikes's proposal, however, makes no mention of these. It simply commands the sale of new shares by auction, and thus deprives existing proprietors of a privilege which it was at their option to relinquish, or not, as they thought fit. It is speciously argued, in *The Times*, that the provision of the Act of 1863, for the retention of which we contend, was and is simply permissive, and is only operative "unless the company, before the issue of 'new shares or stock, otherwise determine.'" We grant it, and only ask to be let alone. If Companies be allowed to deal with their own as they may determine, we shall be satisfied. Whatever may be said to the contrary, the Act of 1863 did confer

on Companies the right of allotting new capital to existing proprietors; and the proposal of Mr. Raikes, if adopted, would take away the privilege which we have said before will confiscate, not a small proportion of the sum paid by recent investors for shares in Gas Companies. The question to be placed before the House of Commons this evening is a very simple one. It is this: Shall a dictatorial Order, prescribing a definite enactment, which, we believe, has no precedent in the book of Standing Orders, be adopted; or shall a recommendation to Select Committees be prescribed, which will allow them to deal with the cases that present themselves, according to their merits? It is quite out of our power to go into the circumstances of the Companies whose Acts, containing auction clauses, we have detailed elsewhere. We have said that these clauses had their origin in the fact that Gas Companies, uncertain of profits, could not depend on original shareholders to supply capital for requisite extensions. They therefore sought aid outside their own community, on conditions such as we have described.

It is desirable to say a few words on the probable effects of the proposed Standing Order if it be adopted. We have hitherto, and more especially in recent times, advised all Gas Companies to apply for Acts of Incorporation or Provisional Orders. If this Order should be adopted, we shall certainly advise all unincorporated Companies to keep out of Parliament as long as they possibly can. They may be subject to annoyances and persecution, but a Company firmly established in any district, and righteously doing their duty, may defy all competition, and laugh at all Local Authorities. Parliament confers but one right, and imposes many restrictions. The right, or rather permissive power, to break up roads, may be secured in many ways; but the restrictions entailed by a Special Act cannot be avoided.

The position is delicate, and we rather hesitate to give advice. The Isle of Thanet Gas Company are pledged to proceed with their Bill; but we believe that the adoption of the Standing Order proposed will morally absolve them from the duty. An entirely new condition is proposed, of which they had no knowledge when the arrangement was entered into. Thus they may fairly withdraw their Bill, and go on as they have gone on; the more so as ratepaying Ramsgate rejects as Commissioners the candidates who would confiscate the Gas Company. Some other Bills may also be withdrawn, and thus a practical protest be made against a dictatorial Standing Order, adopted without any special knowledge of the particular circumstances in which it could be applied. At the last moment we cannot help indulging a hope that Mr. Raikes, or, rather, the permanent officials of the Board of Trade (in whose hands poor Sir Charles Adderley is simply a tool), will be defeated. Trade, as distinct from the Board of Trade, as it is called, is still powerful, as it ought to be, in the House of Commons, and we have little doubt that the participants in joint-stock enterprise will stand up against a proposal which, to-day, threatens only Gas Companies, but to-morrow may be made applicable to all incorporated companies in the kingdom.

We have much pleasure in recording the fact that the Exhibition of Gas Apparatus, opened last Monday by the South Shields Gas Company, has proved a great success. It was, from its opening till its close, crowded with visitors who all experienced the utmost satisfaction with what they saw. In another column we give a special report on the contents of the Exhibition, and the proceedings that took place in connexion therewith. We need therefore only congratulate the Directors of the Company, and their able Manager, Mr. Warner, on the complete success of the enterprise. It was well that the economic uses of gas for other than lighting purposes should be brought more fully to the knowledge of the general public; for the majority are strangely ignorant on the subject. Even in the Metropolis, where numerous shops in all directions display gas apparatus for cooking and heating purposes, a very general ignorance prevails as to their economy and value. And this ignorance is most common among the classes to whom the apparatus would be most useful. We allude to the lower middle and artisan classes. Gas-cooking stoves would be a source of economy to all classes; but when the cost of fuel is no object, and the number of servants unimportant, they may present no attractions. In small households, however, their use would prove a real blessing, and, in summer time, when no fires are required, except for cooking purposes, or for occasionally heating a flat-iron, a great saving would result from the use of gas-stoves. We indulge a hope that the Exhibition, so successful at South Shields, will be repeated in many other towns, confident that such practical displays will result in a large extension of the business of Gas Companies.

The provisional agreement made between a Committee of the Corporation of Leicester and the Directors of the Leicester Gas Company will be found in another column. It is, of course,

subject to the approval of the shareholders, and the inhabitants of the borough must also be consulted under the provisions of the Borough Funds Act. There is no doubt, however, that the shareholders will accept the terms agreed upon, and no fear that the townspeople will oppose. In truth both parties make an excellent bargain. The shareholders will receive perpetual annuities equal to something more than maximum dividends, and the town acquires one of the most successful gas undertakings in the kingdom. How profitable it has been to the Company will be seen in Alderman Stafford's speech, and how promising it is to the Corporation may be gathered from the fact that the business of the Company has doubled itself in about eight years. Gas at Leicester is cheap and good. The illuminating power is about sixteen candles, and the price in the borough is from 2s. 6d. to 2s. 10d., with 6d. extra in the suburbs. That the works have been admirably managed will be seen from the following facts kindly furnished by a correspondent:—The make of gas last year was 455,255,000 cubic feet, and the quantity sold was 426,697,000 feet; the gas unaccounted for was, therefore, only a little over six per cent. The capital at present employed, £220,000, is equal to £4 13s. 10d. per ton of coal carbonized last year, 46,880 tons. A few more figures will show the immediate gain which will accrue to the Corporation by the purchase. To pay the full dividends on the Company's capital, £17,267 are required. The annuities offered by the Corporation will amount to £19,000, while the profits made by the Company last year were very little short of £28,000. There is only one point in the agreement to which we are inclined to object, and that is the disposal of the reserve-fund. We look on a reserve-fund as the property of the shareholders, but in this case it has been arranged that, *minus* £4000 for winding-up purposes, it shall go as a nest-egg to the Corporation. Altogether, however, we must regard the terms of purchase as eminently satisfactory; and, much as we regret the disappearance of the Company, we may congratulate the shareholders. The Bill of the Company, we are informed, will be proceeded with this year, with the understanding that any new capital required will be raised by way of loan. Next year the Company and Corporation will jointly promote a Purchase Bill.

We print to-day a letter from Mr. A. Vernon Harcourt, one of the Referees, on the pressure tests prescribed by that body. There are cavillers who are constantly asserting that gas testings are a mere farce. That is not our opinion, and we do not wish to see them made farcical. The suggestion of Mr. Harcourt, however, that an Examiner should make three out of six tests for pressure while he is engaged on one test for illuminating power, is, to our minds, ridiculous. A test for illuminating power, carefully made according to instructions, will occupy an Examiner about half an hour, and three pressure tests will only show the pressure within that period. Clearly, this is not what the Legislature intended. We think it a pity that the Referees did not prescribe the use of a self-registering gauge. It need not have been an expensive instrument, and its employment would have afforded exactly the information which the Legislature meant should be acquired.

The Quarterly Report of Professor Williamson, the Chief Gas Examiner, might provoke a good many remarks, but we have no space for them. It is clear that the Gas Companies continue to comply as closely as possible with the requirements of the Legislature and the Instructions of the Referees, and that the gas supply of the Metropolis, so far as it is under the observation of the Chief Gas Examiner, is in a highly satisfactory state. We read in a contemporary of great "irregularities" in the conduct of the testings being recorded; but that is a matter which only concerns the Metropolitan Board of Works. If they choose to allow the testings to degenerate into a farce, they are welcome to do so.

Water and Sanitary Notes.

THE water supply of Richmond (Surrey), notwithstanding all the exertions of the Select Vestry—and we may admit they have been great—is still in a very unsatisfactory state, and is likely to continue so. The causes appear to be two in number—first, the sources on which the Vestry at present rely are totally inadequate to furnish a satisfactory supply; and secondly, the fittings of the consumers in the lower parts of the town are so defective, that most of the water supplied runs to waste, to the loss of the inhabitants in the higher parts. Most of the defects are ascribed to the careless behaviour of plumbers; and we have little doubt that the allegation is perfectly true. No sensible man ever admits a plumber to his house, except under the pressure of dire necessity, and then has almost invariably to regret it. The fact is, that no skilled work is done so negli-

gently and carelessly as plumber's. The Vestry, no doubt, accuse the Southwark and Vauxhall Water Company of corrupting the morals of the plumbers; but we do not think the allegation could be sustained. The morals of plumbers do not need to be corrupted. But this is somewhat beside our present purpose. In view of a possible—we might say, a certain—scarcity within a short time, the Richmond Vestry have obtained permission from the Thames Conservancy Board to pump 250,000 gallons of water per day from the river, near the Petersham meadows, just below the "Star and Garter" Hotel. In the meadow, they intend to establish a filtering-bed, and from that they will have to lift the water to their reservoir. The extravagance of this proposal is most remarkable, seeing that the Southwark and Vauxhall Company have offered to put any amount of water into the reservoir at a cost of sixpence per 1000 gallons. We say nothing about the quality of the water the Vestry would take at the point they have selected, but we know that between the intake of the Southwark and Vauxhall Company and that proposed near the Petersham meadows a large amount of sewage enters the river. The inhabitants of Richmond should at once take steps to prevent the Vestry from carrying out their plan. We have prophesied all along that the Vestry would, in the end, be compelled to resort to the Thames, or return to the Water Company. They have chosen the worse alternative, and are about to engage the rates in heavy expenses for a supply of water of a most unsatisfactory character.

The Norwich Town Council have leased their sewage farm for £1710 a year, which leaves them with a deficit on the rental they pay of £823 per annum. The sewage is to be carried to the farm gratis. It must not be supposed that we rejoice over the misfortunes of the Corporation, who have lost, we believe, about £4000 a year on the farm; still, it is open to remark, that a more ill-considered scheme, to say the least, was never adopted by a Corporation. The art of farming with sewage-irrigated land may be said to be still in its infancy. That it may be very profitably followed we believe to be certain in the end. We hope that Norwich has obtained an intelligent, as well as an enterprising, tenant. His experience in the next five years, honestly told, will be valuable.

Sevenoaks is unquestionably a town which presents difficulties in the way of the disposal of the drainage. The Local Board have hit upon the expedient of adopting "absorbing wells," and the adoption of these, as constituting a modified form of intermittent filtration, we are disposed to commend. They do not, however, suit the views of sensational engineers, who are satisfied with nothing but extensive and expensive works. Nor are they satisfactory to those who hope to reap profit from a sewage farm, to establish which the Local Board of Sevenoaks ask for a loan of £37,000. It is clear, however, from an inquiry before Major Tulloch, that the Local Board do not know what they want, and for the present—happily for the ratepayers—they do not get permission to borrow the sum named above. Let them go on with absorbing wells, which, if at all efficient, will fully answer their purpose, and involve but little expense.

AUCTION CLAUSES IN GAS BILLS.

During the last 21 years—i.e., from 1856 to 1876 inclusive—360 Acts of Parliament affecting Gas Companies were passed. This number is exclusive of Acts by which the transfers of gas undertakings to Local Authorities were effected. Of these 360 Acts, 45 contain clauses which provide in various ways for the sale of new issues of shares by auction or tender. The following list embraces the whole:—

Gainsborough Gas Act (1856).—By clause 13 it is provided that one-half of the new shares shall be first offered to existing shareholders *pro rata*, the other half, together with the unaccepted portion of the first half, shall be sold by auction, or otherwise, as the directors deem most advisable. Premiums and bonuses or discounts and losses on such sales shall be "added to or abstracted from the capital of the Company, as the case may be." No calls to be made on shares at intervals of less than two months.

Sunderland Gas Act, 1857.—By clause 21, new shares are directed to be sold by auction. No reserve price is fixed. Premiums on sales not to be considered as capital entitled to dividend.

Glasgow Gaslight Act, 1857.—Clause 1 provides that the Company may create and sell by public or private sale, at such prices as can be obtained for the same, 2600 shares of £25 each. Before offering to sell privately, shares to be offered to public auction. If not sold by auction, the company may for three months afterwards sell privately, but not at a less price. Premiums obtained by sale not to be divided among shareholders.

Glasgow City and Suburban Gas Act, 1857.—All new shares are, by clause 24, to be sold by public roup, either at Glasgow or Edinburgh. All moneys thus received, after deducting expenses of sale, to be applied to extensions and improvements of works, &c.

Shrewsbury Gas Act, 1857.—By clause 23 it is provided that the Company may, by resolution of general meeting, determine to sell new shares by public auction, on conditions to be determined by the

Directors, the premiums on sales not to be entitled to dividend. If no such resolution be passed, or if no sale by auction be effected, new shares to be offered to existing shareholders.

Stockton Gas Act, 1857.—Clause 28 enacts that shareholders, in general meeting, may determine to sell new shares by auction. Directors to determine the conditions; premiums on shares not entitled to dividend. If no resolution of general meeting be passed, and the old shares are at a premium, the new shares shall be allotted among existing holders.

Nottingham Gas Amendment Act, 1858.—By clause 6 the committee of the Company are required to cause additional shares to be sold by public auction—premiums not entitled to dividend.

Maidstone Gas Act, 1858.—By clause 21, the Company, at a general meeting, may determine to sell new shares by auction, the Directors fixing the conditions and the reserve price—premiums to be applied to capital purposes, but not entitled to dividend. If no such resolution, shares to be allotted *pro rata* among existing holders.

Scarborough Gas Act, 1859.—Under clause 3 the Company, at an extraordinary meeting, may direct the whole of the new shares to be sold by auction, on conditions to be fixed by the Directors. Premiums on sales not to be considered profits, but to be expended on capital account, without being entitled to dividend. If no resolution to sell by auction be adopted, and the old shares are at *par*, or at a premium, the new shares to be distributed *pro rata* amongst existing holders.

Dover Gas Act, 1860.—New shares (clause 22) to be offered for sale by public auction. Directors to fix reserve price and conditions of sale. Premiums not entitled to dividend. Shares to be called up at intervals.

Huddersfield Gas Act, 1861.—Shares created by this Act, in lieu of existing shares in old Company, to be first offered to proprietors, and by clause 22 it is enacted that shares unappropriated shall be offered for sale by auction at not less than *par* value. If not so sold, to be disposed of as the Company think fit. (*Company since transferred to Corporation.*)

Swansea Gas Act, 1861.—Reincorporation of Company. Capital divided into 4000 shares of £25 each, 240 of which shares to be allotted to existing shareholders, in lieu of holdings in original capital, with maximum dividend of 10 per cent. Of the remainder of such shares, 480, called "new shares," to be allotted to existing shareholders as paid-up shares, with a maximum dividend of 7½ per cent., the balance—viz., 3280 shares—to be offered for sale by public auction (clause 23) under such conditions as the Company think fit. If a preferential dividend be attached to them, it is not to exceed 5 per cent. Reserve price to be fixed by Directors. No dividend on premiums.

Sowerby Bridge Gas Act, 1861.—By clause 24 it is provided that, upon the creation of any new shares under the powers of this Act, it shall be lawful for the Company to set aside any portion of such shares, not exceeding one-half of the same, to be appropriated to large consumers of gas supplied by the Company, who are not then holders of shares in the Company, or to be sold by public auction, or otherwise disposed of for the benefit of the Company in such manner as a general meeting may determine. Premiums not entitled to dividend. (*Company since transferred to Local Board.*)

Portsea Island Gas Act, 1861.—By Clauses 6 and 7, half of the new shares to be allotted amongst the old proprietors, the other half to sold by auction in the borough of Portsmouth. Unsold shares to be offered to existing shareholders at *par*. Premiums on sales not entitled to dividend.

Leeds New Gas Company's Act, 1862.—Clause 8 enacts that shareholders may direct the whole or any portion of new shares to be sold by auction. Shares not so sold to be distributed among existing holders, upon such terms as a meeting of the Company may direct. Premiums not entitled to dividend. (*Company since transferred to Corporation.*)

Reading Gas Act, 1862 (Clause 52).—New shares to be offered by auction within the borough of Reading, on such conditions as the Company may determine. Shares unsold in that manner to be offered to existing proprietors at *par*. Premiums not entitled to dividend.

Leeds Gaslight Company's Act, 1863. By clause 11 the meeting at which new shares are created may direct the whole or any number to be sold by auction, at not less than their nominal value. Unsold shares to be distributed at *par* amongst existing holders. No dividend to be paid on premiums received. (*Company since transferred to Corporation.*)

Harrogate Gas Act, 1863.—New shares to be sold by auction at Harrogate (clause 22). Premiums not entitled to dividend; 20 per cent. to be the largest amount of call at any time.

Yarmouth Gas Act, 1863.—Clause 24 provides that new shares shall be sold by auction. The largest call to be 25 per cent., and no two calls within a period of three months. Premium on sales not entitled to dividend.

Hertford Gas Act, 1864.—Clause 23 directs new shares to be sold by auction, with one-fifth of their value paid up. Premiums not entitled to dividend.

Salisbury Gas Act, 1864.—Clause 27 directs that new shares shall be sold by auction at such times and under such conditions as the company determine. Premiums to be expended on works, and not entitled to dividend.

Umbridge Wells Gas Act, 1864.—By clause 27 it is made lawful for a general meeting of the Company to direct that the whole, or any portion, of new capital may be sold by auction; if no resolution to that effect be passed, the new shares may be distributed as a general meeting direct. If a sale be made, and premiums realized, no dividend payable in respect of same.

Chesterfield Gas and Water Act, 1865.—Clause 6 provides that new shares shall, in the first instance, be offered to sale in lots, of not more than five shares, by public auction in the town of Chesterfield, after 14 days notice—premiums, if any, on sales to go to the Company's reserve-fund, and not be entitled to dividend.

Exeter Gas Act, 1865.—By clause 30 it is enacted that on every issue of new shares, one-half of the number issued shall be sold by auction in lots of not more than two; the other half may be distributed as the Company in general meeting shall direct. Premiums realized on sales to go to the reserve-fund, and no dividends to be paid in respect thereof.

Fareham Gas Act, 1865.—New shares to be offered for sale by auction in the town, the reserved price put upon them not to exceed the nominal value of the shares, and any money received by way of premium to be considered as profits of the Company. (Clause 23.)

Gomersal Gas Act, 1865.—New shares with 20 per cent. of nominal value paid up, and calls to be made at intervals of not less than three months, may, by clause 47, be sold by public auction, if a general meeting of the Company so determine, upon such conditions, &c., as the directors think fit; unsold shares to be distributed as a further general meeting direct. Premiums from any sales not entitled to dividend.

Hastings and St. Leonards Gas Act, 1865.—General meeting may determine whether all or any of the new shares shall be sold by auction or tender. Shares not sold, or not directed to be sold, to be distributed as meeting may decide. No dividend to be paid on premiums (clause 7).

Littleborough Gas Act, 1865.—Unsubscribed shares in original capital, and one-third of the number of new shares, when created, shall be offered for sale by auction within the village of Littleborough, in lots of not more than five shares each, and not under nominal value. Remaining two-thirds of new shares to be allotted *pro rata* amongst existing shareholders (clause 16). Premiums not entitled to dividend.

Aldrington and Brighton Gas Act, 1866.—(This Company never commenced operations.) One-half of the original capital, by clause 10, is directed to be raised by the sale and distribution of shares by auction, in lots of not more than two each, at par value, such shares, if not so disposed of, to be allotted as the Directors think fit, at their nominal value. Premiums on sales to be carried to reserve-fund.

Brighton and Hove General Gas Act, 1866.—One-half of new shares to be sold by auction, in lots of not more than two each, and not under par (clause 11). Unsold shares to be allotted, in the discretion of the Directors, at not less than nominal value. Premiums not entitled to dividend, but to be carried to reserve-fund.

Canterbury Gas and Water Act, 1866.—Clause 24 provides for the issue of new A and B shares, and clause 29 enacts that, before any A shares are distributed among existing shareholders, they shall be on offer for 30 days among the shareholders of the Canterbury Gas Consumers Company. In default of being thus taken up, the Company, in general meeting, may direct that the whole or any number of the A shares, and the whole or any number of B shares, shall be sold by auction, under such conditions as the Directors may fix. If not so sold, to be distributed at discretion of Company. Premiums not entitled to dividend.

Eton Gas Act, 1867.—The general meeting of Company, at which any new shares are created, may direct the sale of the whole or any part by auction (clause 26). Meeting may also determine what shall be done with unsold portion. Premiums not entitled to dividend.

Hampton Court Gas Act, 1867, contains similar provisions to those last-mentioned (clauses 31 and 32).

Scarborough Gas Act, 1867.—General meeting of Company may resolve to sell the whole or part of new shares by auction or tender (clause 9). Unsold portions to be allotted in the discretion of the shareholders meeting. Premiums not entitled to dividend.

Sutton, Southcoates, and Drypool Gas Act, 1867, contains similar provisions to those last named (clauses 29 and 30).

Hebden Bridge Gas Act, 1870.—By clause 33 the Directors of the Company are empowered, if they think fit, to sell the whole or any portion of new shares by public auction; shares not so sold to be distributed as a general meeting of the Company may direct, and any premiums to be considered as capital of the Company.

Reading Gas Act, 1870.—By clause 7 it is provided that before any new shares are offered to existing holders, whether original shares are at a premium or not, they shall be put up for sale by auction in the borough, with a reserve of not less than nominal value. Shares not so sold to be offered to existing proprietors at par. Premiums on sales not entitled to dividend.

St. Helen's Gas Act, 1870.—The directors, by clause 11, are required to put up new shares to auction; conditions of sale in their discretion. Premiums not entitled to dividend.

Shipley Gas Act, 1870.—Clauses 11 and 12 contain similar provisions to those last mentioned.

Boston Gas Act, 1871.—New shares are, by clause 6, to be first offered for sale by auction, whether ordinary shares at premium or not, the reserve price at sale not to be less than, nor to exceed, the nominal value of the shares. Premiums realized not to go to increase any dividend, nor be considered as capital entitled to dividend. Shares remaining unsold to be offered at par to old shareholders.

Thirsk Gas Act, 1871.—Clause 27 provides that whether old shares are at a premium or not, the new shares shall be first offered in lots of five each to public auction, the reserve price being not less nor more than their normal value. Shares unsold to be offered to existing holders in manner prescribed by the Companies Clauses Act, 1863. Premiums to be applied to the purposes of the Company, but not entitled to dividend.

Todmorden Gas Act, 1871.—The whole or any number of new

shares may be sold by auction, subject to such conditions as the directors may think fit. Unsold shares to be distributed in such a manner, and upon such terms, as a general meeting may direct, and premiums from sales to be considered capital of the Company (clause 35). Highest amount of call 20 per cent.

Whitby Gas Act, 1871.—Clause 28 enacts that new shares shall be offered by auction in lots of not more than five, whether original capital at a premium or not. Reserve price not to be less, nor to exceed, nominal value. Unsold shares to go to existing holders, in manner provided by the Companies Clauses Act, 1863. No dividend to be paid on premiums.

Gloucester Gas Act, 1872.—By clause 9 it is directed that all new shares and stock shall be offered to the holders of existing shares, whether the original capital is at a premium or not, according to the provisions, respecting proportionate allotment, contained in the Companies Act, 1863; if not taken up by any allottee within 21 days after offer, such shares are to be offered to other holders, as the Directors think fit, and so on, *toties quoties*, until the whole of the new shares or stock shall have been accepted or declined; and, if any new shares remain unappropriated at the end of six months, they shall be sold by auction, or otherwise, in the city of Gloucester, in lots of not more than five each, and not under par. Premium to be applied as capital, and not entitled to dividend.

Bristol United Gas Act, 1873.—Clause 8 gives power to create new capital, and directs that it shall, in the first instance, be offered for sale by public auction. Premiums applicable to capital purposes, but not entitled to dividend.

Lincoln Gas Act, 1873.—By clause 8 it is provided that new shares shall, in the first instance, be offered to the then holders of the Company's ordinary shares, as created or reconstituted by this Act. If not taken up by them within 21 days, the shares are to "be offered for sale by public auction, or otherwise, within the city of Lincoln, in lots of not more than five shares each, in such manner, at such times, and subject to such terms and conditions of sale, not inconsistent with the provisions of this Act, as the Directors of the Company think fit, provided that at any such sale the reserve price shall not be more than the nominal value of the shares offered for sale." No dividend to be payable on premiums; no call to exceed one-fifth the amount of share.

Neath New Gas Company's Act, 1873.—Clause 12 enacts that the new shares shall be first offered to the public by auction, in the borough of Neath, whether the old stock be at a premium or not. The Company are at liberty to determine the conditions of sale, the only restriction upon them being that the reserve price shall not be less than the nominal amount of the shares. Premiums on sales, after deducting expenses, are to be employed as capital, without dividend. Unsold shares are to be offered to old proprietors at par.

Newcastle-upon-Tyne and Gateshead Gas Act, 1873.—Clause 10 provides that "the Directors may, by order of a general meeting, from time to time create new stock, &c., and shall cause the new stock to be offered for sale by public auction," on such conditions as they may determine. Premiums on sales not to be considered as capital entitled to dividend. One-fifth of the amount of shares to be paid on allotment, and no after call to exceed that rate.

Nottingham Gas Act, 1873.—New shares of the nominal value of £50 each, with one-fifth paid up, to be sold by auction, on conditions to be determined by the Company—future calls to be at the option of the Directors; no dividends to be paid on premiums.

Scarborough Gas Act, 1873.—Clause 10 makes it lawful for the meeting, at which new shares are created, to direct that the whole, or any part thereof, may be sold by auction or tender. Unsold shares to be disposed of as a general meeting of the Company may direct. No dividends to be paid on amounts received by way of premiums.

Colchester Gas Act, 1875.—Before new shares are offered to existing holders, they are, by clause 7, required to be offered for sale by auction, within the borough, on conditions to be fixed by the Company, but not at less than par. Unsold shares to be subsequently offered at par to old shareholders. Amount paid up to be one-fifth of the nominal value, and no future calls to exceed that rate. No dividends payable on amount received as premiums.

Southampton Gas Act, 1876.—Clause 16 provides that new shares shall, in the first instance, be offered by auction, within the town, on conditions to be fixed by the Directors. One-fifth the amount paid up at once, and calls at intervals of not less than two months, and of not more than one-fourth the amount of share to be made in future. Premiums not entitled to dividend. No provision is made for disposing of unsold shares.

South Metropolitan Gas Act, 1876.—By clause 13, new shares are to be sold by auction or tender, in first instance, whether old shares at premium or not. The Company are to fix the conditions of sale, except that, with regard to reserve price, it is enacted that it shall not be less than the nominal amount of the share. Notice of the amount of reserve fixed to be sent in a sealed letter to the Board of Trade 24 hours before auction, or last day for receiving tenders; and of the intended sale, to the Metropolitan Board and Stock Exchange 28 days previously. Shares not sold by auction to be offered to ordinary shareholders at the reserve price. If not accepted within one month the shares are to be again submitted to auction. Premiums received to go to capital account without dividends. This Act provides a sliding scale of dividends on shares. Rateably with the additional share capital, the Company are required to raise an equal amount of money by the issue of debenture stock, or by borrowing on mortgage.

The Gaslight and Coke Company's Act, 1876, contains similar provisions to those last mentioned, and requires, in addition, that notice of sale of shares shall be given to the Corporation of the City of London.

Communicated Article.

THE GAS REFEREES PRESSURE-GAUGE.

The South Metropolitan and Chartered Gas Acts of last session direct that the Referees shall prescribe and certify the mode to be adopted for testing and recording the pressure of the gas supplied by the companies. The summer instructions of the Referees just issued provide that six observations of pressure shall be made daily, three of which shall take place in the interval from midnight to sunset, and three during the interval from sunset to midnight. The apparatus for this purpose is that now known as "The Referees Pressure-Gauge."

This pressure-gauge is constructed as follows:—A cylinder, A, of pure tin, 7 inches in diameter, closed at the top and bottom by plates of the same metal, forms one leg of a syphon pressure-gauge. A glass tube, D, half an inch internal diameter, flashed at the back with white glass, and graduated on the front in linear inches, is cemented into a metal screw connexion. It is then put in communication with the cylinder by means of an elbow fixed in the side of the latter, near the bottom. Into this the glass tube is screwed, and forms the other leg of the gauge. A cock, F, is fixed into the top of the cylinder, for the purpose of permitting the entry of the atmospheric pressure when it is desired to examine the water-line. Another cock, C, is fixed into the bottom of the elbow, beneath the glass tube, for the purpose of letting out any superfluous water from the gauge. The zero line, instead of being in the middle of the glass tube, as is usual in syphon-gauges, is in this apparatus, placed near the bottom. The reason for this arrangement is that the column of water indicating the degree of pressure rises in the glass tube only. The descent of the column in the cylinder leg of the gauge is inappreciable, by reason of the great difference in its area in comparison with that of the glass tube. Communication with the gas is in this case made through the bottom of the cylinder, by means of a tube, B, rising above the surface of the water, or it may be made by a connexion fixed on the side of the cylinder near the top.

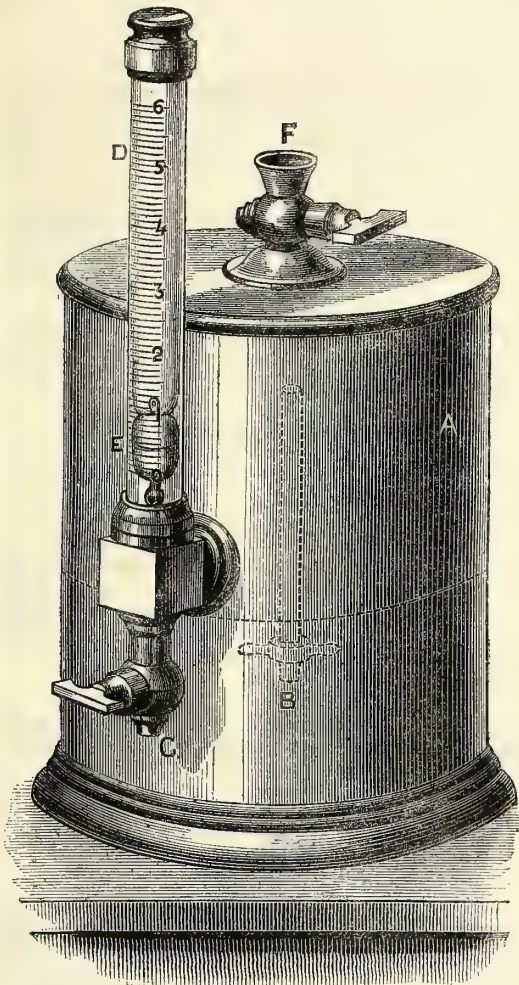
The action of this gauge is as follows:—Sufficient water having been first put into the cylinder through the cock at the top to bring the column of water in the tube up to the zero line, the cock is closed. Gas being admitted into the cylinder displaces the water, and drives it up into the glass tube, until the pressure of that column balances the pressure in the cylinder. The pressure in inches of water is then easily read off on the graduated tube. It is not necessary, even if it were possible, to verify the position of the column of water in both legs of the pressure-gauge, and those who have much to do with syphon-gauges will at once appreciate the advantage of having to deal with only one surface of water.

Such a gauge as this, but on a more exact scale, was designed more than thirty years ago by the late Mr. Alfred King, M. Inst. C.E., of Liverpool, for the purpose of testing the graduations of the gauges invented by him, and which are generally known now as "King's Gauges."

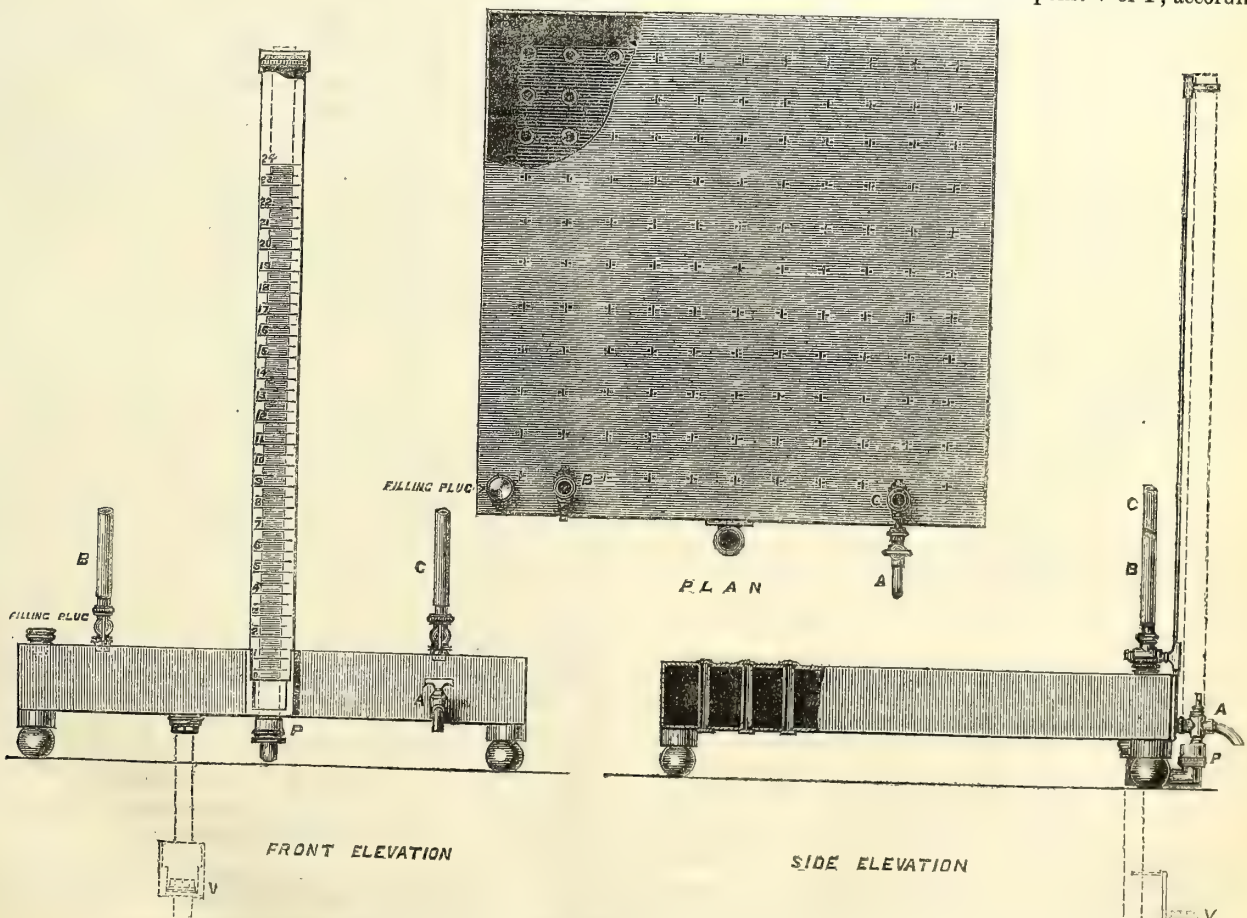
This instrument consists, as will at once be seen from the drawing, of a cistern of tinned copper, 2 feet square and 3 inches deep, stayed all over its surface with copper tubes, three-eighths of an inch in diameter and 2 inches apart, so as to secure great rigidity, and prevent any alteration of form under pressure. On the front of the cistern, a glass tube, three-quarters of an inch in diameter internally, is arranged in such a manner as to permit of the gauge being used either for vacuum or pressure.

The proportion of the cistern to the tube is so great that for all practical purposes the rise or fall of the water in the tube gives correct readings; but, if very great exactness is required, the necessary allowance can be made in graduating the scale. When the gauge is to be used, the cistern is filled with water to the level of zero on the scale, the water-level being adjusted by means of the tap, A. A connexion is then made by the half-inch lead pipe, B, to an accumulator or other source of pressure, and any desired amount is turned on. Another half-inch lead pipe, C, forms the connexion to the gauge or other instrument under examination.

The glass tube with its socket is screwed on at the point V or P, according as the



THE GAS REFEREES PRESSURE-GAUGE.



KING'S PRESSURE-GAUGE.

gauge is to be used for vacuum or pressure, the tube not in use being closed with a brass plug.

The Liverpool Gas Company make all the pressure-gauges—registering, dial, and syphon—used on their works, and it is with the gauge just described that they have always been verified.

For the same purpose, a similar gauge to that adopted by the Gas Referees has been made and used by Mr. W. Sugg, of Westminster, for more than five years past. But it would seem that neither Mr. Sugg nor Mr. King has ever published a description of his apparatus, or used it in any other way than that mentioned. As already stated, Mr. King's gauge is made to show either vacuum or pressure; and the dimension of the reservoir, corresponding to the cylinder of the Referees instrument, is so great, that the error in linear measurement on the graduated scale is less than 1-1000th of an inch. That used by Mr. Sugg is of lesser dimensions, and has, in consequence, a greater error, or nearly 1-100th of an inch.

The Referees gauge has been designed by Mr. A. Vernon Harcourt, who had no knowledge beforehand of the existence of the other two instruments invented by Mr. King and Mr. Sugg; and it has been constructed for him by Mr. F. W. Hartley, of Westminster. In order to facilitate the reading of the pressure, Mr. Harcourt has introduced a small glass float, E, which, being balanced by a drop of mercury, floats vertically in the liquid in the graduated glass tube. A line traced across the middle of the float is the point at which the pressure is read.

Correspondence.

THE GAS REFEREES SUMMER INSTRUCTIONS.

SIR,—The reasons for the prescription by the Gas Referees of three testings for pressure during the interval from midnight to sunset, except in the case of gas supplied by the Commercial Gas Company, are to be found in the recent Acts of the companies concerned.

According to the provisions of The Gaslight and Coke Company Act, 1876 (sections 27, 42, and 52), and the identical provisions of the South Metropolitan Gaslight and Coke Company's Act, 1876, the Gas Referees are to prescribe the mode to be adopted for testing the pressure of gas supplied by the company, and the number of the times of testing; "the average of all the testings of pressure prescribed under this Act from midnight to sunset, and the average of all the testings of pressure from sunset to midnight, shall be deemed to represent the pressures during each of these periods;" and "if on any day, whether during the period from midnight to sunset, or during the period from sunset to midnight, the gas supplied by the company from any station is supplied at a pressure less than it ought to be under this Act, the company shall forfeit a sum not exceeding ten pounds for each station, in respect of which they are so in default."

To carry out these provisions, it is clearly necessary that more than one testing of pressure shall be made at each testing-place daily during the period from midnight to sunset.

We are not called upon to prescribe at what times nor at what intervals these testings should be made. Probably a gas examiner, having to visit the testing-place between "midnight and sunset," would make then a testing of illuminating power and testings of pressure—each of which is, literally, the work of a minute—at the beginning, middle, and end of his visit.

The Commercial Gas Act, 1875, does not divide the day into two periods; and, therefore, in the case of this company, we have not prescribed testings of pressure during the period from midnight to sunset.

A. VERNON HARCOURT.

17, Buckingham Street, Adelphi, W.C., April 13, 1877.

Parliamentary Intelligence.

HOUSE OF LORDS.

FRIDAY, APRIL 13, 1877.

The Examiners reported that no further Standing Orders are applicable to the Edinburgh and District Water, the Falmouth Water, and the London Corporation Bills.

The Blackburn Borough Gas, Water, and Extension Bill was reported, with amendments.

The following Bills, brought from the Commons, were read the first time, and referred to the Examiners:—Dundee Gas; Maryport District and Harbour Gas; Middlesbrough Corporation; Rotherham Corporation; Warrington Corporation Gas; West Surrey Water.

HOUSE OF COMMONS.

MONDAY, APRIL 9, 1877.

The Warrington Corporation Gas Bill was read the third time, and passed.

On the motion of Sir CHARLES FORSTER, it was ordered that the minutes of the evidence taken before the committees on the London (City) Corporation Gas Bill, 1866, and the Metropolis Gas Bill, 1867, be referred to the committee on the Crystal Palace District Gas and The Gaslight and Coke Company Bills.

A petition for additional provision in the Colne Gas Bill was referred to the Examiners.

A petition was presented by Mr. Morgan Lloyd, from the Peterborough Gas Company, against the proposed Standing Order relative to auction clauses in Gas Bills.

A petition against The Gaslight and Coke Company Bill (the petitioners not praying to be heard) was presented from the Vestry of St. Luke, Middlesex.

The petition of Henry Gerard Hoare and Henry Seymour Hoare against the Bolton Improvement Bill was withdrawn.

TUESDAY, APRIL 10.

The Middlesbrough Corporation and the Rotherham Corporation Bills were read the third time, and passed.

The Lowestoft Water, Gas, and Market Bill (Lords) was read a second time, and committed.

Petitions in favour of the Bolton Improvement Bill were presented from (1) Inhabitants, owners, and occupiers in Over Stulton; (2) Inhabitants, owners, and occupiers in Ainsworth.

The petitions of (1) Sir Charles Henry Tempest, Bart.; (2) John Knowles and others, against the Bolton Improvement Bill, were withdrawn.

The Leicester Gas, Ashton-under-Lyne Gas, Ashton-under-Lyne Improvement, Dukinfield and Denton Local Boards of Health, Hanley Corporation Gas, Carnforth District Water, Newcastle-under-Lyme Borough Extension and Improvement, and Heywood Water Bills were referred to a Select Committee, consisting of Mr. Sandford (chairman), Mr. Lambert, Mr. Hanbury, Sir Hugh Cholmeley, and Mr. A. Bonham-Carter (referee); to meet on Thursday, April 19.

WEDNESDAY, APRIL 11.

Petitions were presented in favour of the Ashton-under-Lyne Gas Bill, from the Local Board of Mossley; in favour of the Hanley Corporation Gas Bill, from Inhabitants and consumers of Gas in Hanley; and against the Bolton Improvement Bill (the petitioners not praying to be heard), from Owners, &c., and ratepayers of Tong-with-Haugh.

THURSDAY, APRIL 12.

A petition for additional provision in the Newcastle and Gateshead Water Bill was referred to the Examiners.

The Maryport District and Harbour Gas Bill was read the third time, and passed.

On the motion of Mr. WHALLEY, leave was given to bring in a Bill to give further facilities to landowners of limited estates in England and Wales to charge such estates with the expense of constructing reservoirs for the storage of water. The Bill was afterwards presented, and read the first time.

The petitions were withdrawn of the Dublin, Wicklow, and Wexford Railway Company against the Alliance and Dublin Consumers Gas (Bray Supply) Bill; and of the Stalybridge Gas Company against the Ashton-under-Lyne Improvement Bill.

FRIDAY, APRIL 13.

The Examiners report, "That the Standing Orders have not been complied with in the case of the petition for additional provision in the Colne Gas Bill," was referred to the Select Committee on Standing Orders.

The Stamford Water and Kent Water Bills were reported.

AUCTION CLAUSES IN GAS BILLS.

Mr. BRISTOWE gave notice to move as an amendment to the proposed Standing Order, to add, at end, "In the case of every such Bill it shall be competent to the committee so to regulate the price of the gas to be charged to consumers that any reduction of an authorized standard price shall entitle the company to make a proportionate increase of the authorized dividend, and that any increase above the standard price shall involve a proportionate decrease of dividend."

SATURDAY, APRIL 14.

The petitions were withdrawn of the Corporation of Lancaster against the Carnforth District Water Bill; and of the Corporation of Ashton-under-Lyne against the Dukinfield and Denton Local Boards of Health Bill.

HOUSE OF COMMONS COMMITTEES.

THURSDAY, MARCH 15.

(Before Mr. HIBBERT, Chairman; Mr. BALFOUR, Sir GEORGE CAMPBELL, and Lord MUNCASTER.)

LONGTON CORPORATION BILL.

Mr. CRIPPS, Q.C., and Mr. MICHAEL appeared for the promoters. Sir EDMUND BECKETT, Q.C., Mr. LITTLE, Q.C., and Mr. STEPHENS appeared for the Duke of Sutherland; and Mr. YOUNG for inhabitants of Blurton and other places, petitioners against the Bill.

Mr. CRIPPS, in opening the case for the promoters, said that the object of the Bill was to transfer all the rights and interests of the Longton Gas Company to the Corporation. The advisability of effecting transfers of this description was a matter of principle, but it had been adopted by Manchester and other large towns, and, he believed, had produced beneficial results. In some instances, the gas company might be reluctant to sell; but in this case that difficulty had been got rid of, all the terms having been settled between the corporation and the company out of Court. In 1875 another company was absorbed by the present company, and in 1875 the latter came to Parliament for the purpose of acquiring power to raise additional capital. The Bill was opposed by the corporation, but an arrangement was afterwards made by which the corporation were to buy the whole of the works, and henceforth to supply the town and district on the same terms and conditions as the company had done, and the object of this Bill was to obtain the sanction of Parliament to the arrangement.

The following witnesses were then called:—

Mr. George H. Hawley, examined by Mr. CRIPPS.

I am town-clerk of the borough of Loughton. The gas company there were incorporated by the Longton Gas Act of 1866, and were authorized to supply the town and other places adjoining. Their capital was fixed at £40,000, with borrowing power up to £10,000. Under a second Act obtained by them in 1875, their limits of supply were extended. An agreement has now been come to between the corporation and the company for a transfer of the undertaking. It is also desired to purchase further lands on which to manufacture gas. There is no objection on the part of any one to the purchase of these lands for that purpose. From 1866 down to the present time I have been solicitor to the company, so that all matters about their capital are within my knowledge.

Cross-examined by Sir EDMUND BECKETT: Taking the existing capital of the company at £40,000—viz., £20,000 at 10 per cent., and £20,000 at 7 per cent.—the possible dividend is £3400 a year. We have arranged to give the company £73,150. That at 5 per cent. will amount to £3655. There is no limitation by the Bill as to what we can earn. That being so, we could divide, at the moderate amount of 5 per cent. interest, some £300 a year beyond what the company can. The rates at which the corporation borrow money vary. The money for sewerage purposes was borrowed from the Public Works Loan Commissioners at 4 per cent.; but they will not give us a loan for the gas-works; or, at least, if they give it at all, most certainly it would not be for a longer period than 20 years, or at a less rate of interest than 5 per cent. What there is of the Florence district has risen up quite lately. It is very small—a population of 200 or 300 would be an outside figure, I should think.

Sir E. BECKETT: As to the 7s. 6d. per 1000 feet you have power to charge for gas beyond one mile, how do you justify that? If you step over a single yard, you are to charge double the price; is not that something extraordinary?

Witness: It is justified, in my opinion, in this way—that, as a matter of fact, the extension of mains results in a loss.

Cross-examination resumed: The district of Florence, which, I believe, is all within the mile radius, can only be charged 8s. 6d. per 1000. There was a talk some time ago of creating a separate district with a local board for Florence, but it came to nothing.

By the COMMITTEE: Florence is within the district of the Sanitary Authority of Stone.

Sir E. BECKETT: If a local board were formed for Florence, would you have any objection to their supplying their own gas?

Witness: That is hardly a matter I can answer. Speaking from the corporation and the gas company's point of view, I should say decidedly there would be.

Cross-examination continued: At the first negotiations between the company and the corporation, it was thought a sale and transfer could be effected under the 162nd clause of the Public Health Act of 1875. We applied to the Local Government Board for their sanction; but after mature consideration they decided that we could not buy anything outside our district. I believe the 162nd clause was intended to enable corporations and local boards to buy gas-works both inside and outside their districts. The Local Government Board, however, differed from me, hence we are here with this Bill.

By Mr. YOUNG: The corporation contemplate deriving a profit from the gas-works, but I do not know of what amount. In the Bill the maximum price to be charged in the borough, and within the one-mile radius, is 3s. 6d. per 1000 feet, but it will not disable us from charging one rate within the municipal borough, and another rate within the mile radius. With reference to the population of the outside places, such as Blurton, Blyth Bridge, &c., I believe 10,000 would cover all. The Longton population, according to the last census, was 20,000. I believe Longton will extend towards Blyth Bridge, but I do not anticipate it will be very rapid. In the direction of Blyth Bridge I believe there is upwards of a mile of main which has no connexion on it. I do not know of my own knowledge, but have heard it in the course of examination of witnesses, and so on, that there is a loss in supplying Blyth Bridge with gas. The Gas Committee of the corporation unanimously recommended that the maximum price of gas should be 5s. per 1000 feet outside the mile radius, with a reduction when the price charged in the borough was below 3s. 6d., and by a majority of one, I think, the committee of the whole council agreed to the same terms. Then it is fair that I should say those resolutions were afterwards rescinded by the council by a majority of 13 to 9, and it was stated by some of the members who voted for the original resolution that they had not sufficient evidence before them at the time to justify them in coming to this conclusion. The company are now charging 3s. 6d. within the borough, and 6s. uniformly outside the mile radius, except in the case of the railway company, who are charged 5s. 6d. at Blyth Bridge.

By the COMMITTEE: From the mile radius the mains extend about 2½ miles in a line along the Blyth Bridge Road—that is, to the extent of the company's limits of supply, although they may branch from side to side.

Re-examined by Mr. CRIPPS: The provision for a different charge in and outside the borough is not now introduced, but was the result of the legislation of 1875, when this particular district of Blyth Bridge was taken into the limits of supply. Since that time mains have been laid down, and expenses gone to in supplying them on the basis of the Act of 1875. I do not know that Florence has any defined boundary, and am not aware any portion of it is outside the mile radius. I never heard of any proposal for a new gas company to supply that district, except what is in the Duke's petition. The necessity for our coming to Parliament arises from the fact that we take over the right of supply to some parts out of our borough. What has been done in almost every case, where a gas company have been transferred to the municipal authority, is that the outlying parts which the company were supplying go with the bulk to the corporation. Otherwise, a considerable portion might be left in total darkness.

Mr. Robert H. Hawley, examined by Mr. CRIPPS.

I am an alderman and Justice of the Peace for Longton, and chairman of the Parliamentary Committee of the Council. Longton has an area of 960 acres, and a population of 20,000, principally employed as potters and colliers. Many of our tradesmen and manufacturers, though their places of business are in Longton, reside some distance from the town, and, consequently, are not subject to its rates. There is no opposition to this Bill from the two local boards whose districts are within the mile radius. On the contrary, they have petitioned in favour of it. There is, however, dissatisfaction expressed on behalf of Florence, and a petition presented. There are 155 consumers of gas in Florence, and their total rental is £323 13s. a year, or an average of £2 1s. 3d. for each consumer. Normacott adjoins Florence, and has 58 consumers, whose average rental is £1 17s. 6d. Outside the mile radius at Blyth Bridge there are 45 consumers on four miles of mains. The gross receipts upon that main are £214 0s. 10d. The whole capabilities of the company, and their rights, were certainly considered when the contract to purchase was entered into. This was before the company obtained their last Act; but at the time the cost of carrying this main to Blyth Bridge was one of the matters under consideration in our negotiations with the company. The Blyth Bridge extension cost £3234 5s. 10d. Last year the rental was £214 0s. 10d. We estimated the cost of making the gas to be £81 4s. 9d., being 2s. 3d. per 1000 for £22,300 feet. This leaves a profit of £132 16s. 1d. Seven per cent. on the outlay of £3234 is £226 7s., thus showing a loss of £93 10s. 11d. I am a coal-master, having collieries within the borough. In 1875 we charged 12s. 1d. per ton for coal. Before that there had been a considerable rise in price, but it has been gradually falling since. There is the difference between the 12s. 1d. then and 10s. 6d. now.

Cross-examined by Sir E. BECKETT: The price of coal has been as much as 16s. 8d. per ton. The corporation will not be able to charge more than 3s. 6d. within the mile radius; but if the circumstances justify them, they can charge as much below that price within the borough as they like.

Mr. YOUNG: Notwithstanding East Vale and Dresden are paying 3s. 6d. at the present time—the price at which the inhabitants of Longton are being supplied—by this Bill you will be entitled to charge them a different price from the inhabitants of the borough itself, if you think fit to do so?

Witness: You are wrong there. Whatever applies to the borough will apply to the one-mile radius. We do not seek to alter anything.

By Mr. YOUNG: The lighting of Blyth Bridge commenced, I believe, in November, 1875. I do not think all the houses that might possibly burn gas are attached at present; but, practically, they are. The total cost of the main to Blyth Bridge—£3234 5s. 10d.—includes, I believe, the cost of the parliamentary expenses (£600) and the main from the mile radius; but I am not aware it includes any portion of the expenses incurred between the mile radius and the gas-works. I should think the first year's rental on this main—£214 0s. 10d.—is not very good, and it is not susceptible of much further development.

Mr. YOUNG: Supposing, for instance, that the present main is larger than would be necessary for 12 or 14 years to come, that it has cost 40 per cent. more than it should, and that you ought to put on to the Blyth Bridge main only about a fourth of the parliamentary expenses, would not that reduce the outlay to about £1700?

Witness: In the first place I am not prepared to say that a less main would be practicable to go to Blyth Bridge, because I know that the additional pressure it requires to force gas through a small main for five miles entails a very serious loss upon a company in the way of leakage. I think to take the gas that four miles the main is not too large.

By Mr. YOUNG: When the company's 1875 Bill was deposited, the prices of coal and slack were coming down. I believe the contract the company

had for coal from 1874 to 1875 was 12s. 6d. per ton, and I believe at the present time it is 10s. 4d.

By the COMMITTEE: Since the extension to Blyth Bridge was made, a little more than twelve months, the price of gas has been always at 6s. per 1000. I am not aware the company have ever charged their full maximum price of 7s. 6d.

Mr. John H. Goddard, examined by Mr. CRIPPS.

I am a Justice of the Peace for the county of Stafford and the borough of Longton, and was an alderman of the borough at the time the negotiations were going on for the purchase of the gas company. I am of opinion it would be a benefit to the town for the purchase of the gas-works to be carried out as proposed. There has been, in times past, a great deal of difficulty between the corporation and the company, and it was to put an end to the differences that it was thought expedient the gas-works should be purchased. When the corporation saw the company were about applying for further powers, it was a matter of calculation with them what steps they should take, and I strongly advised them to purchase, as I was of opinion it could not possibly pay to carry the gas to Blyth Bridge, on account of the sparse population. I stated that to the company, but they assured us they had made such calculations that there would be no loss if the scheme were carried out, and we accepted their statement. I recommended the council to purchase, even if they had to face a loss, and unfortunately my anticipations have been realized. It has ended in a dead loss to the company; and the ratepayers of Longton, if the purchase is completed, will have to bear that loss.

Cross-examined by Sir E. BECKETT: I do not think there is a probability of the number of consumers on the Blyth Bridge main doubling for a long time to come. I believe there is not at present any loss in supplying within the mile radius. When investigating the company's affairs, we did not inquire whether the thinner parts of the district were a loss, we took it as a whole.

Sir E. BECKETT: Then how do you make it out that, taking it as a whole, there being a loss upon the Blyth Bridge portion, it is to be such a very good thing for the corporation, because you give a high price for the undertaking?

Witness: At the time of the negotiations the 1875 Act had not been obtained, therefore the Blyth Bridge supply was not existing.

Sir E. BECKETT: I want you to explain why you think it a good thing for the town.

Witness: I hold very strongly that all corporate bodies should be the owners of gas and water works.

Sir E. BECKETT: That is a political proposition, but mine is a much humbler one, mine is merely pecuniary. How is it to be a good thing for the town in a pecuniary way?

Witness: I consider it would be so, as I do not know a single instance where a gas company have ever reduced their rates—that is to say, to give a benefit to the inhabitants of any excess of income that they have derived.

Sir E. BECKETT: Let me see if I can enlighten you. Did you never hear of a gas company being obliged to sell their shares by auction?

Witness: It has never come to my knowledge.

Sir E. BECKETT: Supposing this company were compelled to do that, it would be a better thing for the corporation than buying the works, would it not?

Witness: I think not.

Sir E. BECKETT: I want you to make that out.

Witness: At the time I was connected with the Gas Committee the corporation consumed about an eighth of the whole production of the company, the other seven-eighths being used by the middle classes. The working classes were contributors to the one-eighth, and I had tried repeatedly to get a reduction in the price charged for the public lamps, and had always failed; so seeing there was no probability of our succeeding, I recommended the town to purchase the works from the company at their own price.

Sir E. BECKETT: Do you not know that Parliament never allows the public lamps to be supplied at a lower price than the largest private consumer?

Mr. MICHAEL: That is not so, because the Gas-Works Clauses Act of 1871 expressly provides that the price for the public lamps shall be settled by arbitration; therefore it may be any price.

Sir E. BECKETT: Can you tell me any instance of late where, in a Gas Company's Act, a lower price has been allowed for the public lamps than for the largest private consumers?

Mr. MICHAEL: Yes, several. I should say the general principle has been that 6d. is taken off.

Sir E. BECKETT: Not against the largest private consumer.

Mr. MICHAEL: Yes.

Sir E. BECKETT: I differ from you. (To witness:) Just go on with that calculation, and tell me how you make out the undertaking is to be a profit to the corporation, even with this one-eighth complication, which I confess I do not follow.

Witness: Seeing that no division of profits, or rather that no benefit from overplus profits, had ever arisen to the ratepayers, I thought, and still think, that if the gas could be made at a profit we could reduce the price of the public lamps.

Sir E. BECKETT: Let me take you back to this calculation which I asked the town-clerk about, and he admitted, that supposing you borrow this money at 5 per cent., which he seemed to think was the lowest you could borrow at, you would be paying £3755 a year on your purchase. The gas company can now only divide £3400 a year. That looks to me like a loss of £355 a year to you.

Witness: That is assuming Longton is not going to increase; but if the consumers increase, and the quantity of gas produced increases, of course we shall get, I hope, the same ratio of profit upon the increased consumption as we do now.

Sir E. BECKETT: Supposing Longton does increase, you will have to lay new mains and enlarge your works, will you not?

Witness: I believe the works are in a state to produce a very much larger quantity of gas than is now required.

Mr. YOUNG: Is it not the fact that a year or so ago the corporation could have purchased the gas undertaking at a very much lower figure than at present?

Witness: Unfortunately for the corporation, in consequence of not being able to carry out a contract which was made in 1876, they have had to pay a higher figure by about £5000.

Mr. William Webberley, examined by Mr. MICHAEL.

I am a Justice of the Peace for the borough of Longton, and have been chairman of the gas company since 1868. The terms were arranged between us and the corporation for the purchase of the gas-works. As chairman of the company, I considered it desirable, in the interests of the town, that the corporation should purchase the undertaking. I believe it will be a source of profit, and assist them to reduce the taxes. It is my opinion that the profits should go in diminution of the rates. When we applied for our Act of 1875, owing to some informality in the notice, it was necessary to get the consent of the owners and occupiers in Blyth Bridge and Forsbrook before we could insert them in the limits of the Bill. Every householder in those places signed the memorial, and, in

consequence of that, we laid down upwards of three miles of main, 8 inches in diameter throughout, from the mile radius. The cost of it was £3234 5s. 10d., and the receipts for last year, when gas was sold at 6s. per 1000, were £214 0s. 10d.

Mr. MICHAEL: What ought to have been the annual incoming from the consumption in order to pay the expense and also a dividend upon the capital expended?

Witness: I have not here the figures of what it ought to be, but the loss by supplying at 6s. has been upwards of £90.

Sir E. BECKETT: That does not agree with what was given before. If the whole of the consumers had paid 7s. 6d., that would still have left a loss to the company of £35 7s.

Examination resumed: At what we did charge, 6s., we lost £93, which, added to the £214, makes £307, and if we had charged the maximum price, we should still have lost £35 15s. We hope for some increase of consumption, but not to a great extent, as there are no factories whatever in the whole of the district, from the mile radius on to Blyth Bridge. Up to that place they are generally cottages, and then there are a few villa residences. Before we undertook the district, Mr. Glover's private works were supplying gas at a charge of 12s. 6d. per 1000.

By the COMMITTEE: The gas that was charged at 12s. 6d. was made at Mr. Glover's private residence, close to the village.

Examination concluded: The Town Council were opposed to the extension of our works to Blyth Bridge. They were afraid a loss would be entailed upon the company, which eventually would fall on them, and on that account a deputation was appointed to wait on us. I stated myself to the gentlemen who came, that they ought to depend on our judgment in not taking gas there, unless we thought we could make a profit from it. My idea was, there would be a sufficient supply within the area to justify the expenditure of the money in laying down the main; but the consumption has not come up to the estimate of the directors by a very considerable amount.

Sir E. BECKETT: You take 7 per cent. as the thing you are entitled to by Act of Parliament, but that leaves a very large profit beyond the usual 4 or 5 per cent. which corporations pay. Supposing you take, instead of the 7 per cent., 5, which is the figure Mr. Hawley took, what is 5 per cent. upon £3234?

Mr. MICHAEL: £161 14s., and if you add the cost of manufacture (£81) to that, there is still a considerable loss—that is, £242 against £214.

Sir E. BECKETT: I am inquiring whether this is a wise proceeding or not. I have got enough for my purpose. (To witness:) Have you any kind of analysis you can give of how this £3234 is made up?

Witness: The laying of an 8-inch main and pipes on to Blyth Bridge, beyond the station, £2255; parliamentary expenses, £692 13s. 4d.; and extensions elsewhere, £286.

Cross-examination resumed: The whole of the district within the mile radius is profitable at 3s. 6d. per 1000, but there is a loss by supplying beyond. The thin parts of the district within the mile radius are certainly not supplied at a loss, because under the Act we are not obliged to take the gas beyond a certain distance from the public lamps, except by special arrangement. The districts of Florence and Normacott are new, because the Duke of Sutherland's mines there are only being sunk at present. We never expect any large consumption from them. There are a few villa residences there now, but the people are leaving them on account of the mines, so that we can only expect cottages, which are never profitable to a gas company. If we were keeping on the works, I should have no objection at all to being relieved from supplying beyond the mile radius on the Florence road.

By Mr. YOUNG: The Longton Gas Company have been very successful, having paid maximum dividends since 1866. When we took the concern over from the Stoke Fenton and Longton Company in 1866, we paid £4500 for the works, and £7000 for the goodwill. We paid £1800 out of revenue for the goodwill, and the rest out of capital. By the acquisition of the works by the corporation it is anticipated there will be a considerable reduction of the rates through the increase of consumers. In the half year ending June, 1866, the profit of the company available for dividend was £627 3s. 5d.; in the corresponding period of 1876 it was £1075 16s. 4d. So that the natural increase of the concern must be a profit to the town. That increase must certainly be within the municipal borough; we never expect any great increase from without. The 8-inch main to Blyth Bridge was laid, not so much in anticipation of a development of the works, as for economy. A 5-inch main would have been quite sufficient for the service, but the pressure on it would have caused a greater leakage of gas.

By the COMMITTEE: We did not expect a much increased demand when we made the extension. It was stated particularly before the committee on the Bill, that it was almost entirely an agricultural district from the mile radius till we got to Blyth Bridge. The main was laid at the request of the inhabitants, and there is no doubt there was a little feeling on the part of the directors (I speak of myself) to accommodate certain gentlemen without injuring the company.

By Sir E. BECKETT: The least sum, previous to 1875 or 1876, at which there was any bargain between the company and the corporation for a purchase was £4000 less than the present price. That was in October, 1874. This agreement broke down because the Town Council could not get power without an Act of Parliament. At a directors meeting Mr. Aynsley, the present opponent of this Bill, moved that the increased price should be asked, and he also wished, but the directors would not agree to it, that 25 years purchase should be paid by the town; that would be upwards of £80,000.

Re-examined by Mr. MICHAEL: The progress of the company has been exceptionally rapid, on an average doubling the consumption in eight years. In ten years we have nearly trebled the profits derived from the consumption of gas within the mile radius. There is no reason why that should not continue. On the capital expended on extension of mains outside the radius we have calculated 7 per cent. interest, which we ought to realize, so as not to injure the consumers outside or favour those inside. Otherwise we should, in reality, be detracting from the profits of the consumers within the mile radius, to supply gas at a lower price than it ought to be supplied at in the out-district. I do not think it is possible for an extension of buildings outside to take place. The period must be very remote, I believe, before that district can be made to pay; but supposing the circumstances did exist, we ought, in the interests of the consumers outside, to keep up the price, so that no loss would be incurred.

Mr. James M. Darwin, examined by Mr. MICHAEL.

I have been secretary and manager of the Longton Gas Company since 1868. During that period I have had the conduct and management of the works and undertaking of the company. I have heard the figures stated with respect to the prices charged and the amounts expended, and they are correct, both as to what has been laid out within the mile radius and on the Blyth Bridge extension.

Cross-examined by Sir E. BECKETT: I have no doubt the corporation will reduce the price within the mile radius. In 1874 the cost of gas was 2s. 5½d. per 1000, in 1875 it was 2s. 0¾d., in 1876 it amounted to 2s. 2d.—the average price for the three years being 2s. 3¾d. The gas sold in 1874 was 41,922,700 feet; in 1875, 45,311,000; and in 1876, 48,430,000.

By Mr. YOUNG: There is one block of houses, just outside the mile radius, supplied at 3s. 6d. per 1000; but they were connected before the Blyth Bridge extension was laid. I should hardly think it fair for the corporation to reduce the price of gas within the borough, and not reduce it outside the mile radius, supposing the profit was sufficient, and the same conditions applied. A 5-inch main might be found large enough for Blyth Bridge, but the directors at the time thought the place would naturally increase, and were guided by their past experience of the different mains in Longton. The Stoke Fenton and Longton Company had mains in the town, and in 1866, when this company were formed, they laid a second set; but two or three years ago all of them had to be taken up, simply because together they were too small. The difference in price between a 5-inch and an 8-inch main would be about £770. I do not consider the first year's rental (£214) at all unsatisfactory. You cannot expect an extension of this kind to produce much at the beginning. I dare say it will increase 10 per cent., or a little more, this year. At Blyth Bridge there are only five villas unsupplied with gas, the rest of the houses are cottages. If from the actual cost of the extension to Blyth Bridge you strike off £700 or £800 for the main, and three-fourths of the parliamentary expenses, which are all put on to this extension, last year's supply of gas would give a little profit. If the consumption at Blyth Bridge is not to increase, we have spent £770 more than we ought to have done.

By the COMMITTEE: The difference could hardly be considered a saving, because there would be the friction, and condensation, and leakage, which would be more in a 5-inch than in an 8-inch main. There would be, perhaps, a difference of 5 per cent. in leakage in consequence of increased pressure.

Re-examined by Mr. MICHAEL: It would not have been economical, as we were to supply three miles distant, to lay down so small a pipe as 5 inches, because on each side there are branch roads. If I had to do the work over again I would lay down an 8-inch main, even with my present experience of a less quantity of gas being taken than I imagined would be. If we had laid the smaller main we should have been obliged to put full pressure on the whole town. It is probable this district will increase at least 10 per cent. each year.

Mr. A. Hardwick, the borough surveyor, and Mr. William R. Blair, a member of the Town Council, were called to give evidence as to the present number of consumers, and the likelihood of increase. Both thought that, at least for some time to come, there would not be any large additional consumption.

This concluded the case for the promoters.

Mr. STEPHENS and Mr. YOUNG stated they proposed to call their witnesses first, reserving any observations till the conclusion of the evidence.

Mr. George Menzies, examined by Mr. STEPHENS.

I am the resident agent of the Duke of Sutherland, upon the Trentham Estate, and have filled that office since 1865. The Duke's property is partly within the mile radius and partly outside. In this district there are actually existing 800 houses the property of the Duke, with an estimated population of 4800. Of the houses, 360 are supplied with gas from the main passing to Dresden and Blyth Bridge. The main was laid down for the gas company's own purposes, and merely gives a supply to our houses on the way. The majority of the roads in Florence are the Duke's own property, made by him, and kept by him in repair. None of the roads in that district are lighted with gas. The question of forming the place into a district under the Local Government Act has been a matter under consideration and preparation for two years. Arrangements have advanced so far as to prepare a scheme for submission to the Local Government Board, and are within a week of completion. The district is intersected by the mile radius. The houses in the district have been mainly built by the mile radius. The houses in the district have been mainly built within the last dozen years, and largely within the last two years. I should think quite three-fourths of the houses have been erected since the gas company's first Act, in 1866. When the company applied for their 1875 Act, I understood the Bill to be one for supplying Blyth Bridge, and having no reference to Florence at all, and in so far I made a mistake, else I would have advised the Duke to oppose their proposals. A new colliery has been opened by the Duke within the last three years, and in connexion with it we have made large arrangements as to laying out building land and providing a system of sewerage. We have practically made all the arrangements in anticipation of a town growing up at this point, and we certainly should not have taken that trouble and incurred that expense unless we had a clear view of what was likely to happen. I have always looked forward to the feasibility of providing gas-works for the supply of the town when it had reached a population of 20,000, and have considered the arrangements so far as the site which I should propose for the works themselves. When I designed the railway on the estate, I marked the site of my proposed gas-works, more than two years ago. I have considered the limit of price which the company are empowered to charge, and, having regard to the circumstances of the district, I consider it a very excessive one, and, in the hands of the corporation, prohibitory. I certainly think that now, when matters are again submitted to Parliament, is the proper time for rectifying any mistake which may have occurred in 1875. There are 218 houses in Florence outside the mile radius, and of these I think 53 only are supplied with gas at 6s. per 1000. Inside, the price is 3s. 6d. I have no doubt at all that if the prices were less marked in point of difference an increased number outside would take a supply, and thus ultimately the company would be recompensed. The Stoke Company, whose district adjoins that of the Longton Company, have a limit of price of 5s., but I think the average price in the district is 3s. 6d. They supply the Duke's estate at Trentham, and in order to get to the Hall they have to traverse a clear mile without any connexion at all. Notwithstanding that, they find it answer their purpose to charge only 3s. 6d. and 4s. To the Duke, they supply the first 70,000 feet at 4s., and after that at 3s. 6d. per 1000. To other consumers at Trentham the price is 4s.

By the COMMITTEE: The company laid the mains all the way to Trentham at their own expense. The distance is a little over three miles from the works. The company are quite willing to go on at those prices. They pay 10 per cent., I believe.

Cross-examined by Mr. CRIPPS: The consumption at Trentham last year was 1,300,000 feet. The rents of the houses at Florence vary from 3s. 6d. a week to £50 a year. A considerable portion are of the former class. The houses are largely inhabited by working men, foremen and master potters. I think there are 360 houses in all supplied with gas.

Mr. CRIPPS: I find that is quite contrary to the evidence given upon the other side, because that was 213.

Witness: I can only say I have had the houses counted, and my assistants say 360.

Cross-examination resumed: I am not intending to establish a fresh company to supply Florence, unless driven to do it by the 7s. 6d. charge. I consider we are in a position to supply gas there for less than that price per 1000 without any loss at all. I think at the present time we could erect works at Florence and supply gas, taking it altogether, at 6s. per 1000.

Mr. CRIPPS: That is another thing. Do you know that the greater part of Florence is supplied at 3s. 6d.? You must take in that in order to make up enough to supply. At the 6s. price you must raise the 3s. 6d. people, and even then you would not be able to do it.

Witness : I really believe we could do it for less, but I put it at 6s.

Mr. CRIPPS : Do you really assume that Parliament would grant power for the erection of gas-works within the limits of another company with such a programme as you would have to lay before it?

Witness : If the other company were proposing to charge 7s. 6d., I think Parliament would listen to us.

Mr. CRIPPS : I suppose this is a new idea, because in 1875 you might have come forward with exactly the same view as now, might you not?

Witness : I might; but, as I have already said, I believed the Bill of 1875 related only to Blyth Bridge. So far I made a mistake, that is the only thing I can say about it.

Cross-examination concluded : Since 1875, about a fourth of the houses on the estate have been built. I think the price that would be charged for gas would be a prohibitory one, and check consumption. I find we have 200 houses outside the mile radius, and only 25 per cent. use gas. Whether the company have deliberately put on a prohibitory price or not, I take it to be the fact.

By the COMMITTEE : I think the price over the whole district should not be more than is charged within the borough. I do not see how it can be anything but profitable, the population being quite continuous from Longton.

Re-examined by Mr. STEPHENS : If there should be outside the boundary only eleven houses that are supplied with gas, it looks as if the price is more prohibitory still. As regards the comparative cost of laying works down, I should certainly look at it in the light the gas company did, and, with a view to the future, place an 8-inch main where a 5-inch one would do. I consider the 6s. price would have been the one to start with, and as the district grew there would be a reduction. I think foremen, working people, miners, and so on, are a class of people who would naturally take gas if they could get it on moderate terms. It would certainly be reasonable, if it could be done, to secure to a population of that class the comforts of a gas supply. Particularly would that be the case where a corporation, professing to be the public guardians, are taking the powers of supply into their own hands. The last contract with the gas company at Trentham was for seven years, and that expired more than twelve months ago. The same terms are now running without a contract, so I suppose the company found them satisfactory, or would not have continued them.

FRIDAY, MARCH 16.

Sir E. BECKETT having addressed the committee in support of the petition of the Duke of Sutherland,

The following evidence was called to support the petition of the inhabitants of Blurton and other places:—

Mr. John Aynsley, examined by Mr. YOUNG.

I carry on business at Longton, but have resided at Blyth Bridge for many years. The place has been going on increasing rapidly during the last few years, and, from my knowledge of the district, I am positive it will still go on increasing. At the time the Longton Gas Company obtained their Act in 1875, authorizing an extension to Blyth Bridge, they did so with the firm belief that the project would pay. I myself have no doubt whatever that it will pay at the 6s. rate, and feel confident that it would pay at a 4s. 6d. rate. My opinion in the matter is so strong that if the Town Council feel any apprehension, I should have no hesitation in paying them, should they purchase the company, the sum of £3234 5s. 10d. down in hard cash, give them 2 per cent. in addition, and accept a 5s. maximum for Blyth Bridge, or beyond the mile radius, for three years, and after that I would accept a maximum price of 4s. 6d. I am prepared to do that now, and have no objection to the town-clerk at this moment drawing up a document to that effect.

Mr. YOUNG : Do you think yourself that the interests of the people at Blyth Bridge, and the outlying districts, will be in as safe keeping in the hands of the corporation as in those of the board of directors of the company?

Witness : I should be rather sorry to trust them—they are birds of passage.

Mr. YOUNG : I presume the corporation have more interest in keeping down the rates in Longton itself than outside?

Witness : When a gentleman is appointed to the honourable position of mayor of a town, he is very anxious to distinguish himself, if even it is at the expense of the outlying districts. Positively I think the outsiders will be in a worse position than now if the corporation acquire the undertaking. The directors of the company have no object or interest—nothing to gain in serving one part of their consumers in preference to any of the others.

Cross-examined by Mr. MICHAEL : I am one of the directors of the company, and was so when the 1875 Act was passed. I am also a consumer of gas in the Blyth district. One of the reasons that influenced the directors to make the extension in that district was that my property should be supplied with gas.

Mr. MICHAEL : In the promotion of that Bill, did not you, as a director, arrive at the conclusion that, if a maximum less than 6s. 8d. was inserted, you would withdraw that portion of the Bill?

Witness : As a director personally concerned in the interests of the company, and anxious to do my duty as a director, I considered it was better to erect a 14-inch wall to protect the interests of the company, when it could be done at other people's expense, than put up a 9-inch wall.

Mr. MICHAEL : You were to be the main contributor to the expense incurred. You were to be the largest consumer of gas in the new district. Therefore, you erected a 14-inch wall against yourself?

Witness : Yes, but my interest as a shareholder in the company was paramount.

Re-examined by Mr. YOUNG : The prices of coal and iron at the time the Bill of 1875 was deposited were very different to what they are now. At the present time they are not quite so low as they existed before 1871, but very nearly. Supposing we were promoting the Bill now instead of in 1875, I should say unquestionably we could take gas to Blyth Bridge at a 4s. 6d. maximum.

The CHAIRMAN : Have you ever considered in your company the question of reducing the price at Blyth Bridge?

Witness : It was quite understood, as far as the directors were concerned, that the price was to be reduced, but as we do not profess to be an exception to human nature, we took positive steps to protect ourselves first. The inhabitants of Blyth Bridge were rather restless, so far as the price of gas was concerned. The greatest part of them happen to be manufacturers in the town of Longton, or had been residents in it, and having paid 3s. 6d. per 1000 for their gas, one can easily understand, looking at what human nature is, that it becomes very susceptible when it has to pay 6s. for a mere extension of something like two miles.

The CHAIRMAN : My question was, have the company ever thought of reducing the price at Blyth Bridge?

Witness : They have not. The Act has only been in operation a short time, so that this question has not been brought before them, but the circumstances are such that I feel satisfied the directors would be justified in making the reduction.

The CHAIRMAN : I suppose at the time the Act passed the inhabitants of Blyth Bridge in some way acquiesced in the arrangement made, which

was a maximum price of 7s. 6d., and an immediate rate of 6s. I want to understand from you, speaking in your character of an inhabitant of the place, whether the inhabitants generally had any prospect that the price would subsequently be reduced below 6s.?

Witness : They were anxious to have the gas, and it was suggested the people should get up a requisition to ask the directors to do these things. It is my impression that the town-clerk of Longton, who is solicitor for the gas company, drew up the requisition, and the people of Blyth Bridge signed it; because we, as directors, considered it would help us very materially in getting the Act passed. I know very well, and I appeal to my learned friend the town-clerk whether it was not so, that he considered he gained a very great victory, inasmuch as the council pooh-pooled the very idea of 7s. 6d.; but he said, "Let us try. We shall lose nothing, and we may gain."

The CHAIRMAN : Was there any prospect held out to the inhabitants of Blyth Bridge that at any future time the rate would be reduced below 6s.?

Witness : Positively so. They have been repeatedly told that the price was very high, but they should have a little patience, and no doubt it would soon be reduced.

Mr. John Doxy, examined by Mr. YOUNG.

I reside at Blyth Bridge, and have erected many houses there. I agree with Mr. Aynsley that there is every prospect of the place still increasing rapidly, as it is the only outlet there is for Longton and the Potteries that way. The rents of my houses have gone up from £20 to £30, and, in some cases, as high as £40. When the company were projecting their Bill in 1875, the directors, or several of them, were very favourable towards accommodating us; and from what I understood, in a conversation I had with them, the price was to be reduced according to the consumption—that as more gas was taken the less rate we should have to pay. Taking all my houses, those which I still have and those which I have sold, mine is the only one that uses gas, on account of the price being so high. My tenants will not take it unless the company lower the price, say, to 4s. I feel so certain that it would be a benefit to the company or the corporation, whichever may have the undertaking, to reduce the price of gas in and about Blyth Bridge, in order to obtain a more extended consumption, that I would be quite willing to join Mr. Aynsley in the purchase of our part, and pay down the money.

Mr. William Keary, examined by Mr. YOUNG.

I am the solicitor to the Stoke Gas Company, and am able to confirm what was stated yesterday, that gas is conveyed to Trentham, and supplied there somewhat extensively. The Stoke Gas-Works have been a profitable undertaking. The capital is £40,000, of which £30,000 is called up, and we have paid 10 per cent. on the whole of that from the passing of the Act in 1858. The distance from Stoke to Trentham is a little over three miles. The gas is supplied to the Duke of Sutherland and the other inhabitants of Trentham at 4s. per 1000 feet, unless a certain consumption is arrived at, when it is reduced to 3s. 6d. Throughout the rest of the district of Stoke it is 3s. 6d., which, no doubt, will very soon be reduced to 3s. 3d. The district of Stoke, except the Hall and the cottages belonging to it, is a much less thickly populated district than the Longton district; it would contain about the same population, but much more scattered.

Mr. YOUNG having addressed the committee in support of the petition, and Mr. MICHAEL having replied on the whole case,

The CHAIRMAN said the committee had decided to pass the preamble of the Bill, with the condition that the present limits of prices should continue till the end of 1879, and after that 4s. should be the maximum price outside the one-mile radius.

Mr. MICHAEL stated that he was authorized, on the part of the promoters, to accept the terms which the committee had imposed, and, in reply to Mr. Stephens, said he was willing to put in a clause expressly providing that the price to be charged within the mile radius should be uniform, though that was already provided by the existing Act.

The CHAIRMAN said the committee did not intend to interfere with the price to be charged inside the mile radius.

The clauses were then read and agreed to, and the chairman was directed to report the Bill to the House.

MONDAY, MARCH 19.

(Before Mr. ASSHETON, Chairman; Messrs. SMITH, BELL, and DUNDAS; Mr. BONHAM-CARTER, Referee.)

RAMSGATE LOCAL BOARD BILL.

(Continued from page 539.)

On the assembling of the committee this morning, some further correspondence between the local board and the companies was read, from which it appeared that the board had made a fresh offer for the purchase of the gas company for £110,000, and £57,750 for the water company, in place of their former offer of £117,000 and £62,750. The companies, however, declined to consent to negotiation upon those terms, and the case proceeded.

Mr. G. Hill, examined by Mr. O'HARA.

I am proprietor of the "Belle Vue" Hotel at Pegwell Bay, and am one of the overseers of St. Lawrence. I have about 40 lights in my house, and previous to 1875 there was very great difficulty in obtaining gas. I desired to have a stove for cooking purposes, but Mr. Phillips, a gas engineer, examined the gas, and told me it would be money thrown away to have such a stove. I may say that every one of the inhabitants in West Cliff Terrace has sent for me, as overseer, to complain of the gas. The price at present is supposed to be 4s.; but I find that my last quarter's bill averages the same as when it was 5s. 6d. The public lamps are better now; but the year before last they were continually going out. I have often sent my own men to relight the lamps in my neighbourhood. I have always been of opinion gas and water-works should belong to local boards or town councils. I consider the maximum charge for gas in the Bill of the company—5s. 6d.—is too high, having regard to the capital embarked, and to that proposed by the Bill. I also think it would be a great temptation to the company to keep the price as high as they can, it being their interest to obtain the best dividends. The supply of water has been much better this year than it was before.

Cross-examined by Mr. LEIGH : We have had no cause to complain of the gas for the last six or seven weeks; it has been as good as I could wish to have. The winter before last I was continually making complaints to the gas company. I may have consumed more gas since the price was reduced to 4s.; but we have no more burners than we had then.

Mr. N. B. Kennard, examined by Mr. O'HARA.

I am a tailor and outfitter in Hardres Street, Ramsgate. I have complained to the manager of the gas-works several times about the supply of gas, and a larger service-pipe from the main was laid down, which certainly made an improvement, although at times since then there has been a great deficiency. My workpeople have been very much troubled to get on with their work, more particularly on Saturday evenings. My water supply is very good; I cannot say a word of complaint against it.

Cross-examined by Mr. MICHAEL : I have had to complain of the gas since the new pipe was laid. We have complained very much of the want of heat in the summer time, when we have, of course, to start men to work, and when we require a greater amount of heat for carrying on the work. I have two meters, one is a 30-light meter, carrying 20 lights and a heating

apparatus, and the other is a 5-light meter, which supplies about 16 or 17 lights. I was told the latter meter was sufficient, and it was supplied by the gas company.

Mr. J. Clark, examined by Mr. O'HARA.

I am a gas-fitter, in business in High Street, Ramsgate. The supply of gas for cooking purposes is very inadequate. People have refused to purchase gas-stoves on that account. I have frequently had complaints from customers of the want of illuminating power in the gas. I consider the way in which the gas is supplied to be rather dangerous; the pressure is so small during the day, and the sudden turning on in the evening has in many cases thrown up the light to such a degree that I have seen it set things on fire. The pipes have frequently been very much corroded, and also the metal fittings.

Cross-examined by Mr. LEIGH: The last complaint was made not more than a week ago. I have not complained to the gas company lately, but I have advised the customers to do so. I should think I have had 20 complaints from customers during the last 12 months.

Mr. LEIGH: In the last 12 months how was it, if you had 20 complaints from your customers—you being in the position in which you are, as a gas-fitter—that you made no complaint to the company?

Witness: I told you before; I sent the customers to complain themselves. One customer who complained was Mr. Eve, and that complaint was made last Thursday, since the present inquiry began. I do not recollect exactly what I told him, but I said we had done all we could to give him a supply of gas. He has been pressing for 11 years to obtain a good supply; he has had new pipes put in, and now he does not get sufficient gas.

Mr. LEIGH: Will you mention another complaint during the last 12 months?

Witness: I have not been keeping cases all ready, and making notes of these things.

Mr. LEIGH: You tell the committee that there have been frequent complaints from your customers—will you name one?

Witness: Before that time I can name another—Mr. Rew; that was a year and a half ago.

Mr. LEIGH: Then you jump from last week to a year and a half ago. Is there any other you can name?

Witness: Mr. John Derby. That was not above a fortnight ago. I did not tell him to complain to the gas company, because he knew how to go about it better than I could tell him.

Mr. LEIGH: May I take it generally that you yourself have never—for some time past, at all events—made any complaint to the gas company?

Witness: No; I left off doing so, because I got no redress if I did.

Mr. LEIGH: You are making accusations against the gas company, so I must ask you when you did make a complaint?

Witness: The last time was a twelvemonth ago. It was not in writing. I complained to Mr. Valon, the manager, of there being a very slack pressure of gas, and he said they could not put more pressure on. He said there was always a good stock of gas, and so on, but still there was not the pressure that was required for boiling a kettle on a gas-stove. He also told me he should not put any more pressure on because of the leakage in their mains, and I thought if that was the case there was no use in going to them any more.

Mr. LEIGH: You have given in three or four cases in which you say there have been complaints made to you; do you remember any others? Let us have them all, if you please, that we may meet them.

Witness: I have not had time to make a memorandum of this sort of thing.

Cross-examined by Mr. BROWNE: The complaints made were not about my fitting. I do not know why the people complained to me about the gas.

Re-examined by Mr. O'HARA: When I complained to the manager he said the extra pressure required would cost them more in waste of gas, through the leakage of the mains, than the customers would be worth.

By the COMMITTEE: A 5-light meter would not supply 17 Argand burners; but for bat's-wing or fishtail burners I should say 15 is about the general run for a 5-light meter.

Mr. A. Bonner, examined by Mr. O'HARA.

I am a baker and pastrycook, living in Queen Street, Ramsgate. We begin to use gas at four o'clock in the morning, but have found all day great difficulty in obtaining a supply. I have been obliged to substitute fuel for gas.

Cross-examined by Mr. LEIGH: I get a good supply of gas when it is turned on in the evening. I have not made any personal complaint to the company, because I thought it would be useless.

Mr. T. Clarke, examined by O'HARA.

I am a grocer, carrying on business in Harbour Street, Ramsgate. I have complained to the company, and they suggested I should have a larger service, which I had to put down at my own expense. It cost me 18s., and I thought it was unfair I should have to do it. The complaint against the gas company is very general.

Cross-examined by Mr. LEIGH: I should like to see the supply of gas transferred to the local board, of which I am a member.

Mr. J. W. Barry, examined by Mr. O'HARA.

I have been the Medical Officer of Health for Ramsgate for four years, and have made extensive observations during that time with regard to the supply of water. I found that the officers of the company exercised no supervision whatever over the cisterns and fittings of the consumers. The quantity supplied is totally inadequate to the resident population, and as regards the visitors the supply is much more inadequate. In 1874 I had to go to a house on account of there being a case of scarlet fever there, and after having made general inquiries about the case, I went to look at the sanitary condition of the house, and when I went to the water-closet I found the supply was from a pipe coming directly from the main, and the people of the house told me that during the whole time the water was on—which would be about an hour and a half—the water rushed in and went down the drain, and that that condition of things had continued for the whole time they had been tenants of the house. The danger attending that state of things would be very great, because, in the case of an intermittent service, when the water is turned off, a vacuum is caused in the pipes, and that being the case, if any foul gases or matter should be in the pan, they would be sucked into the mains at the moment of intermission. I have found great inconvenience in my own house, and complained to the water company, and they told me the pipe was too small, but that can hardly be the case, because in winter, when the demand is less, I find the tanks are tolerably well filled. I think the town of Ramsgate has suffered most materially as a health resort on account of the insufficiency of the water supply for many years past; there should certainly not be less than 20 gallons per head per day, exclusive of water required for other purposes, such as sewers, fires, &c. Until three years ago there was no supply from about two or three on Saturday afternoon until seven on the following Monday morning, which was a cause of grave nuisance, because the water-closets were left for 36 hours without a drop of water to flush them. The main sewer was blocked up about twelve months ago, and in my opinion that was due to insufficient flushing. In 1875 I made a written report to the local board, calling attention to the danger the town was exposed to from the insufficiency of the water, and

urging them to obtain a constant supply, but they have not succeeded in doing so, because the application has been ignored entirely. With regard to the gas, I have found the illuminating power to be of the lowest possible order. I should almost prefer a good rushlight, if it were well snuffed.

Cross-examined by Mr. MICHAEL: The quality of the gas was so bad that I could not read by it, and therefore I had to use a lamp as well. The mortality in Ramsgate last year was about 21 per 1000, and the year before about 14, I think. The excess of mortality was chiefly during the summer months, but it occurred at all periods of the year, and was very much higher than it should have been. I attribute the mortality to the spread of scarlatina, and that I attribute to the bad condition of the poorer cottages, and that again I attribute to the insufficient supply of water. We have enforced a supply to all the cottages as far as we could, but it is an old saying, that you cannot get blood out of a stone, and so far as my experience goes, you cannot get water out of the water company.

Mr. MICHAEL: I suppose you have inspectors of nuisances, who report to you from time to time the condition of those houses in which epidemic diseases appear, or are likely to appear. Is it not a part of your duty, as Medical Officer of Health, to visit the premises where epidemic diseases occur?

Witness: It is part of my duty, and I do it in every instance which comes to my knowledge.

Mr. MICHAEL: Your inspectors have access to all these properties, and to all places in the condition you have described?

Witness: They have, if they can get in, but at times they are refused admission. I know that is against the law, but it is not always easy to carry out the law.

Mr. MICHAEL: Are you not aware that at this very time the water company are seeking exactly the powers which you say are necessary—to give a constant supply of water, and to have the power of inspecting the fittings, and seeing they are properly kept?

Witness: I have not an intimate acquaintance with the Bill of the water company, but, as far as my knowledge goes, when they obtained their Act many years ago they promised to give the town a constant supply, but that they certainly have not done.

Mr. MICHAEL: Putting out of view these water-closets, which you say you cannot control, will you say how the absence of water tends to produce scarlatina?

Witness: It is most important, in the case of scarlatina, that the children, or any one who is suffering, or who has suffered from the disease, should be well bathed—that they should have a bath every day; and if the people cannot get sufficient water for their closets, they certainly cannot get sufficient water for baths, and, consequently, the spread of the disease would, by that means alone, be most materially increased.

Mr. MICHAEL: The present water supply being so insufficient, what provision is there in the Bill of the local board to give a better supply? How will it be made better by spreading it over 24 hours instead of over two?

Witness: They will have to go to other places, I suppose. I do not think it is at all impossible that the Isle of Thanet or the neighbourhood of Ramsgate could yield a further supply if proper adits were driven.

Cross-examined by Mr. BROWNE: I believe it is the case in some parts of London that the supply is only turned on for an hour a day; but it is no reason why, because they do wrong in London, we should do wrong in Ramsgate.

Re-examined by Mr. VENABLES: I believe it is the intention of the local board to go to Minster if they cannot get water enough from Whitehall. I am aware that the company had the power of cutting off the supply of water from any house when the fittings were not of a character to satisfy them, and, consequently, they had the most efficient of all modes of securing proper fittings, if they had chosen to exercise it. I do not know what their legal powers are, but I know it is stated in one of their notices that if there is a waste of water the consumer will be fined so much. If the company had obtained their Bill last year they would have been under compulsion to give a constant supply.

By the COMMITTEE: When deaths occur, before calculating the death-rate I always ascertain whether the person who is dead is a resident or non-resident; if the latter, I eliminate the death, because if I were to include it, it would make my returns absolutely worthless. With a population which during four months of the year is doubled, one must take some datum to go upon, and the only reliable one is to take the standing population, and to eliminate the deaths of visitors.

Mr. J. B. Thompson, examined by Mr. VENABLES.

I am a surgeon, residing at St. Lawrence, and am medical officer to the coastguard. In my opinion the water is very good, but deficient in quantity. I have no personal interest in the matter, but I think the local board should have both the supply of water and gas—the former especially, as a necessary of life.

Mr. A. J. Jarman, examined by Mr. VENABLES.

I am a photographer, but was formerly engine-driver at the Ramsgate Gas-Works. About 1869 or 1870 a well was sunk at the gas-works with the intention of obtaining water for their own supply at the works; but after sinking to a depth, I think, of 80 feet in the chalk, the water was found to be completely contaminated with ammoniacal liquor and also with tar, so that we could not use it in the steam-boilers. Mr. Curling, who was then chairman of the gas company, asked me to pump some up, and he saw the condition of it, and it was generally admitted to be unfit for use. That state of things went on for some time; but it was three months before the water became clear, although it was never to my knowledge suitable for drinking purposes. When I was at the gas-works, complaints were often made respecting the state of the gas, and after those complaints were made an order was received in the retort-house to use some cannel for a few days, to improve the quality. At the present time the gas is satisfactory, but a short time since it was very bad. Some time last November I tested the gas for my own amusement, and found a very appreciable quantity of sulphuretted hydrogen. The test I applied was a solution of nitrate of silver, and also acetate of lead, turning on the gas and holding a paper over it while wet, when the paper became brown.

Cross-examined by Mr. MICHAEL: There is always more or less salt contained in our water, but I have noticed it more particularly about August, when there is the greatest draught upon the water. I use a precipitate of silver from my waste bath solution, the water containing sufficient chloride to precipitate it. In winter I have to add salt for my own especial purpose.

Mr. G. W. Stevenson, examined by Mr. VENABLES.

I am engineer and adviser to many gas and water companies, and local authorities who have the control of the gas. Before I was consulted by the promoters of the present Bill, I was spoken to by persons at Margate about a proposal for a competing company. That was about two years ago, and the then Mayor of Margate took an active part in the matter, but he died before the Bill went before the committee, and it was withdrawn. That Bill included a power for the company to sell to the corporation. For some time past there has been considerable dissatisfaction amongst the consumers of gas in Ramsgate and Margate and the consumers of water in Ramsgate. The two companies are very closely connected, having the

same chairman and the same solicitors, and their policy seems to have been very much the same.

Examination continued by Mr. BIDDER (Mr. Venables having to retire from the room): I am aware that both companies are applying for parliamentary powers, and have seen the Bills, but I think it is not in the interest of the ratepayers—nor even of the consumers of gas and water—that those powers should be granted. I am aware that the capital actually called up was only £16,000, while the nominal capital was £24,000. Since 1862 the company have paid 10 per cent. dividend upon the £24,000, which is 15 per cent. upon the subscribed capital of £16,000. I am also aware that the company allege that large sums, amounting to something like £48,000 in addition, have been spent upon capital account.

Mr. BIDDER: Is that method of dealing with their revenue and of extending their works consistent with the provisions of the Gas-Works Clauses Act, and the policy which Parliament has adopted in such cases?

Witness: Certainly not. They have never put themselves under the provisions of the Gas-Works Clauses Act, and it is not even consistent with the Act under which they are working, because they were authorized to raise £24,000 of share capital, but they only raised £16,000, so that they have not exhausted the powers which were conferred upon them in 1834.

Mr. BIDDER: Then I understand your view to be, that it was inconsistent with their parliamentary obligations to be taking money out of surplus revenue for capital purposes, when they had not exhausted their capital powers?

Witness: Certainly; I consider that a breach of their obligations to Parliament.

The CHAIRMAN: You must remember that the Bill immediately before us now is the Bill of the local board.

Mr. BIDDER contended that all the Bills were in competition, and must be taken together.

Mr. MICHAEL dissented from that view, because the committee might feel it their duty, in the public interest, to pass all three Bills.

After some conversation on the point,

The CHAIRMAN said the feeling of the committee was in favour of taking them as competing Bills.

Mr. BIDDER (to witness): Probably, you have observed a statement in the preamble of the gas company's Bill to the effect that, provided the capital be declared and readjusted as hereinafter mentioned, it is desirable that the company should be subject to the powers, regulations, and restrictions of the Public Act.

Witness: I see that is part of their preamble, and I judge from that, if the capital be not declared and readjusted as mentioned, the companies will hold themselves at liberty to withdraw their Bills, as they did last year.

Mr. MICHAEL said he did not see what Mr. Stevenson—who was a most eminent engineer—had to do with the construction of a section of the preamble.

Mr. BIDDER: As regards the first proposition in their Bill—that they should have 10 per cent. upon the whole £24,000, including £8000 taken out of accumulated profits—is that, in your judgment, fair to the ratepayers?

Witness: No; and it is not consistent with recent legislation.

Mr. MICHAEL: What is not?

Witness: That they should be permitted to capitalize their profits, or any portion of them, at 10 per cent.

Examination resumed: Even supposing those profits had been properly and legally applied, the maximum dividend they would be entitled to, in accordance with past and present legislation, would be 5 per cent. As to the £48,000 upon which they ask 6 per cent., they will have to prove that they have spent that amount upon the works, and then they will be allowed 5 per cent.

Mr. BIDDER: I do not know whether you consider it to be an element in the consideration of what they would be entitled to in respect of capital out of accumulated profits, whether during the time that they were taking that money out of revenue they were dividing a full dividend of 10 per cent., or whether they were pinching their dividend for the purpose of saving money?

Witness: It would be an element, no doubt, in the consideration of how far they should be permitted to capitalize their profits.

Mr. BIDDER: An ordinary gas company, under the Gas-Works Clauses Act, when they have divided up to 10 per cent., and made up their reserve-fund, must reduce the price, and give the consumers the benefit of it; therefore, in taking money out of revenue, and profit over and above 10 per cent., and applying it to capital purposes, they are taking money which, if they had been a company under parliamentary restrictions, would have been necessarily returned to the consumers?

Witness: Yes. With regard to the maximum price of 5s. 6d. in the Bill of the company, I say it is too much. The gas now costs them 2s. 6d. per 1000 feet, and it would require 11d. per 1000 feet to pay 10 per cent. upon £16,000, and 5 per cent. upon £56,000, and then there ought to be added a margin for contingencies. The price, therefore, ought to be from 4s. 6d. to 5s. Of course, it does not follow that because 5s. 6d. is inserted in the Bill they are to charge that amount.

Mr. BIDDER: Let me draw your attention to a statement which Mr. Bramwell gave in evidence last year, that the consumers of gas were £19,000 better off than if the company had applied to Parliament, 15 years ago, for a Bill authorizing an increase of capital at 10 per cent. dividend.

Witness: It is not the practice of Parliament to give companies additional capital at 10 per cent.; but, supposing it was so, Mr. Bramwell is incorrect in his calculation to the extent of £11,220. [Witness handed in a number of statements showing the points of difference between himself and Mr. Bramwell.]

In reply to the COMMITTEE, witness said the figures were all supposititious, and the calculations were simply made for the purpose of refuting the statements made by Mr. Bramwell last year.

Examination resumed: I cannot tell exactly how the company expended their capitalized profits—whether in an equal sum year by year, or in a large sum one year, and a small sum the next year—but I have taken an equal sum year by year as being fair. The total amount which could have been paid, £184,540, and the total amount actually paid, £115,320, leave £19,220, which Mr. Bramwell says, by using capitalized profits, the consumers are better off than if the company had gone to Parliament and raised their capital in the ordinary way. I say, however, that in this mode of calculation Mr. Bramwell has overlooked the fact that, in addition to the sum of £48,000 which was taken out of the profits, there were two other sums of £4000 each, also taken out of profits and capitalized, and the calculation should have been as follows:—Total dividend paid, £67,320; add £4000 taken out of profits in 1847, and again another £4000 taken out of profits in 1862, and the £48,000 which they admit to have taken out of profits since 1862, making a total of £56,000, or £120,320 taken out of the consumer's profit. Then deduct that from the £184,540, which they could have taken out of their profits if they had applied to Parliament to obtain 10 per cent. on the whole of their capital, and it leaves only £11,220, instead of £19,220. There is a great deal to be said on the other side, but I have put it in the most favourable way I could for the company. I have given them 10 per cent. on the whole of their £24,000 of authorized capital, £8000 of which

was simply written up, and 7½ on all the new capital they require; that comes out at £62,405. That would represent the total amount they could have divided amongst themselves if they had applied to Parliament and obtained 10 per cent. upon the £24,000, and 7½ per cent. upon the £48,000. Then I have taken the last 15 years, because Mr. Bramwell did the same; the total amount which would have been paid during that period is £62,405, but the total amount actually paid to the shareholders was £35,400. The amount taken out of profits, and capitalized in 1862, was £4000, and since then £48,000, making together £52,000, which, added to the £35,400, makes £87,400, showing practically that £25,000 has been taken out of the pockets of the consumers during the last 15 years more than should have been taken out, and more than would have been taken out if they had been under parliamentary control.

Mr. BIDDER: It occurs to me (to put it shortly) that in most cases the undertakers find the capital and the consumers find the dividends; but here the consumers find both the capital and the dividends, except the original £16,000.

Witness: That has been so; the property has been created, with the exception of £16,000, out of the consumers.

Mr. BIDDER: I think in their Bill they treat the matter as if £72,000 in all had been expended upon the undertaking—that is to say, £24,000 and £48,000; and in 1876, I believe, it appeared that it did not constitute the whole of what they had expended out of the profits of the undertaking.

Witness: No; Mr. Curling proved, in 1876, that £79,972 had been expended on the works, and as only £16,000 had been subscribed, it is obvious that the difference had been contributed by the consumers. I have never had experience of a company so outraging their parliamentary obligations as this company have done; and seeing that it is a monopoly, and was intended to be a regulated monopoly, if the company have so evaded their obligations, I think it is quite the turn of the consumers now, and that the company ought to be made to hand over their concern to these consumers. I find the water company have been pursuing, to a considerable extent, the same policy; but they have only written up £1000 of capital, instead of one-third. They now represent themselves as having expended £19,000 out of profits, upon the extension of their works. In my judgment, these works are not adequate to the requirements of the town. The reservoir is much too small; it should contain two days supply, which would not be less than 2 million gallons, while it will only hold 600,000 gallons, or less than one-third. Mr. Bramwell said, last year, that the consumers of water were £10,500 better off than they would have been had the company obtained an Act of Parliament 15 years ago to authorize the increase of capital; but there was the same rather wild hypothesis on that gentleman's part, that Parliament would have let them have additional capital at 10 per cent. [Witness handed in another set of calculations, based on the same principles as those with reference to the gas company.] In the sum of £10,500 mentioned by Mr. Bateman, he has omitted to note that £1000 of the £15,000 has been written up, and I correct his statement of £10,500 by the sum of £1000; so that, upon his own showing, it is only £9500, instead of £10,500, even supposing the company could have got 10 per cent. on the invested capital from the day they began business until now. I also show that if the company had 10 per cent. on the original subscribed capital of £9000, 5 per cent. on the capitalized profits of £1000, 10 per cent. on the further additional capital of £4950, and 7½ per cent. on the remaining capital, they would have received £33,775, whereas the amount actually paid the shareholders during the last 15 years, and the profits capitalized during those years, amount to £38,733; in other words, that they have taken £5000 out of the pockets of the consumers during the period, instead of the consumers being £10,500 better off than if the company had applied to Parliament. I made another calculation on the assumption that they had 10 per cent. on all their subscribed capital, and 5 per cent. on their capitalized profits; and, according to that statement, the consumers are £9000 worse off than they would have been if the company had applied to Parliament, and had their capital authorized in the proper way.

Mr. BIDDER: Suppose both the gas and water undertakings were transferred to the local board, at what rate would any future capital be raised which was required for extensions?

Witness: Including sinking-fund and one thing and another, I dare say it would amount to 5 per cent.; that would be the gradual redemption of the property.

Mr. MICHAEL: Over what period, should you say?

Witness: Eighty years.

Examination resumed: I think for the sanitary interests of the district it is essential the water-works should be under the control of the Sanitary Authority. The local board are the custodians of the public health, and water is a sanitary agent; therefore I think the local authority ought to have the control of the water supply. Then, again, I think it is very desirable that everything which interferes with the streets or roadways ought to be under the control of the local authority—such as gas, water, and sewers. I have frequently known streets newly paved to be literally destroyed by a gas or water company immediately coming and ripping them up from end to end; but such a thing never happens when these public works are in the hands of a local authority, because these matters are arranged by the chairmen of the various committees. What is called a 5-light meter, with an inch pressure on the main in the streets, is amply large enough to supply 17 or 20 lights.

Cross-examined by Mr. MICHAEL: I do not know a single instance in which more than 5 per cent. has been allowed on capitalized profits.

Mr. MICHAEL: What do you say to the Devonport Water Act of last session?

Witness: I do not know of anything more than 5 per cent. with regard to water, but I have not taken out all the precedents of last session. I have the cases of Harrogate, Skipton, Eastbourne, and Padham, in none of which was more than 5 per cent. allowed. The case of Devonport must be purely exceptional. I can cite a number of cases in which Parliament has refused to allow any capitalization of profits. The Gaslight and Coke Company, only a few years ago, wanted to capitalize £360,000 of profits, and Parliament refused it *in toto*.

Mr. MICHAEL: But is it not the fact that in that case Parliament allowed them 10 per cent. on £1,000,000?

Witness: Yes, of new capital; but that is a point upon which I have not been examined. The legislation in a metropolitan case cannot, however, be applied to provincial companies, or *vice versa*. One of the advantages to be derived by the inhabitants of Ramsgate taking the control of the gas into their own hands is, that while directors of companies such as these are very inaccessible and very difficult to bring pressure to bear upon, the local authority are directly responsible to the ratepayers, who are the consumers; and if they do not act as the consumers wish, they can be removed at the elections. There would be very great difficulty in a stranger setting up to provide Ramsgate and Margate with gas, because they would not be allowed to break open the streets.

Mr. MICHAEL: Are you aware that it has been held by the Court of Queen's Bench that it is not necessarily a nuisance to open the streets?

Witness: I am not aware of that, and should like to know what case it is. Then there is the law of trespass which comes in; you must lay your

pipes in some one's soil, and the common law vests the soil in the adjacent owners on each side of the road. That is a point upon which I happen to have some special knowledge, because I was concerned in a case at Broadstairs where a person, laying his pipes in the soil, was compelled to remove them.

Mr. MICHAEL: Do you contemplate that any profit would be derivable by the local board; and, if so, are those profits to be divided among the persons who are consumers and the non-consumers of gas?

Witness: Yes; half the profits are to be allocated under the Bill to the consumers of gas, and half to the ratepayers; but I do not assume that the same amount of profit would be earned by the local board as would be earned by a gas company, in order to pay a 7 per cent. maximum dividend.

Mr. MICHAEL: You would not advocate that a gas company should be compelled to part with their undertaking to a local authority without being paid an adequate amount?

Witness: No; and I think a well-conducted company ought not to be called upon to part with their concern upon any terms whatever—that is to say, a company that really fulfilled their obligations to Parliament and the public.

Mr. MICHAEL: Supposing Mr. Bramwell's figures to be correct, and that in reality no pecuniary loss has been entailed upon the consumers up to this time, and that now the company are placed under parliamentary restrictions, what is the advantage then which is to accrue to the consumers from the transfer of the undertaking to the local board?

Witness: None at all, supposing your statement to be correct; but you are putting a mere supposititious case. Mr. Bramwell assumes that they paid 10 per cent. on their expended capital every year since they began business, up to the end of last year.

Mr. MICHAEL: Supposing the Gas-Works Clauses Act of 1847 had been in operation in 1824, surely Mr. Bramwell would have been right in calculating 10 per cent. upon the additional capital?

Witness: Yes; because the Gas-Works Clauses Act gave, and does give, companies power to pay dividends until they reach 10 per cent.

Mr. MICHAEL: Supposing they had earned less than 10 per cent. during the first ten years, and subsequently had earned additional profits, they would have been able to recoup themselves the amount of their loss from year to year until they came to the first year; and, therefore, if they had surplus profits, Mr. Bramwell would be right in taking 10 per cent., supposing the operation of the Gas-Works Clauses Act to have gone back to 1824?

Witness: He is quite right in taking 10 per cent. upon the subscribed capital from the beginning of the company till now, but not in taking 10 per cent. upon the capitalized profits.

Mr. MICHAEL: Supposing there had been a power to raise £150,000 in the Act of 1824, and the company were subject to the Gas-Works Clauses Act, would they not have saved the £19,000 which Mr. Bramwell mentions?

Witness: That is a state of things which could not by any possibility have obtained. Parliament would not have given them £150,000 for the supply of the Isle of Thanet with gas in 1824. I should think from £600 to £700 of capital per million feet would be required at Ramsgate, but there are many companies which work with much less than that. I know many companies that are working with less than £400, and others where it is over £1000. With regard to water, the requirement of a district is the maximum daily requirement of the maximum population; in regard to gas, it is the maximum nightly requirements of the consumers. I have told the local board that if they acquire these undertakings they will have to incur a very considerable expenditure with regard to water.

Cross-examined by Mr. BROWNE: It is quite true that the ratepayers in St. Lawrence would not influence the election of the Ramsgate Local Board, but the consumers in St. Lawrence would get the benefit of the influence which the Ramsgate ratepayers would exercise upon the Ramsgate Local Board.

Re-examined by Sir E. BECKETT: I do not think it unfair to charge those at a distance from the source of supply something more than those who are near, because the cost of distribution, collection, and supervision is greater. In the case of Lincoln, the company were allowed to capitalize profits amounting to £86,500, at 5 per cent.

Mr. A. Penny, examined by Sir E. BECKETT.

I have had 30 years experience in connexion with gas-works, and know Ramsgate and the neighbourhood very well. I never heard a case entirely on all fours with the present, although there are one or two cases very like it—viz., Rochester and Bradford. Those cases were parallel to this extent, that, instead of going to Parliament to ask for more capital when they required it to extend their works, they chose to pay for them out of profits. The Rochester Company obtained permission from Parliament to capitalize only a portion of their profits, but the Bradford case was settled by agreement, although upon very different terms to anything we are talking about here.

Sir E. BECKETT: About the financial position of the company—the undivided profits, according to their statement, amount to £48,000, and you say that, in one case at least, a portion of the profits have been recognized by Parliament. How much do you think there is any reasonable case for recognizing here?

Witness: The sum I have arrived at is £27,000, ascertained as follows:—I have divided the period of their existence into two. I find that they raised first £16,000, and they made profits in excess of what they gave to their shareholders up to 1862, equal to £8000. In 1862 they had no doubt exhausted their parliamentary powers of raising capital, inasmuch as they had spent both the £16,000 that they had contributed by shares, and also the £8000 which they had accumulated as profits; therefore, at that period, there is no doubt that they were in a position of absolute destitution as regards the power of raising capital. Then, assuming that they had carried out their parliamentary obligations, they would have found it necessary to apply to Parliament for more capital. If they had obtained power to raise at that time the sum they spent—say, £48,000, and we had in Mr. Curling's evidence that they spent it at certain periods, so that by 1876 they had spent £48,000—they would have been entitled, if they had obtained parliamentary sanction in 1862, to pay a dividend of 7½ per cent. upon that. I say that these sums put together would have been such a sum as would, if that calculation had been made, have given them just the sum of £48,000 less £21,000—that is to say, their profits, giving the shareholders 7½ per cent. for the £48,000, would have left a sum of £27,000 only, as a sum which they might fairly ask to capitalize, because they would have had during the whole period up to 1862 a fair sum for dividends, and 7½ per cent. upon the capital they would have raised—that is, £48,000. Therefore, I say there is £21,000 in excess of what they could have given to their shareholders if they had come to Parliament in 1862.

Sir E. BECKETT: In that calculation you are giving them the benefit of the two sums of £4000, which they took out of the profits to make up their original £24,000?

Witness: Yes; as they had the parliamentary right of raising £24,000, although they only raised £16,000, and they had made profits to the extent of £8000 in excess, I thought it fair to give them the benefit of that, because they might have put it into their pockets and then called it up

again; therefore, I have given them the benefit of the whole £8000, as something which should be considered as their capital. I find that, taking the dividend which they would be entitled to, on the assumption I have made, they would be entitled to £3750 profit, which, at 25 years purchase, would give £93,750, and taking it at one year less it would be £90,000.

Sir E. BECKETT: But you are giving them the benefit of more than 25 years purchase on their present profits, are you not?

Witness: No. I find from the way my calculations are made that they would be entitled now to 10 per cent. on £24,000, which we may call £2400 per year, and 5 per cent. on £27,000 which I say, having regard to the calculation I have made, they would be entitled to; those make together £3750.

Sir E. BECKETT: Now what do you say about their charges for laying on the gas-service pipes, meters, and so on?

Witness: From what I can gather, that is a charge which is entirely different from anything I ever knew, and it is more than any other company charge. It is well known that, under the Act of 1871, any company are compelled to put in a service-pipe free of charge; but, practically, that system obtained long before 1871, because in very many Acts there was generally a clause put in, that companies should furnish service-pipes free of charge, but in this case they have always charged for service-pipes at a very high rate. I have seen a charge which they made for service-pipes; it was at the rate of 6d. per foot, and they charge, in addition to that, the labour for the men who put it in. I have a bill here, from which I find that a 3-light meter is charged at the rate of 6s. per year, and I say, distinctly that is about double the rate charged by most other companies. The price of a 3-light meter is 27s., and as they ask the consumer to pay 6s. per year for it, and to pay in advance directly the meter is put in, in four years it will be paid for absolutely and something left. A meter will last for 10, 12, or 14 years. It will generally last five years without any repair at all. I know of no case in which companies charge their consumers for laying pipes; they simply lay the service-pipe up to the meter, supposing it does not exceed 30 or 40 feet. Taking all these charges together, it amounts in the whole to a very large sum, which makes an addition to their profits. I cannot say exactly what sum it would make, because it depends on the length of the service-pipes, but the effect of it is to prevent consumption of gas, especially in the case of comparatively poor people.

Cross-examined by Mr. MICHAEL: I generally find that there is some sort of complaint or other made about gas companies. The Rotherham gas case was on all fours with the present, to the extent that the local authority were desirous of acquiring the gas-works; there was a great fight, and the company eventually agreed to sell their works when they saw there was a probability of their being taken from them.

Mr. MICHAEL: But with respect to the 25 years purchase of the revenue derivable from the company you speak of, that was a company limited with an absolute dividend, and, therefore, differing from the one we are now considering. What is the amount of profit which the Ramsgate Company are likely to earn?

Witness: That is a question which will never be known until we come out of this committee-room. At present they are only entitled to pay a dividend upon £24,000.

Mr. MICHAEL: But if they like they might divide £8000.

Witness: I know they might, but they would have to do it in the teeth of public remonstrance.

Mr. MICHAEL: As far as law is concerned, there is nothing to prevent them dividing the £8000 if they could earn it?

Witness: They could; but there are some things stronger than law.

Mr. MICHAEL: I am glad to hear you say so, but we are not here to consider the moral aspects of the case. You are now taking 25 years purchase to be multiplied into a supposititious sum?

Witness: I have given my reasons for so doing, and I will assume that this company have got some legal obligations, one of which is to come to Parliament for powers to raise fresh capital when they have exhausted the powers they have already received from Parliament.

Mr. MICHAEL: In the future, supposing the company had obtained an Act of Parliament, that will all depend upon the amount which they are to have upon their capitalized profits, and also upon the amount of the profits which are to be capitalized in future?

Witness: Yes, and I have ventured to put before the committee an estimate of what I think they could get if they consistently adhered to their parliamentary authority. They could only get a sum equal to £27,000 of the money which they saved; that is all they fairly could have asked to be capitalized.

Mr. MICHAEL: Have you any doubt that that amount of money which is here called capitalized profits has been expended upon the works?

Witness: No, I have not assumed any doubt at all. I took what they asked for—£48,000 only—I dealt with it in a certain way, and I say that, having regard to what they should have done, they could not have made that £48,000 in the time, giving them also the opportunity of paying to their shareholders the full dividends which Parliament would have granted them.

Mr. MICHAEL: If they had come to Parliament it would have been necessary to raise the amount of capital at either 10, 7½, or whatever per centage Parliament might have given them; and, whatever they would have earned under those circumstances would in your opinion be worth 25 years purchase?

Witness: Yes, that is exactly my calculation of what they would have earned under parliamentary powers. If they had raised a capital under parliamentary powers, they would have made a profit less by £21,000 than they have done by the rate they have charged for gas, and by these little excesses which they have made—such as the charges for meters, service-pipes, and so on.

Mr. MICHAEL: What are the advantages which you believe will accrue to the consumers of gas in Ramsgate from a transfer of the works from the company to the local board?

Witness: Supposing the company employ a proper manager, and conduct their affairs in a proper way, I cannot see that there are any advantages except a money advantage, which will be simply that, for any future capital, the local board or the authority will be able to raise the money at a less rate than the gas company would. I am not here for a moment to say that the local board ought to acquire this undertaking except at a fair price.

Mr. MICHAEL: Is there any other advantage except the possibility of their borrowing money at a less rate?

Witness: I think not, supposing the conditions are carried out which I have just stated—that is, that the concern is carried on in a proper manner, and to the best advantage. It has not been up to this time, and that is the reason we are here.

Mr. MICHAEL: That is a matter for the committee to decide. Do you consider, in an undertaking of this kind, there is any element of prospective value?

Witness: I dare say there is, but I do not think it has been taken into consideration in dealing with these matters by arbitration.

Mr. MICHAEL: Is the 25 years purchase to include, in your opinion, any prospective advantage which the company might derive from the future conduct of the undertaking?

Witness: As far as my experience goes, and it is not small in dealing with these matters, in transfers of undertakings like these from one body to the other, it has always been distinctly assumed that the future is for the purchaser, and I think I may say at once I hold that view too.

Re-examined by Sir E. BECKETT: I know that the local authorities of the small town of Horncastle were able to borrow money to pay for the purchase of the gas-works at 4 per cent., and, therefore, in Ramsgate the town will get the benefit of the difference between 4 and 7 per cent., which the company propose to take on their new capital. In what I have stated, I have endeavoured to deal fairly with the company, so that they could not complain and say I have done something I ought not. I do not think they have any right to take credit for what would have been their condition in Parliament when they have chosen to stay away from Parliament.

TUESDAY, MARCH 20.

Mr. Penny recalled, and further examined by Mr. BIDDER.

Under the provisions of the Bradford Corporation Gas Act, 1871, the corporation acquired the undertaking of the Bradford Gas Company for the sum of £210,000, the company having asked for the same £325,000. The amount of capital actually paid up was £55,000, and a further sum of £8707 had been received as premiums on shares sold by auction. The company had expended on their undertaking, in addition to these sums, £162,856 out of profits, making in all an actual expenditure of £226,562; so that the amount paid by the corporation was £16,563 less than the company had expended. The Rochester Gas Company applied to Parliament in 1867 for further powers to raise capital, and for liberty to capitalize undivided profits, expended on their undertaking, amounting to £84,000; but Parliament only allowed them to capitalize £28,000, on which they gave them 10 per cent., and 10 per cent. upon their original capital of £14,000. The rate allowed for new capital was 7 per cent. Their original Act was passed in 1825; and their next application was in 1867, when they were threatened with a rival company.

Mr. B. Latham, examined by Mr. BIDDER.

I am a member of the Institution of Civil Engineers, and have given a great deal of attention to the subjects of water supply and sanitary engineering. I have been to Ramsgate in connexion with the subject of the water supply. It is hardly necessary to form an opinion about Southwood as a place from which to draw water, seeing that the company virtually abandoned those works by the substitution of the Whitehall works many years ago, when they found that, with the exhaustive pumping, they began to pump sea water. I understand that water is drawn from Southwood from time to time for the supply of the houses in the town. I do not know it of my own knowledge; but I cannot understand why machinery should be kept there, if it is not intended to be used. There is no doubt that, with regard to Whitehall, the works are much better situated; but even there, the valley beyond is getting to be densely populated, and sooner or later there will be great liability of pollution, even at that site. The Whitehall works will never supply the quantity of water absolutely necessary for a town like Ramsgate, because the total drainage area at the Whitehall works, at the present time, does not exceed 2½ square miles, and, since the formation of these works, others have been established, in the same area, at Broadstairs.

Mr. BIDDER: In your judgment, for the requirements of the town to be properly met, ought an entirely distinct and independent site to be sought elsewhere, in addition to the Whitehall site?

Witness: From my experience, and judging of the quantity of water flowing off the chalk area, we have to deal with the minimum quantity—that is to say, the quantity varies very much. As a rule, it is largest in the early summer, and least in the autumn and winter months. I have never been able to find that more than 300,000 gallons of water have ever flowed off a square mile of chalk, at the minimum period, in 24 hours, and that is taking a year of more than average rainfall. A certain amount of water is absolutely necessary for the fixed population, which, with a constant supply, may be put down at 25 gallons a head, and if the fixed population in Ramsgate and St. Lawrence is taken at 20,000, that would equal half a million gallons a day. But to that must be added the extra quantity required for visitors. I have had some experience with regard to seaside places, and visitors do not consume water in the same ratio as the fixed population do, and therefore a much smaller quantity per head would be necessary for them, which may be put down at 10 gallons per head. If the number of visitors is 40,000, and the resident population is 20,000, it would therefore require a diurnal supply of 900,000 gallons. I have always advocated that water-works should be in the hands of the sanitary authorities. Water is really the great sanitary agent, and should be in the hands of the local authority, but the interests of the sanitary authority and of the water-works company are diametrically opposite. The latter endeavour to conduct their operations at the least possible cost, and to supply the least possible quantity of water; on the other hand, the stint of the water supply is detrimental to the sanitary welfare of the district. Under the provisions of an Act of Parliament, a sanitary authority can now borrow money for sanitary purposes, water-works included, at 3½ per cent., from the Public Works Loan Board, to be repaid in 30 years; but supposing the same capital is raised by the company, it depends upon the dividend which Parliament sees fit to give them. In the present case, the local authority have, with the assent of the body who control such things, a period of 85 years allowed for the redemption of the expenditure, and that, of course, will lessen the burden on the consumers. There is necessarily a limitation to constant supply; there are certain repairs at times to a limited extent. It is customary to supply on the constant system sufficient water, not only to carry it to the tops of the houses, but sufficient for a jet at the top of the house, as a precaution against fire. The level at Ramsgate is such that the water could never be used for fire purposes, even with a constant supply, as it is only a very few feet above the levels of many parts of the district.

Cross-examined by Mr. MICHAEL: I believe the supply at Norwich is about 16 or 17 gallons per head. At Manchester it is 17 or 18.

Mr. MICHAEL: If in such large places from 15 to 18 gallons are sufficient, why have you put down 25 for Ramsgate?

Witness: That quantity is for domestic supply and other purposes. If you take the total, you will find that at Manchester and other places it comes to considerably more.

Mr. MICHAEL: Then if I give evidence that it is less, of course, your calculation will be wrong?

Witness: With regard to Manchester it would be; but I have myself made a very large number of experiments, by metering a number of cases upon the different fittings, and I am ready to admit that, so far as domestic consumption is concerned, it can be brought down to 14 gallons per head. I do not know how much is used for flushing the sewers in Ramsgate. I hear that the company charge 15s. per 1000 gallons, and that is such a price that the local board cannot afford to use it in large quantities.

By the COMMITTEE: With regard to the chalk formation, the rainfall is no criterion whatever as to the amount of water which may be yielded. For example, during the last six weeks not one drop of water which has fallen has affected the springs in the slightest degree in the large area of the chalk formation, but during the whole period the springs have been

rapidly falling; and for a very large period in every year the springs receive no accession to their rainfall. It is only for a very limited period in the autumn, in the chalk districts, that the springs receive any accession of water.

The COMMITTEE: Does it not often happen that the water supply over a given area is very much disturbed, either by the water running from that drainage into an adjoining area, or *vice versa*?

Witness: That is not so with regard to the chalk formation; the water, as a rule, follows the valley lines. There is a very large area of water which can be obtained beyond the limits of the Whitehall source. Under the provisions of the Public Health Act, sanitary authorities can go beyond their districts for a supply.

Mr. BONHAM-CARTER: I suppose that the rainfall ultimately affects the springs in the chalk formation?

Witness: Yes; especially the portion of the rain which falls at the back end. For instance, the last season was a very wet one, and the supply of water to the springs was most exceptional, so that we have now several burns running out of the chalk formation. A burn in the neighbourhood of Croydon has reached as much as 21 million gallons in a day, within a month of the present time, while the largest quantity in that same drainage area was under 2½ million gallons in the middle of last November. An estimate of the yield of water from a chalk formation can only be obtained by absolute measurement.

Mr. J. Mansergh, examined by Mr. O'HARA.

I am a civil engineer, and have had considerable experience in designing and constructing water-works. I went down to Ramsgate, but was refused permission to inspect the water-works. The Southwood works ought, in my opinion, to be entirely abandoned, because it was given in evidence by the engineer of the company that the water was impregnated with sea water, and was probably polluted by infiltration. If I were designing works for Ramsgate, I should provide for 20 gallons per head of the whole population, both normal and visiting. I think the company ought not to have called upon the consumers to keep cisterns for the supply of water, but ought to have given a constant supply, as was intended by their Act of 1835. It has involved an expense of about £5 10s., whereas with a constant supply 45s. would have been sufficient. In my opinion, the district has been very badly treated, and it is time for the company to be improved off the face of the earth. If the works were transferred to the local board, the town surveyor would naturally, in a place like Ramsgate, be the manager of the water-works. He would have the supervision of the fittings from the main to the closet, and from the closet to the sewer; the whole thing would be under him, and he would be responsible. If there is any division of supervision of this kind, the defects which have been spoken of must arise.

Cross-examined by Mr. POPE: I do not think the company ought to have any credit for the steps they are now taking to obtain a further supply, because they are only doing it under pressure.

Mr. T. Knox, examined by Mr. O'HARA.

I am an engineer and ironfounder, and also lessee of the Clarence Baths, at Ramsgate. I know the water-works at Southwood and Whitehall, and have been to the bottom of the wells in both places. At Whitehall the engines pump about 330 gallons per minute, and at Southwood about 275 gallons. At Whitehall the pumps are not used more than about ten hours a day, and the Southwood works are only used when the water at Whitehall is low. The water at Southwood is as salt as brine; I have tasted it. When I have used the water in my boilers it has caused them to prime, and as a rule it destroys the plates very much, and corrodes the cocks and fittings. I think if the local board do not have the water-works in their own hands, the sewerage system will break down.

Cross-examined by Mr. LEIGH: I first tasted the water about 20 years ago, when they took the spring, but I have frequently tasted it since.

Mr. A. Knight, examined by Mr. O'HARA.

I have resided at Margate for nearly 20 years, am an alderman of the borough, and have been for eight years a member of the Town Council. There has been very great dissatisfaction with respect to the quantity and quality of the gas supplied ever since I have taken an active part in public affairs in Margate. In November, 1874, a Bill was contemplated for the formation of an opposition company for the better supply of the town, and to endeavour to obtain possession of the present works, so far as Margate was concerned. That Bill was read a first time in the House of Commons; but in consequence of the sudden death of the two other gentlemen, whose names were inserted in the Bill, in conjunction with myself, as promoters, the measure was dropped. I cannot say that since that time the dissatisfaction with the gas at Margate has increased, but there has always been a dissatisfaction with regard to the price and as to the supply to the public lamps. I was at one time deputed by the Margate Corporation to wait upon the directors of the gas company, in order to try and obtain a better supply for the public lamps. We were received with courtesy, as we always were, but we came away pretty much as wise as we went; we obtained no redress to the complaints we made. At one of the interviews we were told that the public lamps were supplied without any profit, and the company declined to reduce the price in consequence of that. The only thing the corporation could do to lessen the price of the town lamps was to reduce the number of the hours of burning, and that, of course, created great dissatisfaction in the town. In the interest of Margate, it is, in my opinion, desirable that the Bill of the Ramsgate Local Board should pass. Our opposition to the Bill is simply to settle the terms upon which we are to be dealt with. In a sanitary point of view I consider we ought to obtain possession of the works, in order eventually to have them removed, because they are being surrounded with houses. [Witness was examined at some length as to the various meetings of the Town Council, which had been held on the subject of the gas supply, at one of which it was resolved, in consequence of being too late to enter an opposition in the House of Commons, to oppose the Bill of the Isle of Thanet Gas Company in the House of Lords, should it reach that House.]

Cross-examined by Mr. LEIGH: There was a meeting of the ratepayers under the Borough Funds Act, at which it was resolved to support the Town Council. I never heard of a subscription being raised in Margate for the purpose of opposing the gas company's Bill. The last time I took part in a deputation to the gas company was about three years ago. The complaint was as to the price for the public lamps. I cannot say what the price was at that time. I know we once paid £4 10s. per lamp. We never paid a price per 1000 feet.

Mr. LEIGH: Was it at that time that the price of gas was 5s. per 1000 feet?

Witness: It was 5s. at one time.

Mr. LEIGH: It was 4s. 6d. and 4s. at other times, was it not?

Witness: Quite right.

Mr. LEIGH: When the price was 5s., was not that the time when the price of coals was so high?

Witness: Yes; I think it was when they raised their price. Since then the price has been 4s. to the consumers.

Mr. LEIGH: You say that to the consumers the price has been 4s., but it would not be so much to the public lamps?

Witness: It ought not to be, but in my opinion it is.

Mr. LEIGH: You say it is £4 10s.?

Witness: I will not be sure of the price, but you can be told.

Mr. LEIGH: If I tell you it is 10 per cent. less than the minimum price of 48s., what would you say to that?

Witness: I should very much doubt it. I do not come here to give evidence upon these points, but upon the general question.

Mr. LEIGH: You come here to complain of the gas, and when I try to test your evidence as to the public lamps, all you say is that you are not prepared to give evidence on that subject.

Witness: Yes; on that point.

Mr. B. Twyman, examined by Mr. O'HARA.

I am an estate agent, in High Street, Ramsgate. I find the gas corrodes the pipes, and causes us to have them cleaned every three or four months, which process costs from 6s. to 8s. each time. There is a general feeling in the town in favour of the transfer, those against it being more or less interested in the company. I canvassed about 200 people, and found at least four-fifths in favour of the transfer.

Cross-examined by *Mr. POPE:* The inhabitants wanted the benefits of better light, better attention, and certainly better financial administration. By "financial administration" I mean that we should not have to pay interest on the profits which have already accrued.

Re-examined by *Mr. O'HARA:* My objection is that they take the money which ought to have been given to us, by reducing the price of gas, and then charging interest upon it.

Mr. E. B. Bloxam, examined by Mr. O'HARA.

I am a grocer, residing in Cecil Square, Margate. I have been a consumer of gas for 15 or 16 years. My opinion is decidedly in favour of the Margate Corporation obtaining the Margate works. I had occasion, two years ago, to complain to a director of the gas company, and the remedy suggested was that I should appeal to the board at Ramsgate, which was a great inconvenience, as it involved a journey and loss of time, without any recompense. In 1874 the company lowered their price, but that seemed an anomaly, for in reality I paid as much as before.

Cross-examined by *Mr. POPE:* The last complaint I made was some few years back, but I have become tired of making them. I should think there have been from four to six meetings on the subject during the past 12 months.

Mr. W. Perry, examined by Mr. O'HARA.

I have lived in Margate for about 30 years, and remember the meetings held to protest against the conduct of the gas company. On one occasion, when the company thought the burgesses had determined to form a consumers company, they sent a message to the meeting, that if they would forego that intention they would reduce the price and improve the quality, and upon the faith of that promise the project was dropped. Mr. Bentley was one of the chief agitators upon that occasion, but he subsequently joined the board of the gas company.

Cross-examined by *Mr. POPE:* When we waited upon the directors in 1874, the chairman told us they had reduced the price without any pressure from without, but that was not the case—the pressure had come from without.

Mr. R. Dewhurst, examined by Mr. O'HARA.

I am an ironmonger and gas-fitter in Cumberland Road, Margate, and a member of the Gas Committee appointed by the ratepayers. In my opinion the gas supplied has been very impure.

Mr. O'HARA: Have you had any experience of the gas in your own house?

Witness: I saw the gas escape in broad daylight. The first thing that called my attention to it was a smell like that of a cesspool.

Mr. O'HARA: Do you mean that the gas smelt like a cesspool?

Witness: Yes; it was very offensive, and I traced the smell to the gas-meter?

Mr. O'HARA: Did you discover a leak in the pipe leading to the meter?

Witness: I saw it escape.

Mr. O'HARA: The gas came out of the pipe in such an impure state that you actually saw it?

Witness: Yes.

Mr. O'HARA: You actually saw the gas coming out of the pipe, and the smell was very offensive?

Witness: Very, indeed.

Mr. O'HARA: Did you proceed to stop the leak?

Witness: I sent my man to do it.

Mr. O'HARA: Did you conceive the gas you saw coming out of the pipe, and that smelt so bad, to be very impure?

Witness: Very impure.

Mr. POPE: I cannot venture to cross-examine a man whose vision is so strong.

By the COMMITTEE: It was an escape from the meter, and I had two witnesses there to prove it. We saw it escape, like a sort of yellow smoke.

Mr. R. Read, examined by Mr. O'HARA.

I am instructor to the Volunteer Corps, but my experience of gas was derived as steward of the Civil and Military Club, which office I held for rather more than two years. I suppose we had the best burners and proper fittings at the club, as they were supplied by a director of the gas company. We repeatedly found the gas bad in quality, and offensive in smell. The light has sometimes been so bad that we have had to light candles, and on two or three occasions it went out altogether. The defective pressure was very clearly proved. We had 45 burners, and after lighting about half a dozen we found the light diminished.

Cross-examined by *Mr. POPE:* It did not occur to me that the service-pipe was not big enough, but it did to the gas company, who sent and had it enlarged, to meet the difficulty, and the supply was improved, no doubt. There were sooty particles in the gas, and it was a very dirty light, not a pure white light.

Mr. O'HARA said that was the case for the promoters.

Mr. BALFOUR BROWNE, in addressing the committee on behalf of the ratepayers of St. Lawrence who had petitioned against the Local Board Bill, said that his clients, while desirous of seeing the companies put under parliamentary control, and rendered amenable to the General Acts, believed that they would get a better supply of gas and water from the companies than from the local board. He commented upon the trivial nature of the complaints which had been made against the company, and said that hundreds of persons could always be found to make such complaints. The whole matter was brought before a committee of the House of Commons last year, when the case was substantially the same, and, after hearing all the complaints, the committee rejected the Bill of the local board. He had elicited from many of the witnesses that at the present time there was little or nothing to complain of with regard to the gas and water supply. It appeared to him that the case was in every way weaker than last year. While the local board were there in spite of a parliamentary snub, the companies were present in obedience to the suggestion the committee threw out when they rejected the Bill of the local board last year. The case of Stockton and Middlesbrough, in which a compulsory sale had been enforced, was not similar to that of Ramsgate, for, in the former case the companies neglected to obey the suggestion of the committee. The reverse was the case in the present instance, and, instead of being asked to confirm the decision of the committee of last year,

they were asked to stultify that decision. With respect to the question as to whether the transfer would be to the advantage of the outlying district of St. Lawrence, his clients felt that they would be safer in the hands of the companies than of the local board. The price to be paid for the works would be necessarily large; the local board would be overburdened; the price charged for gas and water must be very high; and, even if there were large profits, St. Lawrence would not receive the full benefit of them, as one-half would go to the Ramsgate District Fund. The case of Manchester was not analogous to that of Ramsgate and St. Lawrence, because Manchester was a large centre, and could supply gas to the outlying districts with advantage; but if the principle was to be extended to places like Ramsgate, why should not every little local board around Manchester have its own gas-works? The outlying districts round Manchester were charged considerably more for gas and water than those within the city, and there was nothing in the Bill of the Ramsgate Local Board to prevent them from adopting the same practice towards St. Lawrence. The Rev. Mr. Banks had given evidence in favour of Ramsgate incorporating St. Lawrence; but, if such a thing were proposed, he believed it would be most strenuously opposed by the St. Lawrence people. Mr. Banks had admitted that he thought the transfer would enrich the town of Ramsgate, but this would not be fair towards St. Lawrence. If the Bills of the companies were passed, they would still have the local board to look after them; but if the local board's Bill passed, there would be no supervision, as ratepayers were not allowed to appear in opposition to a local board. If corporations and the local boards were the proper persons to manage the gas and water supply, why should they not extend the principle? Mr. Chamberlain, of Birmingham, had already proposed to extend it to public-houses, and possibly they might soon have the Corporation of London become importers of American beef. In conclusion, the learned counsel said he had several witnesses from St. Lawrence, but he did not propose to call them at that time, but to put questions to them when they were examined as witnesses for the companies.

Sir E. BECKETT objected to this course, and, as the witnesses were not then in attendance,

Mr. BROWNE said he must forego their evidence, and satisfy himself with what he had elicited in cross-examination of the local board's witnesses.

(To be continued.)

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

WEDNESDAY, APRIL 11.
(Before Vice-Chancellor MALINS.)

GLOSSOP V. THE ISLEWORTH LOCAL BOARD.

Mr. GLASSE, Q.C., appeared in this case, in which the plaintiff, the owner of a house and grounds in the neighbourhood, complains of a nuisance committed by the defendants in their sewage operations, whereby the health of himself and family is injuriously affected. The learned counsel complained that whenever the question came before the local authorities, some member moved its adjournment, and so the plaintiff had to sustain continued injury. The plaintiff, however, had no wish to act harshly towards the defendants, if they would give an undertaking to proceed with despatch.

Mr. HIGGINS, who represented the defendants, denied that any nuisance existed, and said some people thought the Thames a nuisance.

The VICE-CHANCELLOR considered the defendants own acts and correspondence proved there was a nuisance, and he would grant an early day, upon which, the motion being treated as the hearing of the cause, it should be disposed of. The motion, therefore, would stand over for a fortnight.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

QUARTERLY REPORT OF THE CHIEF GAS EXAMINER.

The following is an abstract of the report of Professor Williamson, the Chief Gas Examiner to the Metropolitan Board of Works, on the results of the daily testings of the gas supplied by The Gaslight and Coke Company, and the South Metropolitan Gas Company, during the quarter which ended on the 31st of March, 1877:—

	Max.	Min.	Aver.
The Gaslight and Coke Company—			
Common gas, Beckton	19.1	15.9	17.5
" Ladbroke Grove	17.8	15.2	16.8
Cannel gas, Millbank Street	23.4	20.0	20.7
Common gas, Devon's Road	18.3	16.1	17.0
" Carlisle Square	19.0	16.3	17.5
" Camden Street	17.5	15.9	16.6
" Graham Road	19.9	15.8	17.8
South Metropolitan Gas Company—			
Common gas, Hill Street	19.8	14.6	17.2

The average illuminating power of the gas from each station has been above the requirements of the Acts of Parliament, and, in some cases, such as at Camden Street and Graham Road, considerably above those requirements. On the other hand, the gas has, on very rare occasions, been below the required illuminating power, but even then very slightly so.

A temporary diminution of illuminating power down to 14.6 in the gas supplied by the South Metropolitan Company was observed on one occasion. This was due to air having been accidentally drawn into the gas, which, however, even under these circumstances, was slightly above the required illuminating power.

The gas made at the various stations has been uniformly free from sulphuretted hydrogen except on one occasion, in which the gas at Hill Street was found to contain some of that impurity.

	Max.	Min.	Aver.
The Gaslight and Coke Company—			
Common gas, Beckton	21.1	5.4	13.1
" Ladbroke Grove	19.5	11.3	14.2
Cannel gas, Millbank Street	13.9	8.6	13.6
Common gas, Devon's Road	19.97	9.8	16.0
" Carlisle Square	21.5	7.2	13.4
" Camden Street	23.1	12.1	17.1
" Graham Road	22.5	9.5	14.6
South Metropolitan Gas Company—			
Common gas, Hill Street	42.6	8.8	18.0

The greatest amount of sulphur found at every station except two has been within the requirements of the Acts, whilst the average quantity found at each station has been considerably lower than those requirements. The two stations at which an excess of sulphur was found are Beckton and Hill Street. The excess at Beckton was very slight—viz., 1.1 grain per 100 cubic feet. The excessive quantity of sulphur found at Hill Street was due to a temporary defective action of the purifiers.

Ammonia has been uniformly absent at Ladbroke Grove, and almost so at Devon's Road and Graham Road. It has been rarely present at Millbank Street. At Beckton and Camden Street it has been present in small and tolerably regular quantities. At Hill Street there have been great irregularities in the amount. At Carlyle Square the quantity of ammonia present, though always small, has fluctuated considerably.

Dr. Stevenson's report on the gas supplied by The Gaslight and Coke Company to the Vestry of St. Pancras, during the month of March:—Maximum light, estimated by sperm candles, according to the Act—19.5. Minimum light, sperm candles—16.1. Average light, sperm candles—16.9. Traces of ammonia, indicated by turmeric test-paper—Traces only, on all occasions. Traces of sulphuretted hydrogen, indicated by lead test-paper—none at any time. Sulphur, 18.1 grains per 100 cubic feet.

PURCHASE OF THE LEICESTER GAS-WORKS BY THE CORPORATION.

A Special Meeting of the Leicester Town Council was held on Monday, the 10th inst.—the Mayor (Alderman Winterton) in the chair—to consider a report from the Parliamentary Committee in reference to the opposition of the Bill of the gas company now before Parliament.

The proceedings commenced by reading the report of the committee, which stated that, under the authority conferred upon them by the council, they had retained the services of Mr. Bramwell, C.E., and Major Talloch, R.E., to assist in the opposition of the company's Bill. Both gentlemen had visited Leicester, and inspected the present works of the company, and the proposed new site. Other witnesses also had been engaged. The report then proceeded as follows:—

The committee are, however, glad to be able to report that circumstances have transpired which, in all probability, will bring the opposition to a termination, the works having been put in price to the corporation.

The following is a brief outline of the negotiations which have taken place—viz., Mr. Grimsley having had an intimation that the representatives of the company were prepared to discuss terms on which to assign over to the corporation their works and undertakings, he had interviews with Mr. Billson, the solicitor and secretary to the company, and ultimately, with the full concurrence of the mayor, the following proposition was submitted by him for the consideration of the directors—namely, that the corporation should, in respect of the C shares, which are now paying a dividend of 14s. per share, being the maximum amount authorized by Parliament to be paid, guarantee a payment of 16s. per share perpetual annuities, redeemable by the corporation at six months notice whenever they think fit so to do, at 25 years purchase; and also to guarantee annuities for the remainder of the shares (A and B) at a corresponding addition of one-seventh of their statutory dividends, and in other respects on the same conditions.

It having been ascertained that a settlement might be arranged on the above basis, the committee met, and the matter was fully and carefully discussed and considered, and with perfect unanimity it was decided to enter into a preliminary agreement for the purchase of the undertaking, and to recommend the council to give effect to the arrangement.

The following is a copy of a memorandum which was prepared and has been signed by Mr. Billson, on behalf of the shareholders, and by the mayor, the chairman of the committee (Alderman Stafford), and the chairman of the Highway and Sewerage Committee (Mr. Grimsley) on behalf of the council.

The committee recommend the council to ratify the course which they have pursued, and to authorize a detailed agreement to be prepared and settled under their direction, and to give authority to the town-clerk to affix the common corporate seal of the borough thereto.

It will be observed, from the memorandum, that the opposition of the corporation to the Bill now before Parliament is to be withdrawn, but this and some other matters of detail will be more fully explained by the gentlemen who have conducted the negotiations.

Heads of Agreement between the Corporation of Leicester and the Leicester Gas Company.

1. The corporation to purchase and take over the undertaking of the company, with the exceptions afterwards mentioned.
2. The consideration to be paid to be the perpetual annuities hereafter stated—viz.,

In respect of each C share	16s. 0d.	per annum.
In respect of each B " "	17	1 5-7 "
In respect of each A " "	26	3 3-7 "

such annuities to be from time to time redeemable at the option of the corporation, on giving six months notice, and on payment of 25 years purchase for the same.
3. The annuities to be charged upon the gas undertaking of the corporation and upon the borough rates, or in such other way as may be agreed upon.
4. The undertaking to be taken over on June 30, 1878, upon which day the annuities are to commence and to be payable half yearly, on the 1st day of January and the 1st day of July in each year, the first payment being due on Jan. 1, 1879.
5. Until the actual transfer to and taking over by the corporation, the company to carry on their business and make all payments as fully as hitherto, and to make such extensions as may be necessary, and to act in the management of their business for the benefit of their undertaking, as if no agreement had been entered into, but they were carrying it on for the benefit of their shareholders.
6. The company to retain out of their general assets the amount of all unclaimed dividends for which warrants shall have been issued, and also to retain and to distribute amongst the shareholders the half-yearly dividends on their shares in respect of the half year ending on June 30, 1878, and further, to retain a sum of £4000 for payment of all expenses to be incurred after the actual taking over by the corporation, and of the winding-up of the company, any balance thereof being appropriated to such purposes as the company shall think fit.
7. The corporation and the company to apply for a joint Act of Parliament in the next session, to carry out the arrangement, and in the event of such Act not being passed in the next session, or failing that in the next following session, this agreement, unless otherwise mutually agreed upon, to be void. The joint Bill to be settled, in case of disagreement on any point, by some counsel to be selected by the Board of Trade.
8. The company to proceed to obtain their present Bill, the opposition to which by the corporation shall be withdrawn, but such Bill, and all powers to be thereby obtained, to be transferred with the undertaking to the corporation. The company not to issue any further share capital until the result of the application for the joint Bill is ascertained. If more money shall be required by the company than their present borrowing powers shall suffice to supply, the company may borrow from their bankers or other persons, on the best marketable terms, in lieu of issuing shares, and such loans shall be taken to be by the corporation as part of the obligations of the company.
9. The clerks and servants of the company whom the corporation may decide to retain in their service to be considered, with respect to any superannuation funds or other benefits, as having been in the employ of the corporation during the whole time—i.e., their services with the company and the corporation to count as continuous.
10. The corporation to take all the debts, liabilities, and obligations of the company existing at the time of taking over, and hold the company harmless therefrom, and to issue, on such taking over, to each shareholder, certificates of the annuities in a form to be provided by the joint Act.

The report was signed by

WM. WINTERTON, Mayor, subject to the approval of the Council of the Borough of Leicester.

W. BILLSON, jun., Secretary, subject to the approval of the Shareholders of the Company.

JOHN STAFFORD, Chairman of the Parliamentary Committee.

WILLIAM GRIMSLEY, Chairman of the Highway Committee.

Dated April 5, 1877.

Alderman STAFFORD, moved—"That the report of the Parliamentary Committee be adopted, and that the committee be authorized, on the advice of their solicitors or counsel, to settle the terms of an agreement to carry out the recommendation of the committee for the corporation to acquire, with the sanction of Parliament, the works and property of the Leicester Gas Company, and that the town-clerk be authorized to affix the corporate common seal to such documents as may be necessary to give effect to the arrangement." He said: Perhaps this may be considered one of the most important meetings ever held of our Town Council, as it involves a question of great magnitude to the inhabitants generally. Next to water, gas stands out as one of the great conveniences of life. At our last meeting you were called upon to sanction an opposition to the Leices-

ter Gas Company's Bill now pending in the committee of the House of Commons, and I do not in the least regret the stand we took to protect our interests, as it may have been the means to the end at which we have arrived to-day. It appeared to the Parliamentary Committee that an extension of the gas-works, requiring the creation of a capital of £250,000, was altogether beyond the requirements of the town for very many years to come, and that the main object of the Bill could only be to utilize the surplus profits. We, as the custodians of the interests of the town, while sensible of the sagacity of the directors, felt it our duty to oppose this step. All our preliminary arrangements were completed, and we had secured the assistance, as authorized by you, of counsel and engineers, when a change came o'er the scene. Mr. Grimsley learned (notwithstanding the letter he had received from the company that they were not disposed to part with their works) that it was possible some amicable arrangement might be arrived at. This intimation led to talking over terms in strict confidence. At this stage Mr. Grimsley felt bound to consult the mayor and myself, as chairman of the Parliamentary Committee, on the subject; the terms appeared to us satisfactory to both sellers and buyers, and we then summoned a meeting of our committee, and laid the whole thing before them, when they unanimously approved of the offer. As we had to give an answer that day, we had no opportunity of reporting to the council what had been done, but accepted the terms subject to your approval and the approval of the shareholders of the company. One matter which led to the necessity of our immediate answer was, doubtless, the fact that a notice of motion was to come on in the House of Commons by Mr. Raikes, Chairman of Committees, to the effect that in any Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction, or tender, at the best price which can be obtained. It will be seen at once that, if carried out, this would have considerably affected the object of the proposed Bill. Doubtless this has led in some measure to our more easy settlement of this question, and the satisfactory terms we have been enabled to make on behalf of the corporation. Our thanks are due to Mr. Grimsley for the action he has taken, through which we have arrived at this peaceable solution of the difficulty. He shall tell his own tale in detail in seconding this resolution; suffice it for me to speak of the matter generally. Last year the profits of the company amounted to little short of £28,000, while our arrangements are to pay in perpetual annuities the sum of £19,000, which leaves a margin of £9000. Thus, without any money being required to be found to carry out this arrangement, and as the Leicester Gas Company have been a rapidly improving one, there is no reason to doubt that the future will yield even a larger surplus than the past. There is also a handsome reserve-fund of £22,394, and also a gasholder reserve-fund of £7000, together nearly £30,000, to fall back upon for contingencies, while Mr. Bramwell, the engineer whom we had secured to advise us in this matter, says the works are in a splendid condition of efficiency, as might have been expected from a company having really more money than they knew what to do with. It is quite possible that the corporation may be called upon to reduce some part of the liability and pay off their annuities; but this may be done by spreading it over 75 or possibly more years, and thus be made perfectly easy to accomplish. On the whole, I think, while the shareholders of the company on the one side have reason to congratulate themselves that they will receive an increased dividend, we, the corporation, shall possess a valuable property which is certain to produce a handsome profit over and above the annuities and sinking-fund we may have to pay, and this will, of course, go to reduce the rates. I cannot too warmly express the satisfaction I feel at the amicable termination of this business, which stands out in such favourable contrast to the recent water-works Bill. The directors of the gas company have behaved throughout in the most handsome and courteous way, and as we have several of them members of our council, we may hope for their co-operation in the future carrying on of the works on our behalf.

Mr. GRIMSLEY, in seconding the motion, said that he thought the opposition of the corporation to the company's Bill, and the proposed new Standing Order of the House of Commons relating to the disposal of new shares by auction, had been important elements in bringing about the arrangement which had been provisionally agreed to, and had tended very materially to induce the directors to listen to any fair proposal for the purchase of their undertaking. Meeting with Mr. Billson, the solicitor and secretary of the company, he stated to that gentleman that, if he was prepared to go into the question of purchase, he would discuss the matter with him, and Mr. Billson replied that it was not altogether impossible, and that if the corporation were prepared to offer what the directors and shareholders might consider to be fair terms, he believed that there might be a purchase of the undertaking. He (Mr. Grimsley) feeling the responsibility of his position, consulted with the mayor, and, after thoroughly going into the matter, they agreed that it would be well to come to an amicable settlement of the question. He saw Mr. Billson on the following day, and after further discussion, he (Mr. Grimsley), subject to the approval of the mayor, sent the following letter to Mr. Billson:—

Re Gas Bill.

March 29, 1877.

Dear Sir,—In view of the severe fight which awaits us in Parliament, I should much prefer, if possible, to arrive at an amicable settlement of the question in dispute, and with that object I should be glad if you would call your directors together to lay before them the following suggestion:—Although you cannot derive, under any circumstances, more than 14s. per share on the C shares, if your directors are willing to make us an offer of the concern on the following basis—namely, a guarantee from the corporation of 16s. per share perpetual annuities, redeemable by the corporation at six months notice whenever they think fit, at 25 years purchase, and the same proportion to be paid for the other shares—I will do my best to get the offer accepted, the reserve-fund, of course, to be considered as belonging to the corporation. I wish it clearly to be understood that this offer is made without prejudice, and is not to be used on either side in Parliament, in the event of nothing coming of it; and that it is also subject to the necessary clauses being inserted in the Act to carry out the agreement.

I am, dear Sir, yours very faithfully,

W. GRIMSLEY.

To William Billson, jun., Esq.

At a subsequent interview with Mr. Billson, he found that the directors and shareholders were prepared to accept the offer they had made, and the only point of difference between them was as to the reserve-fund. He (Mr. Grimsley) said that the fund must necessarily belong to the corporation, inasmuch as it would form an element in the renewal of any of the works which might be worn out by long usage. Mr. Billson suggested, on the part of the directors, that the sum of £6000 should be retained out of the fund for the purpose of winding up the concern, and for any other matters the directors might have found out. At that time he thought Alderman Stafford should be consulted; and himself, the mayor, and Alderman Stafford finally decided that £4000 should be offered instead of £6000. He (Mr. Grimsley) had also taken the opportunity of consulting Mr. Bramwell, the able engineer who had inspected the works in company with the borough surveyor and himself, and finding that such a sum was a very liberal one, Mr. Billson, on the part of the directors, agreed to settle that as the amount. Having told the council what they had to pay for the undertaking of the company, the next question for consideration would naturally be what would they get for their money? At the present time the dividends paid to the shareholders of the company amounted to £16,672 10s. annually. The annuities which the corporation would have to pay upon the basis of settlement would be £19,054 4s.; therefore they

would give to the shareholders an increase of £2381 14s. per year. The net profit of the company last year, as shown by the balance-sheet, after deducting the sum of £500 paid to the directors for their fees, amounted to £5438 12s. 8d., but he thought it only right that they should add the £500, as it would be saved when the transfer took place, inasmuch as three of the gentlemen who were now very active directors were members of the corporation, and he had no doubt they would be pleased to place their services at the disposal of the town upon the same terms as they did the general work. The company in the second half of last year found that they really had made so much profit that they did not know what to do with it, as they could not divide it because the law prohibited it. They could not add to the reserve-fund because the law prohibited it, and therefore to relieve themselves of a difficulty which was not often felt in financial matters, they charged an item of about £3000 to the reserve-fund, instead of to capital account. If that item of £3000 was added to the £5438, the actual profit of the company, and also the £500 fees paid to the directors, there was shown to be a total profit upon last year's working of £8938. He held that the directors had exercised a wise discretion in making terms which would ensure to their shareholders a very handsome increase upon their existing dividends. The future advantages of the company might or might not be worth a considerable sum to the shareholders, and in consideration of their surrendering the right to any of those advantages, they had secured something like one per cent. more dividend than they could possibly have received under existing circumstances, and that without the slightest risk. The shareholders, therefore, had no reason to be dissatisfied, and the town had no reason to be dissatisfied. He felt that this was a transaction which was creditable to the directors and creditable to the corporation; and what was better, it was profitable to both parties. Then he would remark that the corporation were not taking to a concern which was worn out. He had no hesitation whatever in saying that the condition of the works was equal to any in the kingdom, and that was the opinion of the engineer whom they had engaged. When the council came to consider that they had works in first-class order, that they had a concern which would leave the corporation a handsome profit, he could not conceive for one moment that there would be a member of the council who would vote against the resolution. With regard to the reserve-fund, he remarked that it was not often when they bought a concern that they had to take to something like £30,000 of reserve-fund; but having that amount to fall back upon in any contingency that might arise, they had every reason to be satisfied with the arrangements made. He had every confidence in believing that the ratepayers of Leicester, when they knew the terms, would be gratified at the result. Mr. Billson, jun., who was charged to conduct the negotiations on the part of the directors, had discharged his duty in a manner which had made him personally, and he was sure the council also, under a deep obligation to him; and he hoped there would be a feeling expressed that morning of high appreciation, not only of the services he had rendered in connexion with this matter, but with the liberal conduct on the part of the directors in promoting the settlement of a transaction which, he ventured to believe, would be regarded in future years as a stupendous monument of the wisdom of those who were concerned in it, and which would gladden the hearts of those who might succeed them when their days of service were over.

Alderman BAINES and Alderman BURGESS expressed approval of the arrangements which had been entered into between the committee and the company.

Mr. BERRY said he had no faith in the corporation managing this sort of thing. He thought the town would receive as much benefit from the works being in the hands of the company, as from the corporation. He did not think the ratepayers, four years hence, would have quite so much to congratulate themselves upon as the present directors would have. He wished to know whether the corporation were going to promote the Bill, and then commit the suicidal things it was prognosticated the company would do if they got the Bill.

Alderman STAFFORD remarked that the 8th clause in the articles of agreement provided for what Mr. Berry complained about.

Mr. FOWLER supported the resolution, maintaining that there was a great difference between the circumstances connected with the water-works question and the present, and therefore it was consistent that he and others should support the resolution. Mr. Grimsley had put the most rosy hue upon this matter, and a great deal of credence must be given to the statements he had made. He did not wish them to think it was to be the happy reality Mr. Grimsley had described to them. He honestly believed, however, that the directors were making a good bargain, and that the corporation were making an equally good one.

Mr. WINDLEY congratulated the council upon the eminent services which Mr. Grimsley had rendered to the corporation and the town in this matter. It had been said that they had no right to compare this business with that of the water-works, and he was well aware that comparisons were odious. He hoped Mr. Grimsley would converse with gentlemen connected with the water-works, and startle the council some morning by the announcement that the directors were willing to sell their works to the town.

Alderman STEVENSON bore his testimony to the good spirit in which the negotiations had been carried on by the gas company, and also by Mr. Grimsley on the part of the corporation.

After some further conversation, the motion for the adoption of the report was put, and carried unanimously.

EXHIBITION OF GAS APPARATUS AT SOUTH SHIELDS.

As our readers are aware, from the notices in the "Circular" and our advertising columns, it has been some time in contemplation to hold an exhibition of gas apparatus, demonstrating the applicability of gas to heating, cooking, and other purposes of utility other than for giving light. On Monday, the 9th inst., the efforts of the gas company, their engineer, Mr. Warner, their secretary, Mr. Penney, and the deputy-engineer, Mr. Bolton, were crowned with success by the opening, in the large hall of the Free Library Buildings, Ocean Road, an exhibition, which is entitled to rank as one of the most useful on record. It contained upwards of 300 articles that, with scarcely a single exception, were adapted, not as mere ingenious devices, but as articles of practical daily use either in the mansion, the villa, the cottage, or the laboratory.

It was originally intended that the exhibition should be open for three days only; but so numerous were the visitors, and so great was the interest excited, that on the morning of the second day the inhabitants of the town presented a requisition to the gas company, signed by some 500 persons, begging that the exhibition should continue open for the rest of the week. To this the directors replied by consenting to keep it open till Friday night, beyond which they were unable to go, in consequence of the hall being required for other purposes. It is estimated by a gentleman intimately acquainted with the building, and the quantity of persons the hall will contain, that on this occasion there has been upwards of 30,000 visitors. It has been without doubt in every way a most complete success, and far exceeding the most sanguine expectations of the promoters, who certainly are deserving of not only the thanks of the inhabitants of Shields and the neighbouring towns, but the gratitude of every gas company in the kingdom, for inaugurating a movement that can result only in the extended use of gas, and benefit to both consumer and supplier.

In order to stimulate competition, and increase the interest of the show, the gas company offered seven silver medals to be given as prizes for the best article in each class. We are informed by the chairman that the response on the part of the manufacturers was, however, not so hearty as could be expected until the names of the judges (Mr. John Pattinson, analytical chemist, of Newcastle-on-Tyne, and Mr. W. H. Bennett, C.E., Secretary of the British Association of Gas Managers) were announced, when the increase in the number of intending exhibitors and applications for additional space was most marked.

The exhibits were divided into seven classes, a description of which is as follows:—

CLASS 1.—Efficient and durable portable stoves for boiling, frying, and grilling, suitable for a mechanic's home.—Messrs. Davis and Son, Bath, exhibited a cooking stove and boiling stand. The Economic Gas Range and Roaster Company, London, a cooking stove and roaster. J. Wynn, a registered oven. J. E. Prust, 78, Smallbrook Street, Birmingham, three cookers, one of which obtained a silver medal. S. Leoni and Co., 15 stoves and cookers of various sizes and degrees of completeness. G. Goldsmith, Leicester, one workman's cooker, capable of cooking a steak or couple of chops and half-a-dozen potatoes in about half an hour, with an expenditure of about 3½ cubic feet of gas. (Honourable mention.) Thermostatic Cooker Company, two stoves, hot plate, and grill. Billing and Co., London, three stoves (one of which received honourable mention), hot plates, and boilers.

CLASS 2.—Family gas cooking stoves.—Davis and Son, Bath, a cooking stove. Economic Gas Range and Roaster Company, London, a range, cooking stove, and roaster. J. Wynn, Cheltenham, cooking stove. J. and J. Braddock, Oldham, a cooking stove. J. E. Prust, Birmingham, four cookers, one of which obtained honourable mention. Leoni and Co., London, ten stoves (one of which received honourable mention) and boilers. John Wright and Co., Birmingham, 12 cookers, one of which obtained the silver medal. Thermostatic Stove Company, London, two cookers. James Gray and Son, Edinburgh, two cookers. John Beverley and Son, Leeds, one cooker, obtaining honourable mention. Billing and Co., London, two cookers, one of which obtained honourable mention.

CLASS 3.—Gas-baths.—Ewart and Son, London, one bath. Charles Wilson, Leeds, one bath, to which was awarded the silver medal. Davis and Son, of Bath, circulating boiler for bath. W. and B. Cowan, Edinburgh, vapour bath. S. Leoni and Co., London, two boilers for baths. John Wright and Co., Birmingham, two baths.

CLASS 4.—Closed apparatus for heating halls or conservatories either by hot air or water.—Davis and Son, Bath, a cylindrical stove. Economic Gas Range and Roaster Company, London, a conservatory stove, two room stoves. S. Leoni and Co., London, nine caloriferes. C. Erzzard, Bradford, one stove. John Wright and Co., Birmingham, two hot-water apparatus (for one of which the silver medal was awarded), 12 stoves, and 14 caloriferes. Tangye Brothers and Rake, Newcastle, one gas boiler.

CLASS 5.—Open gas-fires.—S. Leoni and Co., four gas-fires (to one of which the silver medal was awarded), and cheerfuls. J. Wright and Co., Birmingham, five gas-fires and cheerfuls. Billing and Co., London, six cheerfuls.

CLASS 6.—Gas-engines.—Crossley Brothers, Manchester, a gas-engine (to which the silver medal was awarded after being tested), Messrs. Louis Simon and Simons, of Nottingham, being permitted by the judges to withdraw their engine from competition.

CLASS 7.—Novel applications of gas to articles of general utility.—Charles Wilson, Leeds, lace singer. T. Dalziel, Kilmarnock, horse singer. W. and B. Cowan, Edinburgh, still. Gas-Fire Lighter Company, Birmingham, fire-lighters. Mawson and Swan, Newcastle, articles of utility in pursuit of scientific investigation and research in the laboratory, as furnaces, electric burners, thermo-electric pile, thermostat, hot-air blast blowpipes, assaying moulds, in all of which gas is applied. S. Leoni and Co., two laundry stoves, three tailors stoves. C. Erzzard, Bradford, six sets of laundry, tailors, and other irons, so cast as to admit of the heat from a Wallace's burner to pass into and through them. (For these the silver medal was awarded.) J. Hepworth, Carlisle, calender heated by gas. G. Goldsmith and J. Dilkes, coffee-roaster, tailor's goose-heating stove, laundry iron-heating stove, &c., in which the gas is so arranged that the weight of the iron when placed in the stove opens the gas-tap, and when it is removed shuts the gas-way, so that but a minimum of gas escapes, or only sufficient to light the full burner when required, thus ensuring great economy of gas. John Wright and Co., Birmingham, two hot-water cisterns, four steamers, one muller, three tailors stoves, three ironing stoves, three cigar lighters, one horse singer, one tinman's stove, two nursery brackets. W. J. Rennoldson, self-feeding evaporating apparatus. C. S. Robinson, Leicester, soldering-iron heater, with Bunsen burner, fitted with patent gas and air tap; lead-melting cup, with stand similarly fitted. H. Trotter, automatic gas lighter and extinguisher. W. Cowan, fomenting apparatus.

The exhibition was announced to be open at noon, and although it was a short time past that hour ere everything was got into working order, those who possessed the necessary tickets were then admitted. Amongst those present were the Mayor of South Shields (Alderman Stainton), the Mayor of Jarrow (Alderman Berkley), the Rev. T. H. Chester (Vicar of South Shields), the Rev. C. E. Adamson, the Rev. T. N. Roberts, Mr. J. M. Moore (Town-Clerk of South Shields), Alderman T. Glover and Mrs. Glover, Mr. Robert Wallis (chairman of the South Shields Gas Company), and Mrs. Wallis, Mr. W. Anderson (Bent House), Mr. John Henderson (Horsley Hill), and Mrs. Henderson; Mr. Thomas Stainton, and Mrs. Stainton (Sunderland), Miss Horsfield (Sunderland), Alderman J. B. Dale and Mrs. Dale, Dr. Armstrong, Mr. J. L. Hall and Mrs. Hall, Mr. John Ridley, Mr. W. J. Warner and Mrs. Warner, Mr. J. H. Penney, Mr. Belton, Mr. R. P. Spice (president of the British Association of Gas Managers); Mr. Hutchinson (president), and Mr. W. Longworth (secretary of the Manchester District Association of Gas Managers); Mr. J. Hepworth, Carlisle; Mr. W. Smith, Hyde, near Manchester; Mr. Harold Hunter, Stalybridge; Mr. Donaldson, Edinburgh; Colonel Shippey, Birtley; Mr. G. Williamson (chairman of the Tyne-mouth Gas Company); Mr. W. Hardie (secretary to the Newcastle Gas Company); Mr. W. H. Atkinson (secretary to the Tyne-mouth Gas Company); Colonel Allison, and a numerous assembly of the gentry and influential inhabitants of Shields and the surrounding towns.

There was no formal opening, but Mr. Robert Wallis, chairman of the company, introduced Mr. R. P. Spice, president for this year of the British Association of Gas Managers, and, in doing so, remarked that Mr. Spice was one of the most eminent gas engineers of the day.

Mr. Spice, who was received with much applause, said that the chairman of the South Shields Gas Company, in inviting him to be present on that occasion, had done honour not only to himself, but at the same time to the British Association of Gas Managers, of which he was president for the year. It would be seen from the exhibition that gas could be used in the daytime for cooking purposes, and also in a variety of other useful ways, which would tend to reduce the cost of gas to the consumer. He had had much pleasure in being present to witness the various articles represented at the exhibition, which had been so wisely and so liberally inaugurated. The exhibition was a most important event, and it would long be remembered in the annals of the gas industry of the United King-

dom. He congratulated the South Shields Gas Company upon the successful result of the exhibition. It was the first of the kind held in England, and, therefore, great credit was due to the chairman of the company for his special exertions in the matter. The idea of applying gas to cooking and heating purposes was not a new one, and he was pleased to bear his testimony to the credit being due to Mr. Goddard, of Ipswich, and the late Mr. Sharp, of Southampton, who had laboured many years in the work, and Mr. Warner, his kind friend, was also deserving of notice, for his efforts had been the means of establishing the Association of which he (Mr. Spice) was the representative that day, and which was established in 1863. South Shields was entitled to the honour of bringing before the United Kingdom the benefits, advantages, and economy to be derived from the various contrivances which were exhibited in that room. He concluded by calling upon the company to give three hearty cheers for the directors, officers, and shareholders of the South Shields Gas Company.

Three cheers having been given, Mr. WARNER rose to acknowledge the compliment, and in doing so remarked that Mr. Spice himself had devoted a great deal of attention to the subject of gas, and he was greatly pleased to find that, on an occasion of this kind, the exhibition was not only countenanced but encouraged by the presence of one who was ever ready to promote the interests of both gas companies and consumers, and who held a prominent position in the foremost rank of gas engineers.

This part of the proceedings then terminated. At a later period of the day, a large number of ladies and gentlemen were entertained by the directors of the company to luncheon in the reading-room of the institution. The whole of the viands were cooked in the hall by the apparatus exhibited, and in the presence of the company, by a professional cook from the Crystal Palace, Sydenham, the general arrangements being under the superintendence of Mr. W. A. Dunn, Fowler Street. Mr. R. Wallis, of Old Ridley, occupied the chair; and he was supported by the Mayor of South Shields (Alderman M. Stainton), the Mayor of Jarrow (Alderman P. A. Berkley), the Rev. T. H. Chester (Vicar of South Shields), Mr. W. Anderson (Bent House), Mr. John Henderson (Horsley Hill), &c. The vice-chair was occupied by Mr. J. L. Hall.

The CHAIRMAN having proposed "The Queen," which was enthusiastically received, again rose, and after expressing the pleasure afforded to the directors by such a large gathering that day, remarked that the success which had been experienced showed that the holding of such an exhibition as they had opened that day was a step in the right direction. After referring to the various purposes to which gas was now applied, the chairman went on to say that it had often been remarked that there was nothing new under the sun, but he really thought that this was the first time in the history of this country on which an exhibition of gas apparatus had been held. In connexion with the exhibition many novelties were exhibited, and he had no doubt, now that it had been shown to how many purposes, in domestic economy especially, gas could be applied, that many persons would be induced to adopt, and particularly after noticing the attractive cooking ranges which were manufactured, and which were found to be so well adapted for the purpose intended. He concluded by proposing—"Success to the first exhibition of gas apparatus," coupling with the toast the health of Mr. Spice, president of the British Association of Gas Managers.

Mr. SPICE, in acknowledging the compliment, said that the exhibition did great credit to the directors of the South Shields Gas Company, and their talented engineer, Mr. W. J. Warner, who, he was given to understand, first shadowed forth the idea so warmly and spiritedly undertaken by the directors, and with a result that did honour to all concerned, and which his hearers, he believed, fully appreciated.

The CHAIRMAN then proposed the health of the judges, Messrs. John Pattinson, of Newcastle, and W. H. Bennett, of London.

Mr. PATTINSON replied, and, in doing so, said that he had no doubt the example of the directors of the South Shields Gas Company would speedily be followed by many other gas companies throughout the kingdom.

Mr. BENNETT also responded, and remarked that all gas companies acting under statutory powers had to incur certain legal responsibilities, and he believed the South Shields Company had not only fulfilled all that could be required of them in this respect, but that they had also fulfilled a moral responsibility by doing the utmost they could to enlighten their consumers, and teach them the best way to economize and take advantage of the gas supplied to them. He thanked both the company and the exhibitors for the compliment paid to him in appointing him as one of their judges.

Mr. J. M. MOORE afterwards proposed—"Success to the borough of South Shields," coupled with the name of Mr. Robert Wallis, the chairman of the gas company.

Mr. WALLIS rose amidst great applause, and briefly acknowledged the compliment, in the course of his remarks alluding to the fact that the luncheon of which they had partaken neither smelt nor tasted of gas.

Mr. WYNN (Cheltenham) expressed, as a stranger and an exhibitor, his thanks for the manner in which the South Shields Gas Company had received and treated him and the other exhibitors.

Mr. WARNER responded, and after expressing a hope that the use of gas would become much more general for cooking than at present, referred, as a proof of the adaptability of gas for such a purpose, to the excellent cooking of the meat in the presence of so great a crowd as had been assembled.

The proceedings shortly after terminated.

On Tuesday the directors entertained about 80 gentlemen, mostly managers and secretaries of gas companies, to a luncheon, cooked, as on the previous day, by gas in the apparatus exhibited in the hall, the soup, fish, joints, vegetables, and pastry being pronounced excellent by every one who partook.

On Wednesday evening a lecture by Mr. Hugh Lee Pattinson was delivered, and Mr. Warner read the following paper:—

Ladies and Gentlemen,—To me it appears almost impossible to over-estimate the value of exhibitions such as the one just inaugurated. To the directors of the gas company, South Shields and its neighbourhood are greatly indebted. The gas companies, too, of far distant places, as well as those nearer home, will be more or less benefited by the enterprising directors of this company, and by the incessant labours of our estimable chairman and his most worthy colleagues, Messrs. Hall and Henderson, to make this undertaking a success. At their request I have to apologize to those who have visited the exhibition for not having published a catalogue. The time was, however, necessarily so limited for getting the articles into their places, that it was impossible to prepare and print a catalogue in time for the opening. Though thus deprived of the pleasure of consulting a catalogue in a crowded exhibition, it is hoped there has been no lack of means for imparting information. Besides the exhibitors, to whom we are all indebted for their attendance, the company's officers have been in constant attendance to explain and put into operation the articles so well exhibited. The work per cubic foot of gas, whether employed for heating, cooking, or motive power, must necessarily be the measure for comparison. We may fairly say, then, that those articles which do the greatest amount of work per cubic foot of gas consumed, will be economically the most perfect, whether the gas be employed

for heating, cooking, or motive power. The economy must be dependent on the construction and arrangement of the burners and valves in connexion with them, and also upon the construction of the apparatus itself. So many rival claims are set up for various descriptions of burners, that the committee would have felt justified in offering a medal for competition, had it not been thought this would have carried them beyond the objects of the exhibition, which was to be exclusively, or as far as possibly so, of a decidedly practical character; thus it will be seen that the burner could only be dealt with as forming a portion of a whole or a part of an apparatus. As it has been in the case of lighting, so it must necessarily be in the application of gas to other purposes; economy must be a very necessary element in its success; you should, therefore, convince yourselves that it does possess this quality. By this I do not mean that gas can, for all purposes, be placed in competition with coal or coke as a fuel, without reference to the nature of the apparatus or the work to be done. That there is economy in its use for domestic purposes, however, there is abundant proof. Without entering into the experiments of the judges, the exhibitors can give you the results of many experiments and long years of experience. I will give you but two facts; one abroad, the other at home. Sir Edmund Hay Currie, chairman of the London Hospital, says "the gas-cooking system has been carried on for the past six years at this establishment; that the waste in cooking is materially reduced, while as to economy, in comparison with other fuel, we have reason to know that the consumption of gas to the kitchen of the hospital (which has upwards of 600 indoor patients and a corresponding staff of attendants) is something over 1800 feet, representing about 7s. per day, the cooking being done on two days in every week partly by gas, and the other five days entirely; £500 a year is the average saving in meat alone." The other fact is this. The consumption of gas during the recent course of lectures upon cooking in this hall was 6300 cubic feet; the cost was £1 2s. 1d., or 7s. per week for the numberless dishes which were cooked; and the whole of the gas registered was not consumed, one of the pipes having been broken during the lectures, and not discovered for some time. It is not solely upon the grounds of economy that the use of gas is recommended for domestic purposes, but also upon its controllability, and, therefore, its adaptability to all domestic requirements—it will cook an ox as well and with as much ease as a beefsteak, or drive a steam-engine as well as it will simmer a little beef-tea. On talking over this matter with a kind exhibitor, Mr. Swan, of Newcastle, he said to him it always appeared that the distribution of gas was the perfection of civilization; but, he added, "we burn it like heathens." This brings me to another point, upon which I may give you a word of advice; do not believe what some makers and others will tell you about a flue; such is just as necessary with gas as any other kind of fuel. With apparatus for warming apartments, the products of combustion, however, may be, and should be, kept quite out of the apartments; hence the beautiful adaptability, and the uniformity of temperature that may be maintained, by gas for the heating of apartments. In the heating of baths there is another requirement—expeditiousness; in this gas stands pre-eminently alone. This quality is absolutely essential for an occasional fire. With most English people, too, sight as well as feeling must be gratified. For a drawing-room in changeable weather, or on a chilly summer evening, the open "cheerful" gas-fire answers its purpose most admirably. From the drawing-room to the workshop or kitchen, what a change! Can there be a greater? Gas, like the atmosphere, pervades every place in a large city, and answers the purposes of all alike. Just as safely and as easily, without soiling the fingers, the lady may, after lighting her drawing-room fire, descend to the offices and start an engine to do the drudgery of her household. As a source of power, either indirectly, as applied to a boiler for raising steam, or directly by the explosion of the gas, we have a motive power that will at no distant day be generally applied wherever a gas-pipe is laid. Engines set in motion are no toys or philosophical playthings. An engine constructed on the same principles as one of those you see at work, has been in use for some time now in Sir William Armstrong's works. In the apparatus exhibited it will be observed that the energies of the designers have not been exclusively directed to the principles of construction, the form and configuration have been much improved; there is an excellent display of artistic talent. The manufacturers have well responded to our invitation to produce a cheap stove for the million; there are marvels of cheapness displayed. If the blessings of gas-cooking do not fall equally upon the poor as the rich, it will not be the fault of the manufacturers any more than the sin of the consumers ignorance can be laid at the door of ourselves. Besides those things which the exhibition was intended to make you familiar with, others will be found exhibited of a most interesting character. The calendering machine, useful to dyers and others, exhibited through the kindness of Mr. Hepworth, of the Carlisle Gas-Works, whose invention it is, does excellent work. There is, too, the beautiful singeing-machine of Mr. C. Wilson, the patentee, Leeds, which shows, as nothing else can, the perfect controllability of gas-flames to perfect and finish the beautiful productions of the lace manufacturer, the loose fibres of the lace being burnt off by passing the lace through a gas-flame. Mr. Swan, of Newcastle, exhibits some of the most interesting articles—one, a beautiful application of pure science to the common requirements of every-day life. The apparatus is called a thermostat; it is for the purpose of maintaining a uniform temperature, to within a degree, by means of an electric current. There are also the interesting contrivances of Mr. Cowan and Mr. Morrison, of Edinburgh—water still, vapour bath, and gas furnaces. Can I say more to interest you in this exhibition? The gas-pipes appear to be not only "the perfection of civilization," but the conduits of mighty forces—light, heat, power—the elements of which were created, gathered, and stored by our heavenly Father through long past ages to refine, elevate, and bless mankind.

The paper read by Mr. Warner was listened to with great attention.

On the two following days—Thursday and Friday—the hall continued to be attended by throngs of interested visitors, and on Friday evening the exhibition was brought to a close by the mayor proposing a vote of thanks to the chairman and directors for the public-spiritedness and liberality shown on this occasion. The vote was heartily responded to by a round of cheers from the crowded hall, and acknowledged by Mr. Hall, one of the directors.

Thus ended one of the most satisfactory demonstrations of the applicability of gas to the many purposes occurring in daily life. The arrangements made were such as reflected the very greatest credit upon all who were engaged in the undertaking, and for all time to come the South Shields Gas Company and their officials will be pointed at as examples it will be the duty of others to follow.

ROYAL INSTITUTION.—Mr. James Dewar, F.R.S.E., Jacksonian Professor of Natural Experimental Philosophy in the University of Cambridge, was on Tuesday last elected Fullerian Professor of Chemistry, in the room of Dr. J. H. Gladstone, resigned.

BIRMINGHAM WATER SUPPLY.—Dr. Hill, Medical Officer of Health for Birmingham, reports that the water supplied to that town during March was slightly turbid, but showed a marked diminution in the amount of organic matter.

THE CHEMISTRY OF GAS MANUFACTURE.

By A. VERNON HARCOURT, Esq., F.R.S.,

One of the Metropolitan Gas Referees.

[A course of Four Cantor Lectures delivered at the Society of Arts, London.]

THIRD LECTURE.—MONDAY, MARCH 19.

The substances which we have considered hitherto have been those removed from coal gas in the processes of condensation and purification. Fortunately, we can succeed in the manufacture of coal gas, in retaining those substances which are valuable as giving light or heat, and removing those which either diminish the power which the gas has of giving light, or are in other ways injurious. I have placed again upon the wall the diagram illustrating the apparatus by which gas is purified. I spoke in my last lecture of the two alternative materials employed for the removal of sulphuretted hydrogen. The diagram is intended to show an iron box with two layers of oxide of iron, through which the gas passes; and, either by this material or by lime, sulphuretted hydrogen is wholly removed from the gas. There is another of the ingredients of coal gas always present in the crude gas, which may or may not be removed by purification—namely, carbonic acid. In the table to the right are some analyses, made several years ago by Dr. Frankland, of the composition of gas as it is supplied to the consumer, and they represent accurately enough the composition of gas as it is made now, there having been no material alteration in the process of manufacture.

You will see that the gas is here divided into what are termed *illuminating hydrocarbons*, of which ethylene or olefant gas is the principal; *marsh gas*, and *hydrogen*, which together form, by volume, much the larger proportion of the gas; *carbonic oxide*, which comes third in order of quantity; and, besides these, there are small proportions of *carbonic acid*, and of *nitrogen* and *oxygen*. I propose, in my next lecture, to speak of those which are the more important constituents of coal gas, for the purposes for which we use it; and, in the present one, to direct your attention to this substance (carbonic acid), and to another substance chemically resembling it, in which the carbon is combined, not with two atoms of oxygen, but with two atoms of sulphur—namely, carbon bisulphide.

I will show you, in the first place, a familiar experiment, to illustrate the formation and properties of carbonic acid. When a piece of charcoal is heated in the air, we all know that it burns, but not very readily; that, in fact, many pieces must be placed together, in order, by the exchange of heat between them, to maintain a sufficient temperature for their combustion with the oxygen of the air. But if I take, instead of air, a bottle of oxygen, and transfer the piece of charcoal, which is still alight, to the oxygen, you see the brilliant combustion which takes place. That combustion consists in the union of the carbon and the oxygen, the two substances which the bottle contains. They combine directly together, forming carbonic acid or carbon dioxide.

I will allow the carbon to burn, and I will show you the properties of the gas which is formed, using another bottle which has been previously filled with it. Observe, first, the property which carbonic acid has of extinguishing flame. A lighted taper lowered into the bottle is extinguished. This, of course, is a negative property, and shows only that carbonic acid is not air or oxygen, and will not do what air or oxygen will do—namely, combine with the carbon and hydrogen of the taper. Another property of the gas is its high specific gravity as compared with air. If I take this bottle of carbonic acid, and pour it into what we call an empty bottle—that is, a bottle filled with air, we shall, owing to the difference of specific gravity between them, obtain an exchange of their contents. The difference is not like that between water and air; the gas pours rather slowly, but probably I have now effected a transference. The uppermost bottle has lost its carbonic acid, and becomes filled with air, as you see from the way in which the taper burns in it. The lower bottle has received the greater part of the carbonic acid, as you see from the extinction of the taper.

Another property of carbonic acid is the power which it has of uniting with lime. I have here a solution of lime in water. If I take this solution, which is now perfectly clear, so that it looks like pure water, and pour it into the bottle of carbonic acid, and bring it in contact with the gas by shaking the bottle, you see the milkiness which is produced. This illustrates a chemical change which occurs in the manufacture of coal gas. It is on the affinity between carbonic acid and lime, manifested by the precipitation of the lime in this experiment, that the purification of coal gas from carbonic acid by the action of lime depends.

The formation of carbonic acid in the manufacture of coal gas is probably due to a very small extent, if at all, to the direct action of the air upon the carbon of the coal. This can only happen where the exhaustion—as the pumping of the gas out of the retorts is called—is carried too far, so that the pressure in the retorts is less than the atmospheric pressure. In this case some of the air or furnace gas, from outside, enters through the pores or cracks in the clay retorts, and becomes mixed with the gas. The small percentage of nitrogen which is usually found when coal gas is analyzed, and the further fact that this nitrogen is generally accompanied by oxygen, show that this is not a common occurrence. The main source of carbonic acid, no doubt, is a reaction between the water, which the coal placed in the retorts contains, and the heated carbon. In the manufacture of what is called water-gas—that is, gas produced by the action of steam upon red-hot coke—there are formed three gases—hydrogen, carbonic oxide, and carbonic acid, the proportion between them depending on the temperature at which the coke is maintained. The same reaction happens to some extent in the gas-retort in the ordinary manufacture of coal gas. There is always water in the coal, and as the outer part of the charge lying next to the heated sides of the retort becomes red hot before this water is wholly expelled from the interior of the charge, this same action of steam upon heated coke takes place, and one of the products is carbonic acid.

For the removal of the carbonic acid purification by lime is perfectly sufficient, if only the lime is applied in sufficient quantity, and renewed sufficiently often. The presence of carbonic acid in the gas is no injury to the consumer, provided the gas supplied is of sufficiently high illuminating power; that is to say—provided the illuminating power of the gas is fixed, it matters nothing to the consumer whether he is supplied with a gas which is somewhat richer, and whose illuminating power is to some extent diminished by the presence of carbonic acid, or with a gas otherwise poorer, but free from carbonic acid. Although this substance is injurious when present in any large proportion in the air, yet no objection to the presence of carbonic acid in coal gas can reasonably be made on this ground, since the quantity of carbonic acid yielded by burning gas is not materially affected by its presence in the unburnt gas. Two of the ingredients of coal gas—marsh gas and carbonic oxide—yield their own volume of carbonic acid when they are burnt; and the olefines yield twice, or more than twice, their volume. On the whole, the volume of carbonic acid discharged into a room where gas is burnt is more than it would be if the gas contained 50 per cent. of carbonic acid, the rest being hydrogen. It has, however, been proved that the presence of carbonic acid in coal gas has a decidedly injurious effect upon its illuminating power, and since the formation of carbonic acid cannot practically be avoided, either it must be removed by some subsequent process, or the proportion of illuminating constituents must be increased by mixing with

the ordinary coal a larger proportion of the more costly cannel, or by heating the retorts less strongly, which improves the quality at the expense of the quantity of the gas. Therefore, in the interest of the maker of gas, it is desirable to remove carbonic acid. At present the only mode which is in general use for effecting this object is passing the gas through trays or sieves on which damp slaked lime is placed.

I come next to the substance which I spoke of as being chemically analogous to carbonic acid—carbon bisulphide. I have here a little bottle containing a small quantity of this substance. When pure, it is quite colourless, and of an odour which is not unpleasant, resembling the odour of chloroform. Commonly, it is not pure, and has a slightly yellow colour, and an unpleasant smell. It is very volatile, having a low boiling point and a high vapour-tension at the ordinary temperature. If I pour a few drops of this liquid into a bottle of air, and cause the vapour to displace and diffuse through the air, by shaking the bottle and at intervals raising the stopper, and then pour the heavy gas out of the bottle into this beaker, leaving any liquid there may be still remaining at the bottom of the bottle, and then apply a light to the contents of the beaker, you see the inflammation and gradual combustion of the gaseous carbon bisulphide. This experiment shows, in the first place, that the liquid is very volatile, for it has in a minute or two formed sufficient gas to have nearly filled the bottle into which it was dropped; in the next place, that it is heavy, for I poured it quickly through the air, from one vessel into another; in the third place, that it is inflammable—it lights and burns readily. But I might have shown you that it is very much more inflammable than most substances—that is to say, that the temperature required for its inflammation is much lower than that of coal gas, or most inflammable substances; for if, instead of applying a taper, I had simply heated a glass rod in the lamp, and dipped that into the beaker, I should have succeeded equally well in lighting the carbon bisulphide. Its presence, even in small quantity, when mixed with hydrogen, imparts this property of ready inflammability to the gas; and just as the vapour of the liquid phosphide of hydrogen, or phosphoretted hydrogen, imparts to hydrogen or other inflammable gas the property of what we term spontaneous inflammability—that is, inflammability at the ordinary temperature—so this vapour of carbon bisulphide communicates the property of inflaming at a temperature above the ordinary temperature, but very much below that at which hydrogen would otherwise inflame.

You saw that the beaker in which I burnt the gas just now became opaque. This arises from the imperfect combustion which has taken place. The sulphur of the carbon bisulphide was only partially burnt, and so a part of it remains deposited like flowers of sulphur on the sides of the beaker. That part of the sulphur which was burnt united with the oxygen of the air to form sulphur dioxide, or sulphurous acid. When coal gas, or hydrogen containing the vapour of carbon bisulphide, is burnt in the air, probably in the first instance, the same substance—sulphurous acid—is formed. This oxide of sulphur is readily converted in the presence of air and moisture into another substance containing an additional atom of oxygen—sulphur trioxide; or into that which is formed by the union of this body with water—sulphuric acid. I will illustrate to you, in the first place, one or two of the properties of the gas, formed by burning carbon bisulphide or sulphur itself. I have here some sulphur burning dimly with a pale blue flame. You observe that the transference from the air to a bottle of oxygen produces the same increased vividness in its combustion which you saw before in the case of charcoal. The sulphur now burns with a comparatively bright violet flame; and here also, although in oxygen, the combustion is always imperfect. The white smoke which partly escapes from the bottle, and is partly deposited on its sides, is due to some of the sulphur, which is now boiling, passing through the flame, escaping unconsumed, and then being condensed into smoke. I will try to collect some of this gas, by letting the sulphur burn for a little while longer in the bottle of oxygen, and when it has become a little cooler I will examine its properties. This gas is readily soluble in water, and when coal gas is burnt the two substances are formed and travel away together, the volume of steam being, of course, very large relatively to the volume of sulphur dioxide. If we dissolve some of this gas in water, we have at first simply a solution of it, but if that solution is allowed to stand for some while exposed to the air, and we examine it from time to time, we shall find there is in it an increasing quantity of the more oxidized and more permanent product of the union of sulphur and oxygen—namely, sulphuric acid. I have here an apparatus which is used for testing the amount of sulphur in coal gas, and which I have placed here intending to speak of it presently in referring to the modes in which the amount of sulphur in coal gas is ascertained. I will, however, refer to it now for another purpose.

If the little burner at the bottom of the tube is lighted, and the products of the combustion of the gas are allowed to pass up by themselves, without the addition of ammonia which is made when the apparatus is used as a sulphur test, and the condensed water, with what it holds in solution, is collected in the usual way, we shall always find that the liquid contains sulphuric acid; but not nearly so much as when the pieces of ammonium carbonate, ordinarily employed, are placed upon the stand around the burner. In some experiments that I made, I found that about one-fourth of the total sulphur which the gas contains is obtained as sulphuric acid, when no ammonium carbonate is used. It has been contended, on the one hand, that, when gas containing carbon bisulphide burns in the air, the sulphur is wholly converted into sulphuric acid; and it has also been contended, on the other hand, that the only product is sulphurous acid, and that no sulphuric acid at all is formed. I feel confident, from the experiments I have made, that the truth, as so often happens, lies between the two. If the experiment is made of placing pieces of ammonium carbonate within the lower chamber of the condensing-tube, instead of round the burner, or some pieces of caustic soda on the top of the glass balls,—in either way keeping the condensing surface bathed in alkali, instead of allowing the condensed water to become acid and the sulphurous acid which is formed to be exposed to the current of air which is passing through,—we find that the whole of the sulphur in the gas is present in the liquid at the bottom of the apparatus in the form of sulphate. This does not prove that when the gas is burnt the sulphur in it is converted into sulphuric acid, but only that when the glass balls are steeped in an alkaline liquid the sulphurous acid is retained, and that by the time the solution has trickled down into the beaker below, the salt formed is in the condition of sulphate. In the other case, where no alkali is used, but only condensed water, to arrest the products of combustion, sulphuric acid would be fixed as readily as before, since its aqueous solution surrenders none of it to a current of warm air, but sulphurous acid would be imperfectly retained. There is a very large volume of air passing up through the apparatus, and into this atmosphere the sulphurous acid readily diffuses out of the aqueous solution. I mentioned to you, in a former lecture, that a much more soluble substance than sulphurous acid—namely, ammonia—escapes entirely out of a solution freely exposed to the air. And that which happens to the solution of ammonia happens also to the solution of sulphurous acid. Allowed to stand, with a continuously renewed atmosphere over it, the gas diffuses out of its solution, consequently, a good deal of the gas which is formed escapes into the air, and it is necessary that there should be some alkali

present in order to combine with the sulphurous acid, and to form a fixed substance, such as sulphite of ammonium or sulphite of sodium, for it to be permanently retained. When it is thus retained, and exposed for a little time to a current of air, it is oxidized, and the final product is an alkaline sulphate.

I will now show you one or two of the properties of the sulphurous acid which I have formed in this bottle by the combustion of sulphur. I have here two coloured liquids, and I will show you the action which the gas has upon these liquids. I pour some of the sulphurous acid, which is more than twice as heavy as air, over the blue and over the red liquid in these two beakers, and stir with a glass rod. You see that in both cases the colour disappears.

Now the substances which I have here used are delicate chemical reagents; the blue liquid was iodide of starch, and the red liquid was permanganic acid—an acid solution of permanganate of potash. I would not have you suppose that the effect which sulphurous acid has on these liquids at all represents the action of the diluted gas upon ordinary colouring matters. It is true that by the gas, in so concentrated a form, many colouring matters are bleached; but when it is in a dilute form, its action upon colouring matters is, at any rate, exceedingly slight.

A question of much importance, both to the manufacturers and the consumers of gas, is that of the injury which is supposed to occur through the presence of small quantities of sulphurous or sulphuric acid in the air of rooms lighted by gas. As to its effect upon health, I do not believe that there is any evidence that the small proportion of sulphurous acid which can be present in the atmosphere of a fairly well-ventilated room, through the combustion in the room of an ordinary quantity of coal gas, containing no more than an ordinary quantity of sulphur, is prejudicial to health.

Then, again, as to the effect upon objects in the room—articles of furniture or books. The strongest evidence of an injurious effect thus produced appears to be in the case of the effect upon the binding of books. Several years ago there was a very careful investigation made into this matter at the Athenæum Club, by Faraday, Brande, and others. It was shown that the binding of the books was decaying; and it was observed also that the bindings suffered more, of books placed in the upper shelves, than of books in the lower shelves, and it was believed that this injury resulted from the introduction of gas for the lighting of the rooms of the club. It was proved also that sulphuric acid could be found in the air of the rooms. Vessels of water, exposing a large surface, were placed in different parts of the room, and it was shown that by degrees a considerable quantity of sulphuric acid was accumulated. But the evidence as to the injurious effect being due to the sulphur from the coal gas is very imperfect. Evidence was given by bookbinders that there had been a change in the mode of preparation of the leather used in the binding of the books—that more acid had been used after a certain date than before, and, in consequence, the bindings had not lasted so well. There were cases also of other libraries, in which no gas was used, where a similar decay in the bindings of the books had occurred, though to a less extent. Then as to the manner in which the injury was done. Supposing it were produced in some way or other by the gas, there was the further uncertainty whether it was due to the sulphur in the gas, or to the heat produced by the large quantity of gas burnt. As to the effect on pictures, it is certain that some pigments—ultramarine, for example—are injuriously affected by the deposition upon them of acid liquid, and the canvas at the back of pictures is said to be destroyed by the same agency. But I believe it is found in picture galleries which are now lighted by gas, and where, as no doubt should be the case, great care is taken with the ventilation, that no injury has resulted. There is, however, an objection which is very much more difficult to meet—namely, that persons living in rooms which are lighted with gas containing rather a large proportion of sulphur, find it disagreeable. Nor is this an objection which can be simply laughed at. It is not enough to say to a man who complains that he finds the atmosphere of his room unpleasant, that there is no evidence that that which he complains of is injurious to his health. It is not only that which can be shown to be prejudicial to health which can fairly be the subject of complaint. Nor are experiments upon the quantity of sulphurous acid present in the air of a gas-lighted room, nor the conclusions which may be drawn from the rate of ventilation, and the amount of sulphur burnt, as to the quantity of sulphurous acid which can possibly be present, conclusive as against the complaint that the atmosphere of the room is found to be unpleasant, and that the unpleasant smell is that of sulphurous acid. The only logical conclusion to which a comparison of these data can lead is, that a very small quantity of the gas is unpleasant. My own impression is that where ventilation is imperfect, as it commonly is, and the proportion of sulphur in the gas is rather large, it is possible to distinguish the presence of sulphurous acid. These direct sensations are not very describable to others; a certain sense rather perhaps of taste than of smell, which is familiar to travellers by the Metropolitan Railway, and is known to chemists as that which sulphurous acid produces, may be observed in these circumstances, when no fire is alight and sulphurous acid can proceed from no other source than the combustion of gas.

Really, the question resolves itself into a commercial question, as to what is the value of the impression which exists on this subject. Now, if it were possible that gas could be supplied otherwise than as a monopoly, and that consumers of gas could have the choice, which they would have—gas which cost rather less, say 3s. 9d. per 1000 cubic feet, and which contained some 35 grains of sulphur in 100 cubic feet, or gas which cost rather more, say 3s. 11d., and which contained less sulphur, say 10 or 12 grains in 100 cubic feet,—which would be preferred? I do not know what the general feeling is, but, for myself, considering both the sensible effect on the atmosphere of a room, and the likelihood of injury to articles of furniture from even a slight vitriolic dew, such as undoubtedly is deposited, I would rather pay the extra twopence and have the purer gas.

I pass now to the modes by which the carbon bisulphide in gas, supposing its removal desirable, can be removed. The process generally employed for its removal is the transmission of the gas through lime which has already served for removing sulphuretted hydrogen; and, as far as the immediate object is concerned, it is not possible to have a better agent. If coal gas, or hydrogen which has been charged with bisulphide of carbon, passes through a not excessive quantity of sulphide of calcium,—the substance into which the lime is changed by the action of the sulphuretted hydrogen—the bisulphide of carbon is wholly removed. I believe this removal can be effected almost as completely by the action of sulphide of calcium as that of carbonic acid, or sulphuretted hydrogen, by the agency of clean lime.

I have here a little apparatus which I contrived a year or two ago for the estimation of sulphur in coal gas. It consists of a small bulb, which is filled with pieces of pumice which have been steeped in solution of platinum, the object being to have in a small space a large surface. Through this bulb the gas passes; it is surrounded with a cylinder of porous clay, and there is a lamp burning with a very low flame beneath it. The gas enters by the tube, passes down to the bottom of the bulb, and then up through the heated material, and so out by the horizontal tube. Thence it passes downwards through the liquid in this glass. The liquid

is a solution of lead in soda, mixed with some syrup or solution of sugar. The lead serves to give a dark colour with the sulphuretted hydrogen, which passes through the solution. The gas as it enters the apparatus is free from sulphuretted hydrogen, but the action of the heated surfaces upon it transforms the bisulphide of carbon which it contains, in presence of the hydrogen of the gas, into sulphuretted hydrogen. Thus the test consists of two parts. First, there is the action of the heated surfaces on the gas, which turns the bisulphide of carbon into sulphuretted hydrogen; and, secondly, there is a test for sulphuretted hydrogen—namely, this lead solution which is coloured by it. In order to make a quantitative estimation, I have by the side of the lead solution another glass, containing a liquid of a colour similar to that which the lead solution will acquire. The solution is not the same, for the solution which is coloured with sulphide of lead is not coloured permanently; by this light it is permanent, but exposed to daylight it quickly fades. All that is necessary is to have a solution, whose colour is fixed, comparable with that of the liquid coloured by the sulphide of lead. It is necessary also to know what quantity of gas is operated upon. That is ascertained by running the water from the aspirator, which draws the gas through, into this graduated cylinder. Then, on reading off the quantity of water, I know that from a volume of gas, which is equal to this volume of water, has been extracted a quantity of sulphur sufficient, in the form of sulphide of lead, to impart this degree of brownness to this volume of lead solution. That, of course, constitutes a quantitative test, and by the action of the heating apparatus it is applicable not only to gas containing sulphuretted hydrogen, but also to gas which does not contain sulphuretted hydrogen, but only bisulphide of carbon, for the estimation of the quantity of sulphur present in that form.

Besides calcium sulphide many other substances have been tried for the purification of gas from bisulphide of carbon. It would be very desirable, if it were possible, to use a liquid instead of a solid reagent for this purpose, because it would be much easier, in working with a liquid, to avoid that nuisance which is liable to be caused, unless special precautions are taken, by the handling of this sulphide of calcium, or, as it is justly called, "foul lime." I have made many experiments on this subject, and the results of a few I have made recently are written upon the board. I have tried with an apparatus which I showed you at my last lecture, and which is a very efficient form of washer for laboratory experiments, the action of various liquids upon the coal gas supplied in Oxford, which contains a very fair proportion of carbon bisulphide. These are some of my results. I made an examination first of the gas supplied to my laboratory, and found it contained 33½ grains of sulphur in 100 cubic feet. Then I passed gas, at the slow rate at which it travels through the testing apparatus, over a solution of ammonium sulphide—which is one of the liquids that have been recommended—and found that the amount of sulphur remained practically the same. Then I passed it over ammonium sulphide in which an extra dose of sulphur had been dissolved; the liquid dissolves sulphur readily, and acquires a bright yellow colour. Again I found that practically the sulphur was unaffected. Then I tried a solution which suggested itself to me as being likely to answer—a mixture of ammonium sulphide with calcium chloride. When these substances are mixed the lime is not precipitated, but remains in solution. We have, therefore, a solution probably containing ammonium chloride and calcium sulphide, and I thought this might answer as well as the solid calcium sulphide. I have given the actual numerical results obtained in the different experiments, but they are practically the same. There was no improvement produced by washing the gas with that reagent. Then I tried another substance, which has been recommended—a solution of sodium sulphide. It has been assumed that this solution would answer as well as the solid calcium sulphide itself. But again I found no effect was produced. I tried a solution of litharge in caustic alkali, and that again had no effect.

The only liquid which produced any effect upon the gas was some of the less volatile part of petroleum. It seemed likely that the reason why the other substances had no effect was that they were all dissolved in water. Bisulphide of carbon does not mix with water, and, consequently, substances which are in aqueous solution are as if they were varnished over and kept from contact with the carbon bisulphide. If we take a liquid which can be mixed with carbon bisulphide, such as alcohol—an alcoholic solution of potash, for instance—then we have an action. I found that the heavy petroleum mixes readily with carbon bisulphide; and I found, using that as a washing liquid, that there was, by no means a complete effect, but still a considerable effect, that the quantity of sulphur in the gas was reduced to something like one-half what it had been previously.

Another mode of removing carbon bisulphide from gas, which has suggested itself to various persons—I believe the first who brought it prominently forward was Mr. Bowditch, a good many years ago—is by acting upon the gas with heated surfaces. I use that expression rather than heating the gas; because I believe if it were possible to heat the gas without placing it in contact with heated surfaces, the effect would be little or none. When gas is brought into contact with heated surfaces—it is not necessary that their temperature should be even near that of a red heat—the change which I have already referred to in speaking of the action of the colour test takes place, and the hydrogen of the gas and the carbon disulphide act upon one another, and sulphuretted hydrogen is formed. This, therefore, if used on a large scale, offers the means of removing the sulphur from coal gas; since we can transfer the sulphur from its combination with carbon—in which form we have no more convenient reagent than calcium sulphide for arresting it—into a combination with hydrogen, which we are able to remove by means of oxide of iron.

The experiment of acting upon gas with heated surfaces was tried on a rather large scale, between two and three years ago, at the Horseferry Road station of The Gaslight and Coke Company. I have here a diagram showing two sections of an apparatus constructed by Dr. Siemens for this experiment.

The apparatus was in action for some time, but, as will happen with experimental apparatus, there were many difficulties in working it. The iron plates which separated the gas from the fire cracked, and were difficult to mend. The gas which escaped ignited, and added to the strength of the fire, and the temperature was liable to become unduly high. Also the material through which the gas passed was in too large pieces, and did not present a sufficient surface.

I have here a record of my experiments, showing that two or three times, for a week or ten days together, when passing gas through the apparatus at the rate of 10,000, or even 20,000, cubic feet an hour, I succeeded in reducing the amount of sulphur from 30 or 40 grains to between 10 and 15 grains per 100 cubic feet of gas. But after these short periods of successful working the purifying effect gradually diminished.

I think that probably this disappointing result arose from the difficulty of managing the temperature of the apparatus, and the ill effect of heating it too strongly—viz., a deposition of carbon upon the materials with which it was filled. The amount of this deposition of carbon was not such as to produce any prejudicial effect on the illuminating power of the gas, but it affected the surface of the material which was used to act upon the gas, and rendered it much less efficient for the purpose.

I have made, since that experiment was terminated, a good many more laboratory experiments on the same subject, especially to ascertain what material was most favourable for the purpose, and I find that the quantity of the substance which it is necessary to heat, and also the requisite temperature, may be very much reduced by having a different material, and that in a form more favourable to the action of its surface and the equable distribution of the gas current. I have made recently a number of experiments with a material made into what appears to be the most convenient form—viz., little balls, and consisting of a mixture of clay and oxide of iron, the latter of which is changed, when thus heated in the presence of coal gas, into metallic iron. The particles of iron thus formed being separated by being mixed with clay, do not fuse and run together, as iron which is heated in gas containing sulphur is apt to do if its particles are contiguous one to another, but are kept apart in a state of fine division, and thus present a large surface. The quantity of gas that can be purified by a very small quantity of this material is really very remarkable. I have made quantitative experiments, using only the small amount of material which I have in such a bulb as this, containing about 2 cubic inches, or somewhat less. I have passed the gas through this bulb, heating it in the manner shown, measuring the rate at which it passes, collecting it, and then ascertaining how far the sulphur in that gas was reduced.

I tried, first, whether making these balls of clay only would answer the purpose, and I found that for a moderate rate of passage of the gas, clay answered fairly well; but when I forced a larger quantity of gas through the small bulb the effect diminished. I then tried the mixture I have described, of clay and iron, and with this I found that I could purify gas as fast as, with the pressure at my command, I could send it through the bulb. On sending the gas through at the rate of between 9 and 10 cubic feet an hour, which, considering the quantity of material used, is very fast indeed, the purification effected is as great, with that rapidity of passage, as it is with a lower rate.

After streaming through the contents of the bulb, the gas was purified from the sulphuretted hydrogen which is formed, by passing it through a small tube containing oxide of iron. When balls of clay were used, and a small quantity of gas passed through, the amount of sulphur remaining was only 9 or 10 grains; but when a larger quantity was sent through—namely, 6, 7, 9½ cubic feet per hour—then gradually the effect diminished, and almost disappeared. But with balls of clay and iron, even with this large quantity of gas passing through, the effect was always uniform, and the amount of sulphur, which, as it entered the apparatus, was between 30 and 33 grains per 100 cubic feet, was uniformly reduced in all my experiments to between 9 and 10 grains per 100 cubic feet.

I have, of course, been alive to the danger of this effect being a transient one. Some weeks of continuous heating and passage of gas have not impaired it, and I am now engaged in pushing the trial further. I hope to find that the lower temperature which, with this material, is sufficient for the destruction of carbon bisulphide, may be low enough to cause no deposition of carbon from the gas. Experiments on a large scale are difficult and costly to make; but my belief is that, if I could place in the top of the large experimental apparatus such a material as I now use, it would purify a much larger volume of gas than was actually sent through it. It is easy to calculate, from the experiment on a small scale, what should be the effect of using the same material on a larger scale—that is, how much gas should be purified, if, instead of employing these two cubic inches, I employed, say, a cubic yard. I find, making this calculation, that to purify the winter make of gas of some of the largest London gas-works, such as 5½ million cubic feet a day, it would only be necessary to use one cubic yard of such material—that is to say, a quantity which could most easily have been placed in the top of the apparatus that I had in use.

There is one other point I wish to refer to—namely, the effect of carbonic acid in gas upon the purification of gas from sulphur by the action of calcium sulphide. It was pointed out a few years ago, I believe by more than one person at about the same time, that the main reason why the purification of gas from sulphur by the action of lime showed so great a want of uniformity was, that the calcium sulphide—the chief purifying agent—was liable to be decomposed by the carbonic acid of the gas. What was necessary for effective purification was, that lime should be used in sufficient quantity to remove the carbonic acid wholly, in the first purifiers, so that some of the purifiers should contain undecomposed calcium sulphide which would then retain the bisulphide of carbon. I made, at that time, some experiments upon the effect of carbonic acid on calcium sulphide, which had been used to purify gas from sulphur and the results I think are still interesting. I first prepared some calcium sulphide, and used it to purify gas, which it did very effectually, down to 10 or 12 grains per 100 cubic feet for some weeks together, the carbonic acid in the gas being carefully removed before the gas entered the tube filled with calcium sulphide. I then allowed gas to pass through, containing carbonic acid, and pushed the experiment further by adding carbonic acid to the gas. The issuing gas then contained a very large quantity of sulphur indeed. The gas freed from carbonic acid showed only some 10½ grains per 100 cubic feet. When I passed through the same material gas to which I had added a little carbonic acid, I found 68½ grains per 100 cubic feet. I pushed the experiment further, adding a larger quantity of carbonic acid, and found 135 grains of sulphur. With still more carbonic acid I got as much as 245 grains of sulphur given off. Crude coal gas may occasionally contain a considerable quantity of carbonic acid. So there can be no doubt that the cause assigned for the fluctuations in the amount of sulphur when lime was used in insufficient quantity is a true cause, and that the very large quantities of sulphur sometimes found in gas result from carbonic acid being allowed to go forward in the lime purifiers, and so to set free the sulphur which has been removed by the lime from a previous quantity of gas.

In the next and concluding lecture I propose to speak of those ingredients of coal gas which are most important for their heating and illuminating properties.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The week has again been a quiet one in most respects, although there have been throughout some very persistent and disquieting rumours of further forthcoming failures in two or three branches of business.

In pig iron the current transactions are on a moderate scale only, and prices are only just maintained, owing, to a great extent, to the weakness of other markets. Forge pig is selling rather more freely for the Leeds and Wakefield districts, but it is not coming here at all freely. Foundry numbers are in steady request, although it cannot be said that the parcels which are changing hands are very bulky. Producers of all sorts of pig iron appear quite willing to sell a month or so ahead, but they do not care to bind themselves for long forward deliveries at the present prices.

In merchant iron there has been a drop of 10s. per ton by some of the vendors of medium bars, but no general reduction has been declared, nor is it likely to be announced now that the quarterly meetings have passed over without producing the change so much needed. In the brass foundries, and generally in the brass-works of Sheffield, Rotherham, &c., there

is a fair amount of work in course of being executed, but there is not any activity, in the proper sense of the word, nor do the order-books promise any great improvement in the immediate future. Water fittings appear to be in best request at the leading works.

In the coal trade there is no quotable alteration of prices, the tendency of all kinds of house fuel being downwards. Steam coal is unchanged by the mutual combination of its vendors; but gas coal and slack are rather firmer, although I do not anticipate that the former will become appreciably dearer during the summer. At several of the South Yorkshire collieries there are strikes, and in Derbyshire some pits are being temporarily closed.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade generally continues in a depressed condition, and although the recent stoppage of many of the pits for the holidays tended to reduce temporarily some of the surplus stocks lying in waggons on the pit sidings, supplies are still generally abundant in the market, and there is every prospect of low prices ruling during the summer. So far as gas-making coals are concerned, although the price of cannel may not be materially affected, it seems probable that consumers of ordinary descriptions of gas coal will be able to place their contracts on favourable terms, as round coal has been so plentiful this winter that holders will be anxious to secure orders, if only to enable them to meet the requirements of their customers for slack, for which they are now able to command fair prices. The average pit quotations at present are without material alteration, and may be given about as under:—Good Arley, 9s. 6d. to 10s. 6d. per ton; Pemberton four-feet, 8s. 6d. to 9s.; common coal, 6s. 6d. to 7s. 6d.; burgy, 5s. to 5s. 6d.; and slack, 3s. 9d. to 4s. 9d. per ton, according to quality.

The grievances which the coal merchants of this district have against the railway companies were brought before a meeting of the recently-formed Lancashire Coal Traders Association, held in Manchester last Tuesday. One point of complaint dealt with was the unreasonably short time which the companies allowed for loaded waggons to stand on the sidings before charging for demurrage, and it was strongly urged that not less than four days, exclusive of the day of arrival, should be allowed. Another grievance was the frequent delays which occurred in the transit of coal from the pits, and upon this question it was urged that the railway companies should be made liable for all loss arising therefrom.

In the iron trade there has been little or nothing doing, but prices are without material alteration, as makers are unable to do legitimate business at lower rates than they have been quoting. For finished iron there have been a few inquiries, but there have been very few orders given out. Manufacturers are, in some cases, pushing keenly for business, but the current market rates remain at from £6 15s. to £7 per ton for bars, according to quality. Founders are very slack, and it is the same with engineers, except in one or two shops here and there, which have special work on hand.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At the ordinary monthly meeting of the Town Council of Dumfries, held on the 9th inst., the clerk reported that in terms of the resolution of the meeting held on the 2nd ult., he had made the publication directed by the Gas Act in the three local newspapers, and also in a placard throughout the burgh during the month, and that no remonstrance against the adoption of the Gas Act had been lodged with him by any ratepayer, and that therefore there was now nothing in the way of the resolution of the council being carried out. Bailie Nicholson was of opinion that there had been a virtual adoption of the Act by the burgh, but the clerk said it still required to be registered before it could be said to be completely adopted, but that could be done at any time, should the council resolve to apply the Act. He said he had received a notice from Bailie Wood that at next meeting he would move that the council, as commissioners under the Burghs Gas Supply Act of 1876, resolve to exercise the powers conferred upon them by the said Act, and give notice to the Dumfries Gas Company that they were prepared to treat for the works, lands, and plant of the company, on terms to be mutually agreed upon, or to be fixed by an arbiter, as provided for by the Act. On the motion of Bailie Nicholson, seconded by Mr. Johnston, it was agreed to get the Act registered preparatory to Bailie Wood's motion being considered.

A special meeting of Police Commissioners of Johnstone was held on the 5th inst., to consider and decide upon the further proceedings to be taken under the Burghs Gas Supply (Scotland) Act. The clerk read a copy of the minute of registration of the adoption of the Act by the commissioners, in the sheriff books of the county of Renfrew, by Sheriff Cowan. The next step was the appointment of a Gas Committee, and, on the motion of Provost Shanks, it was unanimously resolved that the said committee should consist of the whole of the commissioners.

Many persons connected with the manufacture and supply of gas in other large towns throughout the kingdom, and possibly even abroad, may feel interested in being enabled to inspect the following table, which represents the quantity of gas manufactured annually in Glasgow from 1827 to 1875:—

Year.	Quantity of Gas made, in Cubic Feet.	Year.	Quantity of Gas made, in Cubic Feet.
1827	79,234,910	1857	697,378,000
1832	100,068,200	1862	821,849,000
1837	162,605,800	1867	1,119,842,000
1842	198,522,500	1872	1,559,190,000
1847	391,353,000	1875	1,649,616,000
1852	505,285,000		

It may be noticed that there was no very material increase in the period from 1872 till 1875, but the explanation of that circumstance lies in the fact that it is since 1872 that the Partick, Maryhill, and Hillhead Gas Company commenced to supply gas over a large area that would otherwise have been included in the Glasgow supply, including suburban districts, whose population has increased enormously during the last few years. I think I am quite safe in saying the consumption of gas, in proportion to the population, is not so great in any other large town in the kingdom as it is in Glasgow.

The illuminating power of the gas supplied to Greenock during the month of March was equal to an average of 28·96 standard candles.

On Tuesday last the Glasgow Corporation 6½ per cent. Gas Annuities brought an advance of 15s. at 168, and on the following day the 9 per cent. Gas Annuities changed hands at a rise of £1 at 224.

On the 6th inst. a number of the Kirkintilloch Gas Company's shares were sold by public auction. In lots of three shares each, the £5 shares brought respectively, £10 4s., £10 9s., and £10 11s. per share. These shares were originally £5 shares, and the highest price ever previously attained was £8 10s. about two months ago.

At a recent meeting of the Glasgow Corporation Gas Committee it was resolved to make very considerable extensions to the coal storage accommodation at the Tradeston and Dalmarnock Gas-Works. The estimated expense in the one case is about £6000, and, in the other, about £5800.

It was reported at the last monthly meeting of the Broughty Ferry

Police Commissioners, that the average quality of the gas supplied to the burgh during the month of March was equal to 28.17 candles.

The Police Commissioners of Paisley have lately received a report (long expected) from Mr. Leslie, C.E., as to the drainage of the town. Three plans have been proposed—irrigation, filtration, and precipitation—and Mr. Leslie recommends the latter, which would cost in all £83,000. One of the commissioners had no doubt it would mount up to £100,000. It was agreed to print the report for the convenience of the commissioners.

The town of Montrose was supplied with an average of 301,000 gallons of water per day during the month of March, and the rainfall only amounted to 1.4 inch, as against 2.24 inches at Aberdeen, 2.67 inches at Edinburgh, 4.38 inches at Greenock, and 2.5 inches at Dundee. The rainfall at Paisley was also 1.4 inch. At the Glencorse reservoir (Edinburgh Water-Works) the rainfall amounted to 16.90 inches from the 1st of January to the 10th of April, as against 14.00 inches over the same period in 1876, and 8.85 inches in 1875. The supply of water to Edinburgh, during the fortnight ending the 10th of April, was 28.99 gallons per head per day to a population of 281,200.

Pig iron was selling at 54s. on Monday last, and again on Friday forenoon, but the market closed in the afternoon with business reported at 53s. 9d. one month, buyers offering 53s. 8d. cash.

There has been a little more activity in the coal trade during the past week, owing chiefly to the temporary demand for the Quebec fleet. Prices, however, have not experienced any improvement.

SOCIETY OF ARTS, CHEMICAL SECTION.—The lecture on Thursday next will be by Charles W. Vincent, F.R.S.E., F.C.S., "On Spontaneous Combustion in Factories and Ships."

GLASGOW WATER SUPPLY.—Dr. Mills, of the Andersonian University, Glasgow, reports that during last month the water supplied to that city from Loch Katrine was of a very pale brown colour, and contained abundance of fine muddy particles, with some fibres and hairs. The hardness was the highest yet recorded of this water (1.4°).

REDUCTIONS IN THE PRICE OF GAS.—It was stated in the JOURNAL of the 3rd inst. that the Leamington Priors Company had agreed to make a reduction of 3d., which would make the price of gas 4s.; it should have been 3s. 9d. The Pembroke Docks and Town Gas Company, Limited, announced a reduction to 5s. per 1000 from the 1st inst.

WALLASEY LOCAL BOARD.—Lieut.-Col. Cox, R.E., held an inquiry at Egremont, on Wednesday last, relative to a recent application of the Wallasey Local Board for a Provisional Order to enable them to borrow £45,000 for gas and water purposes, and £125,000 on account of new ferry works, including £50,000 for new boats. It was stated that the board previously had powers to borrow £50,000 for water, and £40,000 for gas.

HULL GAS SUPPLY.—Mr. Baynes reports that the gas sent into the Sculcoates and Myton district, during March, by the British Gas Company gave the following results, sulphuretted hydrogen and free ammonia being at no time present to the ordinary tests:—

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16.05	15.28	15.63
Grains of sulphur per 100 feet	30.50	28.40	29.68

Mean barometer and temperature in experiment-room: Bar., 29.82; temp., 56°. In the east district, Mr. J. Baynes, jun., makes the following report:—

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16.35	15.48	15.83
Grains of sulphur per 100 cubic feet	—	—	18.92
Grains of ammonia per 100 cubic feet	—	—	12.72

Mean barometer and temperature in experiment-room: Bar., 29.52; temp., 56.5°.

ACCIDENT AT THE PICKERING WATER-WORKS.—On Monday, the 9th inst., the reservoir belonging to the Pickering Gas and Water Company, situated in the Whitley Road, some quarter of a mile above the town, was finished. The reservoir, which is to supply the town, and holds 100,000 gallons of water, appeared all right on Wednesday night at 8 p.m., when the manager left it. Early yesterday morning, however, it was found that during the night the whole of the roof had fallen in. The outer walls, fortunately, remain quite safe, or the town would have been flooded. It is supposed that one of the iron girders supporting the roof has given way, but the exact cause of the accident cannot yet be ascertained.—*Leeds Mercury*.

NORTH OF ENGLAND GAS MANAGERS ASSOCIATION.—The managers and other gentlemen connected with the gas companies of the North, taking advantage of the opportunity afforded by the exhibition of gas apparatus at South Shields, met yesterday in the board-room of the South Shields

Gas Company. Mr. W. H. Atkinson, the secretary to the Tynemouth Gas Company, who is the oldest gas manager in the district, occupied the chair. On the motion of Mr. Ford, seconded by Mr. Whyte, it was resolved—"That it was desirable to form an association, to be called the 'North of England Gas Managers Association,' to consist of managers and those connected with gas undertakings situate in the counties of Northumberland, Durham, Cumberland, Westmoreland, and the north of Yorkshire." Mr. Ford moved, Mr. Studholme seconded, and it was carried unanimously, that Mr. W. J. Warner, the engineer of the South Shields Gas Company, be the first president of the association. Mr. J. Hepworth, of Carlisle, was appointed vice-president. Other business was transacted; and it was agreed to hold the next meeting in Newcastle.—*Newcastle Daily Journal*.

GAS BILLS IN THE HOUSE OF COMMONS.—Mr. Alfred Frisby writes to *The Times* as follows:—"It is 7 per cent., and not 10 per cent., which is, and has for some years past been, fixed as the limit allowed to be divided on the capital." Mr. Frisby admits that the clause proposed by Mr. Raikes was inserted last year in the Acts of certain gas companies of the metropolis; "but," he says, "this was only in conjunction with another clause not proposed to be applied to other gas Bills, whereby a reduction of the price charged to consumers below a certain limit involved a possible raising of the dividend payable to shareholders. I wish to add two, among other, material objections to the application of the principle. The first is, that such a radical change, affecting interests to the amount of about one hundred million pounds, ought not to take effect without giving considerable notice—say three years—to all parties involved. The second is, the fear whether its ultimate adoption will not prove more hurtful by checking enterprise in the origination of new companies than the relief, which I do not deny that it will afford, though in a very considerably less ratio than was stated, to the public in connexion with existing undertakings."

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1339.—**CRAYER, J. W., and BUTTON, G.,** Kingston-upon-Hull, Yorkshire, "Improvements in reflecting surfaces for increasing the illuminating or lighting power of gas and other lights." April 6, 1877.
 1407.—**KENNEDY, W. W.,** Glasgow, "Improvements in taps, cocks, or valves, the same being in part applicable to water-gauges and analogous apparatus." April 11, 1877.
 1415.—**KUNKLER, E.,** Lenzburg, Switzerland, "A self-closing tap or valve." April 11, 1877.
 1426.—**PRICE, W.,** Gas-Works, Hampton Wick, "Improvements in screens." April 12, 1877.
 1428.—**JOHNSON, R.,** Seedley, Lanes, "Improvements in machinery for pumping, forcing, blowing, and exhausting air and other fluids." April 12, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3965.—**STEEL, J.,** Glasgow, "New or improved apparatus for purifying and condensing gas, and for extracting and collecting ammonia therefrom." Oct. 13, 1876.
 4036.—**VANDENDRIESCHE, A. E.,** Lombard Street, London, "An improved gas-regulator designed for the purpose of being applied to burners of every description without altering the original appearance of the fittings." A communication. Oct. 19, 1876.

PATENTS WHICH HAVE BECOME VOID

- BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.
 1168.—**RUSS, E.,** "Improvements in the construction of taps or cocks for liquids." April 4, 1874.
 1171.—**SHORT, T.,** "Improvements in apparatus for purifying sewage." April 4, 1874.
 1176.—**PEARSON, E.,** "Improvements in taps, cocks, or valves, for adjusting or regulating the flow of liquids and gaseous fluids." April 4, 1874.

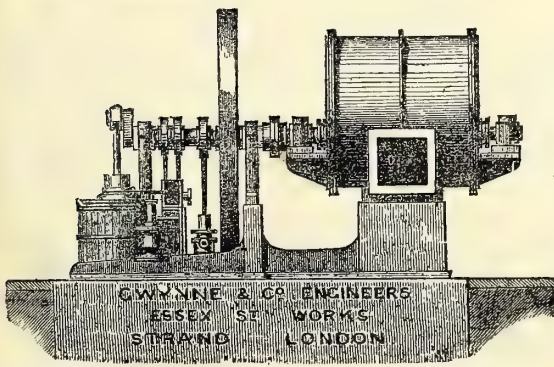
PATENT WHICH HAS BECOME VOID

- BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.
 1014.—**YOUNG, W., and PRASH, P.,** "Improvements in the manufacture of illuminating gas." April 6, 1870.

The **GRAND MEDAL of MERIT** at the **VIENNA EXHIBITION**, and **TWO MEDALS** at the **PHILADELPHIA EXHIBITION**, have been **AWARDED** to **GWYNNE & CO.** for **GAS-EXHAUSTERS, ENGINES, and PUMPS**;

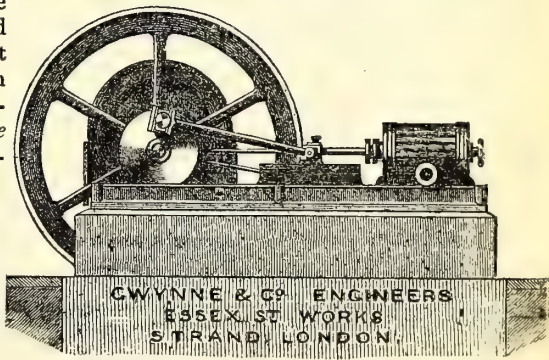
Also **27 OTHER MEDALS AWARDED** at all the **GREAT INTERNATIONAL EXHIBITIONS**.

GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

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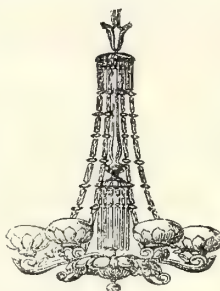
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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

R. R., Hiogo, Japan.—Your letter of the 24th of February received. It will be better to wait your return to England next year than to risk sending the "Treatise" to you in monthly parts.

PARIS GAS COMPANY.—The annual report of this company is in course of translation, and will appear in the JOURNAL shortly.

COMMUNICATIONS RECEIVED.—N. S.; T.; C. E. J.; C. T. Salomons, Rotterdam.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 24, 1877.

Circular to Gas Companies.

BACKED by the Government, Mr. Raikes, on Friday last, succeeded in carrying his new Standing Order, but with additions which some will regard as of much importance. It will be seen that Select Committees of the House of Commons on Gas Bills are now recommended to insert auction clauses in all such Bills, unless they see fit to omit them, the reasons for such omission being reported to the House; but, together with them, the Committee may compel the adoption of the sliding scale by any Company promoting a Bill for new capital. A difference will be noticed in the two clauses of the new Order. The insertion of auction clauses is made imperative, so far as a Standing Order can make it so; but the adoption of the sliding scale is made permissive.

In another column we publish our own special *verbatim* report of the debate. There is but little in the discussion which calls for observation. Mr. Raikes and Sir Charles Adderley also devoted themselves to demonstrate that the proposed new Order would not contravene the provisions of any existing Act of Parliament. The former member took higher ground, and contended that Parliament had a perfect right to revise previous decisions. No one will dispute that position. Parliament once enacted that people should be hanged for shop-lifting and sheep-stealing, but subsequently, and very properly, saw fit to abolish capital punishment for such crimes. But the reversal of a commercial policy, under which millions of capital have been raised and changed hands, is a very different matter. Granted, that, as Sir Charles Adderley contended, the Companies Clauses Act of 1863 was in the nature of a permissive

measure; still it is a fact, that most Gas Companies who have gone to Parliament since the date of its enactment have adopted its provisions. They have been renounced, of course, by those companies who have accepted or proposed auction clauses; but that does not affect our argument. When people get permission to do something which it is obviously to their advantage to do, they generally avail themselves of the privilege. Thus, Gas Companies adopted the Act of 1863, which allowed them to allot new shares to existing proprietors at par, and this, as we have said, has had a very important influence in fixing the price of gas property.

How far the sliding scale of dividend can be regarded as a *quid pro quo* for the abolition of the privilege conferred by the Act of 1863, we shall not stop to discuss. Much will, of course, depend on the standard price granted by a committee; but this much is certain, that the first fall of dividend under the action of the sliding scale, will create a perfect panic in the world of gas shareholders. Such an event, at the present moment, looks like a very improbable contingency; but the future is always uncertain, and another coal famine may be upon us before non-dividend bearing capital obtains such a proportion to capital entitled to profit, that dividends may be considered as perfectly safe.

Sir Charles Adderley professes to consider auction clauses as indispensable for the protection of the public, and he has so little faith in the disposition of honourable members of the House of Commons (they are all honourable), that he prefers an imperative to a permissive Standing Order.

The story told by Mr. Goldney, to show the necessity for a "Standing Order," is not a bad one in its way. The three honourable members, standing up in 1869, confessing their ignorance of resolutions adopted by the House in the previous year, would form the subject of an interesting picture, which might be fitly engraved, and hung up in every committee-room as a caution. Henceforth, however, and as regards the matter now under consideration, honourable members will be under the guidance of that very useful class of professional men, Parliamentary Agents, controlled by the Examiners of Standing Orders. They will be in leading-strings, which are, perhaps, more or less, necessary for all men.

We extract from the proceedings of the House of Commons the terms of the new Standing Order as adopted by the House:—

"Ordered, That in every Bill by which an existing Gas Company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender, at the best price which can be obtained, unless the Committee on the Bill shall report that such provision ought not to be required, with the reasons on which their opinion is founded.

"In the case of every such Bill it shall be competent to the Committee so to regulate the price of the gas to be charged to consumers that any reduction of an authorized standard price shall entitle the Company to make a proportionate increase of the authorized dividend, and that any increase above the standard price shall involve a proportionate decrease of dividend.

"Ordered, That the said Order be a Standing Order of this House [to follow Standing Order 188]."

A reference to Sir Charles Adderley's speech will show that a somewhat important proviso, suggested by the Government, is not embodied in the foregoing Order. It was to the effect that, in auctions, if a proprietor bid as high as the highest bid of a non-proprietor, the former should be the purchaser. This suggestion, although, as it is seen, it is not embodied in the Order, will be a useful hint to Parliamentary Agents, who will not neglect to insert it in the auction clauses. It is a very small atonement for what we consider a very great wrong; but, in these days of confiscation, we must be thankful for very small mercies.

We do not encumber our columns with the division-list, which, nevertheless, presents some remarkable features, not the least amusing of which is seen in the fact that the Irish Home Rulers, who would confiscate every species of valuable property, helped to swell what must be regarded as the Government majority.

It remains to be seen how far the new Standing Order of the Commons will bind the House of Lords, or rather Earl Redesdale. If the noble Earl had considered auction clauses harmless to gas proprietors, and advantageous to the public, we feel certain that he, who, more than any other man, has striven to reconcile the interests of both parties, would have insisted upon them long ago.

The Blackburn Borough Gas, &c., Bill has gone down from the Lords, amended in a very particular manner. Our readers will remember that the Corporation of Blackburn proposed in a most peremptory clause to make a compulsory purchase of the

gas undertaking. The clause by which it was intended to enact that the Company, on receiving notice from the Corporation, should be required to sell, has been modified by Earl Redesdale, so that it now reads as follows:—"The Corporation and the Gas Company may, at any time after the passing of this Act, agree for the purchase by, and sale to, the Corporation of the gas undertaking, for such consideration, in gross or by annuities, and on such terms and conditions as the Gas Company and the Corporation may agree." It is thus left optional to the Company to sell or not, as they may feel disposed. Probably, if an adequate consideration be offered for an undertaking of a somewhat exceptional value, the Company will agree to sell; but we regard this amendment of Earl Redesdale as constituting a most important precedent. It says plainly to Corporations: "Get well advised, and make fair terms with a Gas Company, but do not come here with a fishing proposal, which will probably lead to a very expensive arbitration." We hope Corporations will take the hint.

In another column will be found a report of the Surveyor of the Bermondsey Vestry, as to the steps necessary to compel the Surrey Consumers Gas Company (if compulsion be necessary) to comply with the provisions of the Metropolis Gas Act, 1860. It shows that the Vestry have put themselves hopelessly in the wrong, by neglecting to comply with the provisions of that Act, which required them to set up a testing-station and appoint an Examiner; or, as the Surveyor does not mention, join with another Vestry, like St. Olave's, in doing so, if they were economically disposed. Not having done so, they are not in a position to take any proceedings against the Gas Company, however much the latter may have failed in their duty to the public. The position of the Surrey Consumers Company is, in some respects, *unique*; they charge the highest price, and supply the lowest quality of gas in the Metropolis. This is not as it should be. After allowing sixteen years, however, to elapse without fulfilling an obvious duty, it is rather late in the day for the Bermondsey Vestry, in view of impending changes, to set up a testing-station; but surely the Gas Company might do something to allay the discontent which rages within their limits.

The Corporation of Hull appear to be making a serious effort to purchase at least two of the three undertakings which supply gas within the Corporation limits. Overtures, it seems, have been made to the Kingston, and also to the Sutton, Southcoates, and Drypool Companies, with what result we do not, as yet, know. The undertaking of the British Company is, of course, beyond the reach of the Corporation, except by a very compulsory measure; and, moreover, we doubt whether the Corporation would care to acquire it.

The Corporation of Dublin have notified to the Gas Company, through their Lighting Inspector, their desire to reduce the consumption of gas in the public lamps to three-and-a-half feet per hour. The Company very naturally protest against any alteration in the rate of consumption—first, on the private ground that it would be a violation of an agreement entered into last year, in virtue of which they reduced the price of gas to private consumers (and thereby, they might have added, saved the citizens £8000 a year); and, further, on the public ground that, even with the present consumption, the lamps are so far apart that Dublin is about the worst-lighted city in the kingdom. Three-and-a-half feet of sixteen-candle gas per hour in Dublin would, we should think, give just sufficient light to render darkness visible.

In our summary last week, and also in the list we gave of special Gas Acts containing auction clauses, we omitted to mention one of the first Acts passed with such clauses—the Bristol Gas Act, 1853, which Act united the two Companies then supplying gas in Bristol and the neighbourhood. This Act gave the United Company power to raise £80,000 of new capital, and directed that the shares, as they were issued, should, in the first instance, be offered for sale by public auction in the City of Bristol. It further enacted, that any premium paid for such shares should be applicable to the purposes of the Company, but not entitled to dividend. A letter appearing in another column, from Mr. G. W. Stevenson, which reached us after this paragraph was written, gives a still earlier instance—that of Ashton-under-Lyne, in 1847. We have heard of more than one claimant for the honour of having invented auction clauses, but the real inventor is still unknown to us.

The Town Commissioners of Mansfield are anxious to acquire the Gas and Water Works supplying the district. We do not know whether any negotiations have taken place; but we notice that the Chairman of the Commissioners values the gas-works at £45,000, and the water-works at £30,000; and he estimates that the profits of the gas-works will be sufficient to provide a sinking-fund, to pay off the £75,000 to be borrowed, in seventy years, and also to cover the inevitable loss incurred by the

supply of water. Our engineers, skilled in valuing gas property, are having a busy time of it just now, and their business, we are afraid, is likely to increase.

The Corporation of Swansea, as our readers are aware, are hankering after the gas undertaking, failing the purchase of which they are desirous to set up competing works; but recent proceedings in the Town Council seem to show that the consideration of the purchase, or the installation of new works, is likely to be deferred for some time. If the Company agreed to sell, or if the Corporation obtained a compulsory Act—both very improbable contingencies—or if it should be resolved to enter into competition, it would be necessary for the Corporation to raise, by loan, a very considerable sum of money, for which the sanction of "My Lords" the Commissioners of Her Majesty's Treasury would be necessary. Fortunately, or unfortunately, the credit of the Corporation is, just now, not very good in that quarter. Some two years ago, "My Lords" sanctioned a loan of £20,000; but no return, it would appear, has ever been made of how it was expended, nor has a sinking-fund been provided. Quite recently the Corporation memorialized "My Lords" for power to borrow the modest sum of £800, the sanction for which was promptly refused, until a full, true, and particular account was furnished of the way in which the last loan had been applied, with a statement of all the existing obligations of the Corporation. The Gas Company are evidently safe from molestation for some years to come. Let us hope that a good feeling will presently be established between them and the Corporation.

The tyrannical conduct of Gas Companies is constantly denounced. Recently, in the lobby of the House of Commons, a member remarked that Gas Companies deserved no consideration, for they never showed any to their customers. They sin, however, in good company, for the following is what we see written of a Corporation supplying gas:—"Having erected a powerful monopoly, they make it the instrument of a gigantic tyranny, and, overriding all commercial axioms, they prefer money in hand," &c., &c. The Corporation of Glasgow are alluded to, and the cause of this outpour of wrath is rather amusing. We had occasion to mention, some months ago, that great complaints had been made of the presence of sulphuretted hydrogen in the gas sent out from one of their stations. It was the result of accident, and the cause was speedily remedied. Among the complainants was a medical gentleman who thought fit to discontinue the use of gas in his consulting-room, and adopt, for a time, what he describes as "a moveable table-light." By-and-by the inevitable gas bill arrived, whereupon the indignant doctor indited a letter to the Gas Committee, requesting that some deduction might be made for the annoyance he had been subjected to. The answer was that he was free to burn gas or to use a moveable table-light; but, if he burnt gas, he must pay for it, and the Committee could not recognize any claim for compensation if he chose to discontinue the use of gas. A good deal more correspondence ensued; but the Gas Committee were inexorable, and it only remained for the aggrieved doctor to detail his wrongs in a lengthy communication to the *Glasgow Herald*, from which we take the expressions quoted above. Surely no Gas Company was ever better abused, and with less reason.

Water and Sanitary Notes.

LONDONERS, or rather a section of them, are just now rejoicing over the prospect of obtaining an unlimited supply of pure soft water from the lower greensand formation, which at a great depth underlies the Metropolis. We read in a contemporary that the news that the greensand had been tapped with success created a panic among the shareholders in the Metropolitan Water Companies. If it were so, nothing more absurd was ever known.

Most of the London breweries have wells sunk into the chalk under the London clay. The level of the water in these, however, slowly falls as they are pumped, and they periodically require deepening. Messrs. Meux and Co., at their brewery at the corner of Tottenham Court Road, had a well, the bottom of the bore of which was in hard grey chalk 365 feet below the surface of the ground. But it gradually gave out, and the firm determined to make the attempt—somewhat hazardous in North London—to reach the lower greensand, and they are reported to have arrived at that stratum at a depth of 1001 feet. An attempt had been made before to reach the greensand north of the river, and that was by a sinking at Kentish Town, where, at a very great depth, the borers came upon a mass of Palæozoic rock, and the attempt was abandoned. Geologists were uncertain how far this rock extended, and no encouragement was given to further

efforts. Another attempt was made at Crossness, but was abandoned at a depth of 920 feet, when 147 feet of gault had been bored through. It was stated at the last meeting of the Metropolitan Board that these operations have been renewed, and the boring carried to a depth of 976 feet, but it is yet in the gault. The matter is of some importance to the Metropolis, for if it be proved that the lower greensand is accessible at a reasonable depth around London, we shall hear no more of those extravagant schemes for bringing water from a long distance at an enormous cost.

There is no doubt that the lower greensand constitutes an enormous reservoir of water. Mr. Prestwich has estimated the subterranean area of the formation to occupy 4600 square miles; and, assuming the thickness of the stratum to be 200 feet, he calculates that we have 920,000 square miles, one foot thick; and his experiments have led him to the conclusion that each of these miles holds water sufficient for a day's supply to the Metropolis.

We might congratulate the public rather than the Messrs. Meux on the success of their enterprise, for lower greensand water is very soft, and, consequently, not well adapted for brewing purposes. It is, however, better than the water from the chalk under the London clay, which usually contains a considerable amount of carbonate of soda. We wait, with interest, for more complete details of the experiment, which, at present, has only furnished matter for somewhat sensational articles in the daily papers.

It is pleasant to see Mr. G. H. Whalley engaged in a rational, if rather a hopeless, enterprise. He is a landowner, and has a large amount of water on his property, which he distributes on

very liberal terms. He is anxious to see others follow his example; but, having regard to the impecuniosity of many landowners, he has brought in a Bill to give further facilities to owners with limited interests, to charge their estates (with the sanction of the Enclosure Commissioners) with the expense of constructing reservoirs to supply Local Authorities and Water Companies. No objection, we believe, has hitherto been made to landowners constructing works for the supply of water to labourers and others resident on their estates; but we expect the extension now proposed by Mr. Whalley will encounter much opposition. Every rill that runs from one man's estate may run through that of another, who may claim a pecuniary interest in the water. Thus, this Bill, if successful, may give rise to a great amount of litigation. Mr. Whalley's object is, however, decidedly praiseworthy.

We propose next week to print Dr. Frankland's somewhat sensational report on his analyses of the waters supplied to the Metropolis during the past year, omitting the tables, which would occupy too much of our space. The Doctor continues his attacks on Thames water, which he denounces as utterly unfit for domestic use, notwithstanding the fact that it is used and drunk by over two millions of people, and has never been proved to do anybody the smallest harm. He will doubtless be rejoiced at the prospect of a supply from the greensand, although his preference is for chalk water, softened by Dr. Clark's process. Notwithstanding the stated results of his analyses, and his microscopic observations of living and moving organisms, we venture to regard the water supply of the Metropolis as eminently satisfactory, and the death-rate for the past year seems to us to confirm our opinion.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXXII.

SERVICE-PIPES.



FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.



FIG. 5.



FIG. 6.



FIG. 7.



FIG. 8.



FIG. 9.

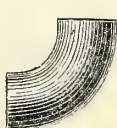


FIG. 10.

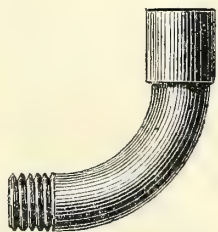


FIG. 11.

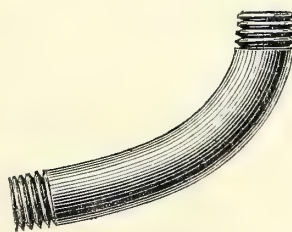


FIG. 12.

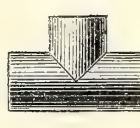


FIG. 13.

All pipes, of whatever size or description, branching out from the main-pipes for the distinct supply of gas to the premises of consumers, public lamps, &c., are called service-pipes. Those for the supply of extensive works, mills, factories, large railway stations, theatres, &c., are of cast-iron, and vary in size from 3 inches diameter and upwards, whilst the great majority of service-pipes are of wrought-iron tube from 3-4ths of an inch up to 2 inches bore (fig. 1).

By the term "service-fittings" is meant the short pieces of wrought-iron pipe, equal and diminishing, either straight, as connecting-pieces, (2), ferrules (3), sockets (4), nipples (5), caps (6), plugs (7), and back-nuts (8); angular, as elbows (9), square and round bends (10), springs (11), tees (12), and crosses (13), uniform or irregular in size or diameter at their different ends, which are used to join the wrought-iron pipes together in straight lines, or at angles to each other, by means of screw-threads on the pipes and fittings.

Wrought-iron tubes and fittings, to be good, should be perfectly cylindrical, with no ribs or flat places, and internally as smooth as possible. The welding should be scarcely discernible from the other parts, and the screw should be equally deep throughout the thread.

In the manufacture of service-pipes of wrought-iron, it is of paramount importance that there should be uniformity of screw-pitch amongst the different makers. In England this uniformity prevails, but in Scotland each maker follows the bent of his own inclination in this respect, the consequence being an amount of confusion and inconvenience, leading to bad jointing and loss of time in recutting the threads, which we are at a loss to understand should be tolerated for one month.

Wrought-iron pipes of smaller internal diameter than 3-4ths of an inch should never be put in the ground. There is no economy in their use. They are soon filled up with dirt and scale; if the gas is at all impure, they become clogged and contracted in their bore. The friction of the gas passing through them is enormous, and if their

length is great, a high initial pressure has to be maintained to force the gas through them to give the necessary supply. The expense of labour in laying them is also as great as for pipes of larger size.

All wrought-iron pipes, if laid in the ordinary unprotected way, are subject to rapid oxidation in the ground. This is especially the case in made ground, filled up with ashes and the refuse of iron and chemical works. Under such conditions they may not be expected to last beyond two or three years. In open, porous, gravelly soil, also, through which the surface water percolates readily, their destruction is rapid. This is the case also in sandy soils in proximity to the sea, and impregnated with saline matter. In all such circumstances, it is of advantage to employ galvanized pipe, and that, too, of a strength greater than is otherwise necessary.

The average life of wrought-iron service-pipes, as generally laid, is about eight years. They are the least durable part of the distributing plant of a gas undertaking. From this statement we may realize to some extent the enormous corrosion that is constantly taking place in these pipes, the incessant renewal that is required, necessitating the tearing up of the ground, with all the waste, annoyance, and expense attendant on the process. All this may have been unavoidable, and in a large degree excusable, in the earlier years of gas lighting, when experience had to be gained, and the art of canalization had to be learned; but it is excusable no longer, when, by the use of obvious precautions, the life of pipes may be prolonged greatly beyond the time mentioned.

Putting aside the recent discovery of Professor Barff, whose process of preserving iron, if it answers the expectations entertained of it, and can be generally and inexpensively applied, will vastly extend the use of ironwork of every kind, and enhance its value in those circumstances where its use is at present indispensable, there are other expedients that may be, and are, resorted to by thoughtful gas managers and engineers. These are the careful protection of

the pipes by thickly embedding them in soil, or surrounding them, under and over, with clay, brought from the nearest accessible place, if these materials are not already found in the newly-opened trench.

Another practice, also to be highly commended, and which has been extensively adopted by The Gaslight and Coke Company in the Metropolis, is that of placing the pipe in a slight wooden trough, made of half-inch laths, three inches broad, left rough from the circular saw, and either V-shaped or U-shaped in section, into which, after the service is completed, melted pitch is poured, surrounding the pipe from its junction with the main to the wall

of the premises being supplied, and completely protecting it from the deteriorating effects of air and moisture. The liability of the wood to decay suggests the idea whether it would not be desirable to use cast-iron troughs of light construction for the same purpose. These are necessary precautions in the laying of service-pipes of wrought-iron that no manager is justified in neglecting to use, and which, indeed, he will not fail to adopt if he cares for his own reputation, and the interests of those by whom he is employed.

The great bulk of the leakage of gas is unquestionably to be traced to the service-pipes, either from defects in the pipes themselves, or by corrosion, or at their junction with the mains. It follows, therefore, that the best results would arise from more careful manipulation here, and the employment of the best materials. This latter is a point on which something must be said. With some persons it would appear that the chief recommendation for the adoption of the pipes of any maker is the amount of discount that such is able to allow from the ordinary list price, the strength or quality of the metal composing the pipes being quite a secondary consideration. This ridiculous parsimony, it must be admitted, is more often an attribute of directors than managers, the opinion of the latter being frequently overruled in this as in other matters.

It is desirable to prove all service-pipes when they are received from the manufacturer. This can readily be done by plugging one end, and attaching a hand-syringe to the other. On immersing them in a shallow cistern of water, and compressing the air into them, defects will be indicated by the air-bubbles rising through the water to the surface.

Wrought-iron is not the only material used for service-pipes. These are sometimes of cast-iron down to the smallest size. Composition and tin pipes have also been tried, and lead piping, which has much to recommend it, is used exclusively by some engineers.

Cast-iron service-pipes are of great durability; but the drawbacks attending their use are such as to counterbalance any advantage in this respect. They are necessarily made in short lengths, not exceeding 6 feet long each, and the number of joints, and the consequent risk of leakage, is greater with them than with most of the other pipes mentioned. Their liability also to fracture, by settlement of the ground and overhead traffic, is obvious, and their first cost in material and laying is greater than either wrought-iron or lead.

Composition pipe is not suitable for placing in the ground, as it is rapidly destroyed by contact with the soil and moisture. Pipes made of pure tin are exceedingly durable; but the cost of the material necessarily precludes its extensive use for this purpose.

Lead pipes are slightly more expensive than wrought-iron, but they cost less in laying; they are more durable in most soils, and when they require to be replaced, the old material is intrinsically of value for re-melting. The objections to their employment are their liability to sink after being laid, and to be crushed and flattened, or otherwise injured, in the opening of the ground by workmen. These objections, however, can be overcome to a large extent by laying the pipes either on wood slabs half-an-inch to three-quarters of an inch thick, and protecting them by a similar covering, or by providing wooden troughs for their whole length, and embedding them in pitch as recommended for wrought-iron pipes. In connecting them to the main, the latter is drilled and tapped in the usual manner, and a brass ferrule is inserted, having a union joint, to which the lead pipe is attached by soldering. This is the only joint that requires to be made between the main and the consumer's meter, and this absence of joints and couplings is no slight recommendation in their favour. In Paris the services are principally of lead, protected by earthenware tubes, through which the pipe is passed.

(To be continued.)

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

AUCTION CLAUSES IN GAS BILLS.

SIR,—You will doubtless insert in your "Parliamentary Intelligence" the New Standing Order *verbatim*. I need not, therefore, quote it; but a word or two upon the proceedings may be necessary to clear away any possible misunderstanding upon the result.

There is nothing in the Order, as passed, that the companies have any just cause to complain of, inasmuch as the main objection on the part of the companies—viz., that of making a hard inflexible rule, by means of a Standing Order, to treat all companies alike, irrespective of any consideration as to whether they have honourably complied with all their obligations or otherwise—is given up, and the recognition of the sliding scale removes all other valid objections.

Had it been known before the discussion commenced that Mr. Raikes intended to make these concessions, the matter might have been settled without any further opposition; but, as often happens after discussion, when one amendment is proposed upon another, there was in the end some misunderstanding as to how the question actually stood. Some

members, it is to be feared, thought the companies had got all they were entitled to ask for, and were unreasonable in carrying the opposition further, while others thought that all the companies had asked for had been refused.

After the division, application was made to what was supposed to be the official source of information, and there we were informed that Mr. Bristowe's motion had not been put.

W. LIVESEY.
Gas and Water Companies Association, 6, Victoria Street,
Westminster, S.W., April 21, 1877.

SIR,—Permit me to correct an error in your "Circular" of the 17th on this subject. You say such clauses were never, you believe, embodied in a Gas Act before 1856; but you have overlooked the cases of Ashton-under-Lyne, in 1847, section 15, and of Nottingham, in 1853, sections 22 and 23. In both of these Acts all the new shares were required to be offered by auction.* And it is scarcely correct to say that in all the cases quoted by you, except the most recent, the auction clauses were introduced voluntarily by the promoters of the Bills; for in many (I think 16), in which either part or the whole of the new shares are required to be sold by auction, I was myself concerned, and was more or less instrumental, by opposition, in causing the insertion of the clauses referred to.

With regard to the metropolitan legislation of last session, resulting in the introduction of auction clauses into the Bills of The Gaslight and Coke Company and the South Metropolitan Gas Company, it is only fair it should be stated that it was I who volunteered evidence, and produced precedents, before Mr. Forster's committee, urging the imposition of the auction clauses upon the former of these two companies, as being, in my opinion, the only effectual means of bringing the capital into a proper relation to the extent of the business. This I did, as I explained to the committee, without the sanction of my clients, the Metropolitan Board of Works, whose counsel did not examine me, and only as a consequence of strong personal conviction on the subject. My evidence is recorded *in extenso* from page 212 forward in the published Blue-Book, and no evidence was furnished to the committee other than that given by me.

My own opinion is, that the exclusive monopoly which gas companies have sought to maintain—backed, as I think, unwisely, by the JOURNAL OF GAS LIGHTING—has occasioned much of the jealousy with which they have been regarded of late years; and I am satisfied that in urging on many occasions the sale of new shares by auction, and the consequent admission of the general investing public as co-proprietors, my course will, a few years hence at the latest, be viewed as entirely friendly, by those who at present may consider it somewhat hostile, to the interests of the companies.

Auction clauses for new capital, a fair standard price for gas, subject to revision from time to time, and a sliding scale of dividends operating inversely to the selling price, supply the antidote to nearly all the complaints current against gas companies; and it would be a very good thing, both for proprietors and consumers, if the affairs of the companies throughout the kingdom could be forthwith brought under legislation in respect to these matters.

G. W. STEVENSON.

4, Westminster Chambers, S.W., April 21, 1877.

THE GAS REFEREES PRESSURE-GAUGE.

SIR,—In the article in last week's number of the JOURNAL, under the above heading, it is stated that "such a gauge as this, but on a more exact scale, was designed more than 30 years ago by the late Mr. Alfred King, M. Inst., C.E. of Liverpool," and further that "a similar gauge to that adopted by the Gas Referees has been made and used by Mr. W. Sugg, of Westminster, for more than five years past." To the foregoing I may be permitted to add that "such a gauge" was made and used by myself 18 to 20 years since, and I think in all probability by many others. When I constructed one I was unaware, and have remained unaware until just recently, of what Mr. King had done, and I may admit that the scale error of mine was about twice as great as given for Mr. Sugg's, but the error was compensated in the scale. I attached no importance to the thing, made no publication, and claimed no merit. The instrument was devised and made, like many other instruments and appliances of which one says nothing, to meet a special requirement; that requirement satisfied the gauge was done with, as I preferred to work with a large tube syphon gauge, or with the instrument which is universally known as the "King's Gauge," when the latter was applicable.

When, however, Mr. Harcourt's drawing and description reached me on the 25th of January last year, I recognized that he had made such improvements as to render the gauge almost a new thing—first, in the greatly increased difference between the area of the cistern and of the tube; secondly, the graduations being on the tube itself; and lastly, and it may be most importantly, the employment of the glass float, which obviates all the difficulties which attach to readings of the height of a water column terminating with a curved line due to capillarity.

Of course there is nothing new in the idea of a gauge with unequal tubes. I have seen and used one 27 years ago, devised by the late Alexander Wright. It consisted of two concentric glass tubes, with brass fittings top and bottom, and a scale whereby to read the pressure on the outer tube only. It was a very pretty gauge, but was objectionable in some respects, which I need not stay to mention. The "King's Gauge" itself generally has unequal chambers, and it can be no matter of surprise that the active and ingenious mind which invented that gauge should have also invented another of the kind in question; but it is a pity that its invention and character were not announced to the world.

I may state also that some 14 or 15 years since, at the request of Messrs. Robinson, of Leicester, I arranged a registering pressure-gauge on Wright's system, which indicated pressures on a scale of 8-10ths to an inch—the concentric cylinders being of unequal area—and these have been regularly produced ever since. Indeed, there is no practical difficulty in making such instruments to indicate on a scale of 9 or 9½ tenths to the inch, although an objection might arise in respect to their increased dimensions.

* One other omission occurred—that of the Bristol United Gas Bill, in 1853. In that case the company introduced the clause in the Bill as deposited.—ED. J. G. L.

I have mentioned what I consider are the points of novelty in the new gauge, and while admitting generally, with all readiness, the late Mr. King's claim to priority, I feel that Mr. Harcourt is entitled to much credit for devising a gauge which is free from the imperfections which characterized those of the kind (with the exception, it may be, of Mr. King's) which had been previously produced.

Whether a pressure register would not have been a better instrument for the Gas Examiners to employ—registering, as such instrument does, the pressure continuously during the 24 hours of day and night—is a question. I think that it would.

F. W. HARTLEY.

55, Millbank Street, Westminster, S.W., April 18, 1877.

IMPROVEMENTS IN PRESSURE-GAUGES.

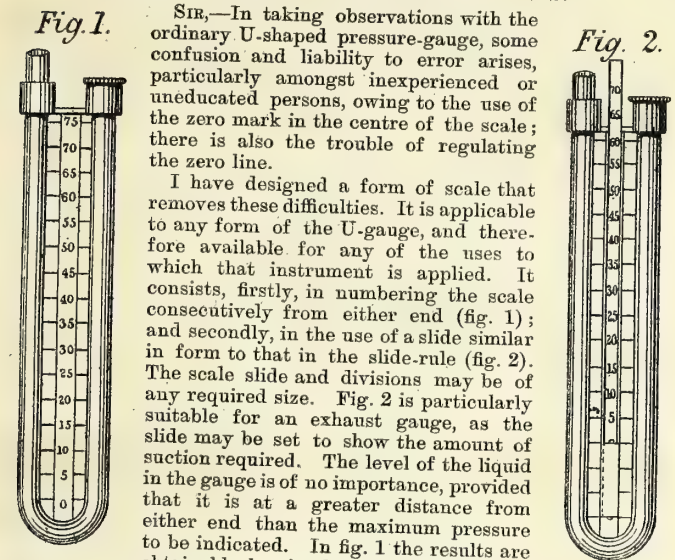


fig. 2, by adjusting the zero mark of the slide to the level of one liquid surface, the amount of pressure is indicated by the other.

Westbury, April 10, 1877.

H. N. HUMPHRYS.

EXPANSION JOINTS FOR GAS-MAINS.

SIR,—In your issue of the 23rd of January you notice the manner of joining the gas-mains in Callao, Chorrillos, and Iquique, and as I am not aware that the same has been used elsewhere than in this Republic, it may interest you to know something of its history.

In 1852 the writer, being then a pupil of the late Mr. George Lowe, was entrusted with the preparation of designs for gas-works for this city—Lima. Among other local circumstances which had to be kept in view were the earthquakes to which this place is subject, and although these received more attention than was subsequently found to be necessary, they were the cause that suggested the use of vulcanized india-rubber.

The only experience then available was that derived from some experiments by Mr. Lowe at Brick Lane, from which it appeared that the vulcanized india-rubber withstood the action of common London gas after passing the condensers or scrubbers. These experiments having been of limited duration, and it being intended to use in Lima gas of high illuminating power, it was considered advisable to use a form of spigot and socket which would admit of reversion to a lead or rust joint in case of the rubber failing. The first form was, therefore, that of a common spigot and socket, the socket being a little longer than usual, and very slightly bell-mouthed, to facilitate the entrance of the ring, and the spigot being without a bead, but having a slight hollow round the end instead, to retain the ring in its proper position on entering. Provision was made for laying the whole of the mains—from 12 inches downwards—in this manner; but when the mains were being laid, 30-candle gas having been determined upon, the writer, fearing to risk the whole on an unproved plan, laid rather less than one-half—some 14 or 15 miles—with rubber, and the rest with lead.

The rubber joints were a source of anxiety for many years, and every opportunity was taken for examining them, without discovering cause for regret.

In 1865, when the Callao works were projected, several lengths were taken up, carried to the works on men's shoulders, without any precaution to keep the joints from bending, and when proved—the ends being sealed with water and mercury—the rubber joints were found all but perfectly gas-tight. The sealing with water and mercury is mentioned, because, in the first instance, when the ends were simply closed with turned hard wood-plugs, painted, and puttied with red lead, there was a sensible fall in the pressure-gauge, although no escape could be detected either at the plugs, the rubber joint, or the fittings. On setting the pipes on end in a bucket of water, and sealing the upper end also with water, the escape was found in small bubbles of gas coming through the pores of the wood. The upper end was then filled with mercury, and the joint proved with about 15 inches of pressure. When the gas supply was cut off, the gauge rose and fell with the daily variations of temperature, showing not more loss than was probably due to the condensation of the gas, to leakage through the pores of the metal, or to absorption and exhalation by the rubber itself.

Callao was, therefore, all laid on this plan, as shown by your fig. 28, omitting the bead, however, at the commencement, in order to retain the option of recurring to lead joints. Emboldened by further experience, the lead was added, and with it the mains of Chorrillos, Iquique, and Arequipa, as also all extensions here and in Callao, have been laid. Every new superintendent has been cautioned to watch the joints well, and, so far, all reports received have been quite satisfactory.

Before Callao was laid, samples of rings of various qualities were obtained from different manufacturers, and tested by hanging them in

an atmosphere of gas for periods varying from two or three days to as many weeks. They were all found to increase more or less in bulk and weight, some of the inferior kinds even exfoliating and almost dropping away, so that it is important to use the best quality only.

Some of those used at first in Lima, after being exposed to the air for a year or two became hard and brittle, apparently by the evaporation of the naphtha or other solvent employed in their manufacture, but when laid in the pipes they were not so affected. It appears that whatever solvent is imbibed at their inner edge only serves to keep them in an elastic state, and that any excess is given off at the outer edge.

They do, however, take a decided set. A ring of, say, three-quarters of an inch in diameter in the solid, after being compressed to three-eighths of an inch in a joint, and left for a few months, if taken out and exposed to the air, would probably never recover its original form, and for this reason the writer has never used them in water-mains.

Notwithstanding what precedes, the writer does not consider the propriety of their use in all circumstances as yet quite established.

He has only further to correct a small error regarding the Chorrillos gas. It is certainly not less than 26 candles for 5 feet per hour, and the consumption per public lamp is nearer $2\frac{1}{2}$ than 2 feet per hour. It is impossible to get at the exact amount of leakage, but at most it is very small.

Lima, March 13, 1877.

A. PRENTICE.

QUANTITY OF BRICKWORK IN RETORT-SETTINGS.

SIR,—Your JOURNAL is one of the few periodicals that comes to hand regularly. Whatever may be the cause, I thank Heaven for the bounty.

Well, having received my paper, I, of course, soon dip into its contents, and am happy to find that things are moving so smoothly in the dear old country; but now and then I meet with an old friend, though dressed in a new costume, as, for example, the retort-setting figured in your issue of the 30th of January.

This system is claimed as having been invented in Germany some 15 years ago. I think I used it at Doncaster and Rotherham some 22 years ago, and a modification of it, for five retorts, was published by the late T. G. Barlow, Esq., in 1856. I can vouch for its success as a means of heating retorts to a very high temperature; but it requires the retorts and furnace bricks to be of very first-rate quality; and, to remedy the defect caused by the use of inferior bricks, I had recourse to additional transverse supports. This leads me to say a word or two in reference to much or little brickwork in the setting of retorts. I must confess I have been compelled to abandon my old notions about very open settings, and say that my practical experience leads me to believe in a little excess, rather than any deficiency, in support to clay retorts, and I will proceed to give a very practical proof.

I came to these works under very peculiar circumstances, and had to improvise almost retorts to carry on the manufacture. To complete a couple of benches of through retorts, I had to use up a number of short pieces of retort, some of them less than 3 feet long. In this oven I had to put in more supporting walls than usual, to accommodate the varying lengths of my pieces; in fact, I have a great excess of brickwork, but I do not find that I consume more fuel in these furnaces than in the others, and the heats are far more uniform. I quite endorse the idea that the extra brickwork, when once heated, acts as a reservoir of what would otherwise be sent up the main flue, and thus equalizes the temperature of the retorts. The great drawback I have to contend against is surface radiation. The arches of the benches here are 8 feet 6 inches wide by 8 feet 3 high, and arranged for eight retorts—five large-sized ovals, and three 15-inch round ones. The loss of heat by radiation is something enormous, even with 14-inch front walls.

This leads me to say a word to those who design gas-works for foreign countries, and beg of them, when they are arranging their retorts and other working plant, to remember that they are not within 24 hours of Birmingham, Glasgow, or Newcastle-on-Tyne, and that they have poor, ill-fitted workmen to deal with, and not the sturdy stokers who feed on good beef and bread, and who can stand before a furnace or bench of retorts without fainting or getting sick. I have now had nearly 20 years experience in gas-works in foreign countries, and I am more than ever convinced that, if the working plant of many establishments were designed for the special requirements of the climate and circumstances of the localities where the works are to be carried on, the capital invested in foreign gas-works would be far more productive than it is, and instead of paying 5, 6, and 7 per cent., which many works do at present, 10, 15, and 20 per cent. might be realized.

I had hoped I should have been in England before the next meeting of the British Association of Gas Managers, when, if permitted, I might have said a few words about retort-houses in hot climates. I fear, however, I shall not be in England so soon, so I must retain my growlings until another opportunity; in the meantime, I shall watch with interest the discussion on retort-settings. The retorts are the life's blood of a gas-works; if they be ill, all the rest of the system is deranged, and will drag on but a defective existence.

Buenos Ayres Gas Company, Limited (late Mutual Gas Company), March 12, 1877.

HENRY GORE.

MR. VERNON HARCOURT ON SULPHUR PURIFICATION.

SIR,—I have just read with astonishment Mr. Harcourt's statement respecting gas purification, in his lecture published in your JOURNAL of to-day—viz., that sulphide of sodium and sulphide of ammonium are alike incapable of absorbing the bisulphide of carbon (or, to use the parliamentary phrase, the "sulphur in other forms than sulphuretted hydrogen") from coal gas. But when reading the mode of experiment adopted by Mr. Harcourt for trying the effect of these materials, my astonishment ceased—or rather, it assumed a new form; I ceased to be surprised at the results which he obtained, but was filled with astonishment that any one conversant with gas purification, still more an eminent chemist, should have conducted such experiments in such a manner.

Mr. Harcourt has a model washer for ammonia, in which the gas is purified from ammonia by passing the crude gas over the surface of the water. Whether this washer removes the last traces of ammonia, Mr.

Harcourt has not ascertained, but he believes it is capable of doing so, and probably this may be the case. Now, this effect of water upon ammonia has been not only known, but applied in gas-works for many years. To take one instance, well known to every gas engineer in London, the "Livesey scrubber" (not the greatly superior and admirably perfect washer which Mr. Livesey has recently invented) is constructed precisely on this principle of passing the gas, not through water, but over an extensive watery surface; and four or five of these scrubbers have been in successful use for many years at the South Metropolitan Gas-Works. But what suffices for ammonia does not necessarily, or even naturally, suffice for the sulphur purification. The affinity of ammonia for water is extraordinary, whereas Dr. Odling, and every one who has properly experimented with the bisulphide of carbon, have recognized and stated the fact that this kind of gas impurity can only be absorbed from gas slowly, or by prolonged contact with the purifying materials employed. But even to take the case of impurities, which are easily and rapidly absorbed in the purifying processes, would any gas engineer (or, one would have thought, any chemist) ever dream of purifying gas from H_2S , by merely passing it over the surface of oxide of iron, or of extracting the CO_2 by passing the gas over the surface of lime? Or, to come to the bisulphide of carbon, Mr. Harcourt finds (as I was the first to show, five years ago), that when the gas has previously been properly prepared, especially by the elimination of the CO_2 , the bisulphide of carbon will be thoroughly extracted by passing the gas through sulphide of calcium. But certainly I never imagined that this absorption would take place if the gas were merely passed over the surface of sulphide of calcium. And if Mr. Harcourt tries sulphide of calcium in the same manner as he has chosen to try the two other alkaline sulphides (viz., of sodium and ammonium), by merely passing the gas over the surface of the purifying material—and if he chooses, as he has done relative to the two other alkaline sulphides, to give the results of his experiments authoritatively to the gas world—he will have to astonish gas managers anew, and in the teeth of five years experience to the contrary, by declaring that sulphide of calcium is totally inefficient for extracting the "sulphur" from gas.

Let Mr. Harcourt pass the gas through these two liquid alkaline sulphides, and then he will find that they do absorb the "sulphur," and that most efficiently. In the beginning of 1872 I made dozens of experiments with the sulphides of sodium and ammonium, and I found them quite as efficient as the sulphide of calcium. I used these solutions in a small tin scrubber, about 4 feet high, filled sometimes with coke and sometimes with pumice, through which the gas, as supplied to the public, was passed, after being freed from its CO_2 . The analyses of the gas so purified were made by Mr. W. H. Thompson, the Chemical Assistant of the Referees, whose ability, carefulness, and integrity are a sufficient guarantee to all who know him for the correctness of the results. These analyses, with the conditions of my experiments, were regularly entered by him in his note-book, which, since his premature and lamented death in 1874, I have been unable to recover. But I have still some loose MS. pages, in which I entered, at the time, the results of some of the earliest of those experiments—those which naturally most interested me at the time. From this contemporaneous MS. I extract the following experiments, the analyses, as I have already said, being made by Mr. Thompson:—

Sulphide of Sodium in Coke Scrubber.

	Sulphur remaining in Gas.	
Experiment 1 (imperfect)	7.8 grains per 100 feet.	
" 2	5.09 " "	
" 3	4.2 " "	
" 4	5.47 " "	
" 5	3.8 " "	
" 6	4.23 " "	

With Double Scrubber.

Experiment 1	4.8 grains per 100 feet.
" 2	5.4 " "

I remember that in one of these experiments with sulphide of sodium, the gas so purified contained only a fraction of a grain of sulphur. Mr. Harcourt, in his lecture, states that he believes the "sulphur" can be wholly extracted by sulphide of calcium, as employed by the process which I made public in 1872—a statement which accords with the results which I obtained five years ago; and I venture to repeat that equally good results can be obtained either from the sulphide of sodium or the sulphide of ammonium.

But I carried my investigations of the action of soda and ammonia upon the sulphur impurity much beyond this—indeed, into ground which, certainly so far as public knowledge is concerned, is even now a *res nova*. In my patent of March, 1872, I attacked the sulphur impurity systematically, and at every practicable point, as indeed is evidenced by the fact that, although no less than £3000 has been spent by the present Referees in experiments to discover some other means of extracting the sulphur, no other such means have been discovered.

One of the several processes deliberately planned and tried by me in 1872 was the employment of soda and ammonia in their simple state of caustic alkaline solutions; my object in doing so being to act upon the bisulphide of carbon through its acid or acidulous character, but always applying my new principle of previously preparing the gas, by the extraction of the other elements, CO_2 and H_2S , which would combine with these materials, and destroy their alkaline action on the bisulphide of carbon. In my contemporaneous memoranda I find the following experiments:—

Soda in Coke Scrubber.

(No lumps on top.)

Experiment 1.—Sulphur left in gas	14.65 grains.
" 2.—Ditto do.	16.9 " "
" 3.—Ditto do.	18.8 " "

Soda in Pumice Scrubber.

(Lumps on top.)

Experiment 1.—Sulphur left in gas	20.1 grains.
" 2.—Ditto do.	20.9 " "
" 3.—Ditto do.	21.13 " "

Ammonia (Half Strength) in Coke Scrubber.

Experiment 1.—Sulphur left in gas	12.5 grains.
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These experiments (and I made several others) show that, provided the gas be previously prepared, in the manner which I was then the first to make public, the action of simple caustic alkalies in solution is capable of reducing the "sulphur," steadily and reliably, to about one-half its ordinary quantity. This was really a great result to be obtained at that time, and by a cheap and simple process; and if this method is now (very rightly) disregarded, it is only because I simultaneously made public processes which were perfect, and entirely efficient for the same purpose. One point in connexion with the action of these simple alkaline solutions in absorbing the bisulphide of carbon (provided the gas be previously suitably prepared by the extraction of the CO_2 and H_2S) is worthy of notice—namely, the new proof thereby given of the well-known chemical fact, that substances act more efficiently in the liquid than in the solid form; because, as is well known, fresh or caustic lime, an equally potent alkali, yet which, owing to its being but slightly soluble, is most efficiently employed as a solid, is incapable of extracting the bisulphide of carbon from gas. This superior action of solutions over solids is pointed out at considerable length by Dr. Frankland, in his essay, in the latest edition of "Clegg," the passage ending with a quotation and adoption of one of the oldest chemical dicta in existence—"Corpora non agunt nisi sint soluta."

At the time I made my invention, no method had been devised for revivifying gas liquor without a serious loss of the valuable ammonia, owing to its extreme volatility; and hence I gave my attention to soda (which is non-volatile) as well as to ammonia. But now that Mr. Hills, by an improvement of his apparatus (which I am surprised is not in general use in gas-works), has successfully accomplished this most valuable object, a solution of caustic ammonia will, of course, be preferred to the use of soda; in fact, as I can state, on the authority of Mr. G. Livesey, caustic ammonia (in the form of gas liquor revivified by Mr. Hills's apparatus) can now be obtained at one-half the cost of lime, besides the saving of labour, by employing washers or scrubbers in lieu of purifiers, which require constant filling and emptying.

In addition to all this is the fact that, by using alkaline solutions, whether of soda or of ammonia, according to my process (now well known), the gas can be entirely purified from beginning to end in closed vessels, which occasion no nuisance; and purifiers can be (and even upon economical grounds I make bold to say ere long will be) wholly dispensed with. All this is to be found stated expressly in the specification of my patent five years ago.

I have but one word more to say. The present Gas Referees, in their letter or report to the Board of Trade, dated the 5th of March, published in your JOURNAL of last week, while stating "that it is not to be denied that the refuse lime is offensive," speak as follows:—

"We believe that much more lime is used than is requisite for the purpose of removing sulphur. At least nine-tenths of the lime employed serves another useful but quite distinct purpose, that of removing carbonic acid, and thus improving the illuminating power of the gas. If other means (such, for example, as are now in use at the South Metropolitan Gas-Works) should be found available for the removal of carbonic acid, the discharging of a lime purifier would be a much less frequent event, and might be conducted in a more leisurely and careful manner."

Now, turn to my Specification (March 9, 1872), and you will see that I made the same remarks five years ago, and also, *inter alia*, recommended the ver process which, since 1874, has been employed at the South Metropolitan Gas-Works, and which is now recommended by the present Referees. The following is quoted from my Specification:—

"Note.—Lime is a dirty material to use in gas-works; moreover, however used, it is objectionable on account of the nuisance which it occasions to the neighbourhood; accordingly it is desirable to reduce the quantity of lime used in gas-works to the smallest amount necessary. As hitherto employed, lime has been used to purify gas from sulphur in all forms—namely, both from sulphuretted hydrogen and from the sulpho-carbons, &c., &c." (p. 10.)

I then show how an alkaline solution, whether of soda or ammonia, can be advantageously employed antecedent to the desulphurating vessels, according to my then new principle of gas purification, "thereby eliminating all the carbonic acid." (p. 12.) And my third claim (omitting, for my present purpose, the mention of the other alkalies than NH_3) stands thus:—

"The employment of caustic . . . ammonia, used in washers or scrubbers in the manner hereinbefore described, to eliminate the carbonic acid from coal gas, and in such manner as to convert the lime in purifiers into sulphides of calcium, and also, if required, to maintain them in that condition."

Is not this exactly the process now employed at the South Metropolitan works, and recommended by the present Referees?

R. H. PATTERSON.

22, Wingate Road, Hammersmith, April 17, 1877.

NEW YORK GAS SUPPLY.—The *Polytechnic Review* states that the New Municipal Gas Company of New York have accepted a charter by which they agree to furnish gas of illuminating power not less than 16 candles; to supply the city buildings with gas for 2 dols. per 1000 feet; to light the street-lamps for not more than 20 dols. each, and not to charge private consumers above 2 dols. 40 cents each 1000 feet used; to expend at least 10,000 dols. a year in laying mains, and to restore the pavements to a condition satisfactory to the Commissioner of Public Works.

RIVER POLLUTION IN AMERICA.—The New York court has been occupied four weeks in the hearing of a case affecting the dairy interests of that State. The plaintiff, Julius T. Howard, is a farmer in the vicinity of Chardon, Geauga county, and he owns a farm on a stream just below a cheese factory belonging to a New York dairy company. He declared that the slops and whey from this factory polluted the stream which supplied his farm with water, and as his cattle drank the water, the flow and quality of milk from his dairy was diminished. It was also alleged that the stream thus polluted was a nuisance and a source of disease to persons in the neighbourhood. The case was a test one, as several other farmers had suits pending on the same ground, and the expense was shared jointly among them. On March 23, after a very patient hearing, the jury awarded the plaintiff five dollars damages. The reason for the smallness of the damages was because the costs, which would be borne by the defendants, were unusually heavy, 186 witnesses, mostly scientific men, having been examined.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, APRIL 16, 1877.

A petition against dispensing with Standing Orders in the case of the Dublin Improvement Acts Amendment Bill was presented from Rate-payers and owners of property in Dublin.

TUESDAY, APRIL 17.

The Examiners reported that no further Standing Orders are applicable to the Rotherham Corporation and the Warrington Corporation Gas Bills.

The following report from the Standing Orders Committee was agreed to:—"That the Standing Orders not complied with in respect of the Dublin Improvement Acts Amendment Bill ought to be dispensed with, and the Bill allowed to proceed, provided that all clauses, except such as relate to the water supply of the city of Dublin, be struck out of the Bill, and that costs only shall be allowed in respect of that portion of the Bill, such costs to be taxed by the proper officer of the House of Commons."

The Edinburgh and District Water, the Falmouth Water, and the London Corporation Bills were read a second time, and committed.

THURSDAY, APRIL 19.

The Examiners reported that no further Standing Orders are applicable to the Dundee Gas and Middlesbrough Corporation Bills.

The Falmouth Water and London Corporation Bills were reported, without amendment.

The Blackburn Borough Gas, Water, and Extension Bill was read the third time and passed.

FRIDAY, APRIL 20.

The CHAIRMAN of COMMITTEES informed the House that the promoters do not intend to proceed with the Dublin Improvement Acts Amendment and the North-East Worcestershire Water Bills during the present session. The Edinburgh and District Water Bill was reported, with amendments.

HOUSE OF COMMONS.

MONDAY, APRIL 16, 1877.

The adjourned debate on the amendment proposed to the new Standing Order, "Gas Companies Additional Capital," was further adjourned from Tuesday, the 17th, to Friday, the 20th inst.

On the motion of Sir CHARLES FORSTER, the order of Feb. 21, "That the Limerick Gas Bill be committed," was read and discharged. Bill withdrawn.

The Examiners report, "That the Standing Orders have not been complied with in the case of the petition for additional provision in the Newcastle and Gateshead Water Bill," was referred to the Select Committee on Standing Orders.

A petition in favour of the Epsom and Ewell Gas Bill was presented from Owners, &c., of property and consumers of gas in Epsom and neighbourhood; and one in favour of the Hanley Corporation Gas Bill from Inhabitants and consumers of gas in Smallthorne.

The petition of the London and North-Western Railway Company against the Dukinfield and Denton Local Boards of Health Bill was withdrawn.

The *locus standi* of the following petitioners has been disallowed:—Stalybridge Gas Company against the Ashton-under-Lyne Gas Bill; Rate-payers and owners of property in Stoke-upon-Trent against the Newcastle-under-Lyme Borough Extension and Improvement Bill; Consumers of gas, and ratepayers in Dukinfield, except such of the petitioners as are consumers of gas, against the Dukinfield and Denton Local Boards of Health Bill; Corporation of Newport against the Newport (Monmouthshire) Gas Bill.

TUESDAY, APRIL 17.

The following report from the Standing Orders Committee was agreed to:—"That, in the case of the Colne Gas Bill, petition for additional provision, the Standing Orders ought to be dispensed with—that the parties be permitted to introduce their additional provision accordingly, if the committee on the Bill shall think fit."

A petition was presented by Mr. Whitwell, from the Kendal Gas and Water Company, against the proposed new Standing Order.

A petition in favour of the Perth Water Bill was presented from Rate-payers and inhabitants of Perth.

The petitions were withdrawn of the Corporation of Leicester against the Leicester Gas Bill; and of the Bridgend of Perth Water Company, Limited, against the Perth Water Bill.

The Bridgewater (Corporation) Water, Bristol District Water, Bristol United Gas, and Christchurch Gas Bills were referred to a Select Committee, consisting of Mr. Pease (chairman), Mr. Dalrymple, Lord Edmond Fitzmaurice, and Mr. Boord; to meet on Tuesday, April 24.

The Sunningdale District Water, Epsom and Ewell Gas, Crystal Palace District Gas, and The Gaslight and Coke Company Bills were referred to a Select Committee, consisting of Mr. D. R. Plunket (chairman), Mr. Foljambe, Mr. Lewis Starkey, and Mr. Courtney; to meet on Thursday, April 26.

WEDNESDAY, APRIL 18.

The Reservoirs Bill was read a second time and committed.

The petitions were withdrawn of (1) Dukinfield and Denton Local Boards, (2) Earl of Stamford and Warrington, against the Ashton-under-Lyne Improvement Bill; and of (1) Earl of Kinnoull, (2) Feuars of the Earl of Kinnoull, against the Perth Water Bill.

The *locus standi* of the Sutton Gas Company, as petitioners against the Epsom and Ewell Gas Bill, has been disallowed, except as against clause 4 of the Bill, and so much of the preamble as relates thereto.

FRIDAY, APRIL 20.

The following resolution of the Standing Orders Committee was agreed to:—"That in the case of the Newcastle and Gateshead Water Bill, petition for additional provision, the Standing Orders ought to be dispensed with—that the parties be permitted to introduce their additional provision accordingly, if the committee on the Bill shall think fit."

The Tudhoe and Sunderland Bridge Gas Bill was reported. The petition of the North British Railway Company against the Perth Water Bill was withdrawn.

AUCTION CLAUSES IN GAS BILLS.

The adjourned debate on the proposed new Standing Order—"That in every Bill in which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender, at the best price which can be obtained"—was opened by

Mr. RAIKES, who said: In resuming the debate which commenced on this subject a fortnight ago, I wish to say, speaking on the amendment of my honourable friend the member for Cambridgeshire to the Standing Order I ventured to suggest to the House, that I do not wish to detain the House at any length, because I stated my views on the subject generally on the first occasion. One particular point was raised by my honourable and

learned friend, and another point was raised by the honourable and learned member for Dewsbury, both of which are certainly worthy of consideration, and on which I should wish to say a few words while the amendment is before the House. The point, sir, which was raised by the honourable and learned member for Dewsbury, took the form, as the House will remember, of a question addressed to yourself, and the point, shortly stated, was whether it was desirable or proper to allow a Standing Order of this House to come into collision with, or override, a general public Act of Parliament, and you, sir, said that the question so put by the honourable and learned member for Dewsbury admitted of a simple answer. You said that a Standing Order is not a legislative proceeding, but is only a direction to a committee of this House to do certain things in regard to a particular Bill, and it is on the action of the House, and not on the action of a committee, that any change in legislation is effected. After that question had been answered, however, I believe that some doubts arose in the minds of some honourable members of this House, which I shall be anxious, if I can, to remove on the present occasion—that it would be more constitutional that the proceeding should be by Bill rather than by Standing Order. As I said on that occasion, I should, of course, prefer a Bill, because that would relieve me from the duty of enforcing the Standing Order, and transfer the burden to the shoulders of Her Majesty's Government. But I wish to limit that preference to personal grounds, because I cannot see any constitutional grounds for preferring a Bill on this matter to a Standing Order. I think that the question as to contravening an Act of Parliament by Standing Order which was raised by the honourable and learned member for Dewsbury was effectually disposed of by the ruling of the chair; but I wish to go into the question a little further, and ask what Act it is that it is supposed this Standing Order is likely to contravene? I do not see the honourable and learned member in his place, but it will be recollected by the House that the question was put on rather general grounds, and it is one in which the question of technical procedure is so mixed up, and so necessarily mixed up, with the question of public policy, that it is difficult to separate these two ideas in the minds of many honourable members. But I should like, if it is supposed that this Standing Order is likely to contravene a public Act of Parliament, or a private Act, to go into this question. Let us take the particular case of some gas Act; let us suppose a gas company which had obtained an Act in 1867, and had incorporated into that Act all the provisions of the Companies Clauses Act of 1863, could it be for a moment pretended that Parliament, by passing a particular Act in 1867, dealing with the particular matter then under consideration, could have precluded itself from acting in 1877 as it should think proper with regard to matters which were never contemplated in 1867? It appears to me impossible to sustain that proposition for a moment. I do not think any one will contend that the clauses relating to additional capital in the Companies Clauses Act, and which are supposed to be incorporated in that particular Act, can have reference to any capital not then in contemplation. But then it is supposed by some of the honourable gentlemen who think with the honourable member for Dewsbury, that the Companies Clauses Act—the Act of 1863—is itself a barrier against such a proceeding in a matter of this sort, and that it is a violation of guarantees. Now, as I said before, these two questions get so mixed up, that it is exceedingly difficult to separate them. Well, I wish to ask whether the gentlemen who have raised this question are familiar with the Act of 1863? Do they think that that Act is one of universal application? Do they believe that it was in any way intended to be an unalterable code? If so, why are we every year passing a number of private Acts. What is the title of that Act? It is:

An Act for consolidating in one Act certain provisions frequently inserted in Acts relating to the constitution and management of companies incorporated in carrying on acts of a public nature.

Turning from the title to the preamble, I find it is stated:

And whereas sundry provisions of the like nature, but not comprised in the said general Acts respectively, are very frequently introduced into Acts of Parliament relating to such companies, and it is expedient to comprise such last-mentioned provisions in one general Act, such Act to be applicable to England or Ireland or to Scotland as the case may require, and that as well for the purpose of avoiding the necessity of repeating such provisions in the Acts relating to such undertakings as for ensuring greater conformity in the provisions themselves.

Could there be anything plainer in the world than that this was a skeleton Bill, a sort of model Bill, and that it was passed by Parliament as incorporating such general provisions as might be thought expedient to introduce into particular Acts? Let us look at clause 3 of that Act, part 1:

This part of this Act shall apply to every company, incorporated either before or after the passing of this Act, which obtains a special clause incorporating this part of this Act.

Why have limited its provisions to such Acts as should contain a particular clause incorporating this Act? Let us come to clause 12:

Where any company, incorporated either before or after the passing of this Act for the purpose of carrying on any undertaking, is authorized by any special Act hereafter passed, and incorporating this part of this Act, to raise any additional sum or sums by the issue of new ordinary shares, or by the issue of new ordinary stock, or (at the option of the company) by either of these modes, then, and in every such case, the company, with the sanction of such proportion of the votes of the shareholders and stockholders entitled to vote in that behalf at meetings of the company, present (personally or by proxy) at a meeting of the company specially convened for the purpose of raising the additional sum or sums from time to time, create and issue (according as the authority given by the special Act extends to shares only or to stock only, or both) such new ordinary shares, of such nominal amount, and subject to the payment of calls of such amounts and at such times as the company thinks fit, or such ordinary new stock as the company thinks fit.

The limitation is as clear and precise as a limitation can be—that it is only to apply to those particular Acts which incorporate this particular clause in this Act. In asking Parliament to pass this Standing Order, I am asking Parliament to lay down a rule for the direction of its committees in relation to gas companies in future, if they should not incorporate this Act. I am willing to do credit to the objections raised by the honourable gentleman who first raised this point—that a Standing Order applies either to a general Act or a particular Act—but I am more certain of nothing than that this Standing Order will not override nor clash with the provisions of any gas company's Act now in force, or of the Companies Clauses Act. Now we come to the question of the breach of faith; that depends on whether there was anything like guarantee of future capital; but I confess that I should be very unwilling to do anything which might be supposed in any way to trench upon any rights which had been guaranteed by Parliament. But I think the two apprehensions must stand or fall together. Either we are doing something by this Standing Order—I hope we are doing nothing—by which we shall upset the existing state of things under which it is said there is a guarantee; or, if we are not interfering with the existing state of things, we cannot be said to be committing a breach of faith. And one or two points I may mention which have occurred to me since this matter was last under discussion. Of course the principal question is as to the effect of passing such a Standing Order. The honourable and learned member for Cambridgeshire is now in his place, and I wish particularly to commend to his consideration what I am going to say. There was a Bill brought before Parliament in the present session granting further powers to the Leicester Gas Company. That Bill has not been formally withdrawn. It is, I understand, on the point of

being withdrawn, and why is it going to be withdrawn? The Bill was opposed by the Corporation of Leicester, on the ground that it proposed to raise additional capital for the purpose of enriching the shareholders rather than in the interests of the public. Since that Bill was introduced a change has come over the spirit of the parties, and an arrangement has been come to by which the Leicester Corporation are to take the concern, and to pay perpetual annuities in this proportion—the existing A shares, on which £13 has been paid, and the price of which in the market is now from £23 to £24, are to receive 26s. 3½d.; the existing B shares, on which £10 has been paid, and the price of which in the market is from £15 to £16, are to receive 17s. 2d.; and the existing C shares, on which £10 has been paid, and which now commands the price of from £14 to £15, will receive 16s. The company are very glad to accept these terms from the corporation, and why? Because, as was said at the meeting, “Mr. Raikes has given notion of a motion which will take the virtue out of the Bill.” Well, I am glad that, if this motion has not any other effect, it at least has given the inhabitants of Leicester the opportunity of coming to terms with the gas company in that town. There is another case, that of a much larger company. I am now referring to the report of The Gaslight and Coke Company for the year 1876, and I am looking at what I believe to be a faithful report of the proceedings of a meeting of that company. The governor made a long speech just after the company had obtained their Act, which had been referred to the committee of which my right honourable friend opposite was chairman, and that committee had inserted the auction clause which I am now proposing shall be introduced in all future gas Bills; and they had also inserted the clause providing for a sliding scale of profits. I do not wish at this moment to offer an opinion on the latter point, because I think we had better dispose of the amendment of the honourable member for Cambridgeshire in the first instance. But this report states, first of all, the views of the directors of that company with regard to the sliding scale, and then it comes to the question of the auction clause, and the governor of the company, who is a very good authority on this subject, said: “I think, gentlemen, we have not done wrong in accepting them, but as I expressed my opinion, and the opinion of the Board, on a former occasion, I will only repeat what I said then, that I think it is a most valuable enactment.” And he goes on to say—I will summarize it—that when a gas company make an addition to their capital, of course a great premium is realized, being the difference between the market value of the shares and the nominal value, but at the present time that goes into the pockets of the shareholders, and does not go to the company in a company point of view, but if the premium is realized by the company it will add to the value of the stock of the company, and the effect will be to send up the value of the shares immediately by some 10 or 12 per cent., and therefore he thought the auction clauses were based on sound policy, and were likely to be to the interest of the proprietors. I must now say a few words on the amendment of the honourable and learned member for Cambridgeshire. By that amendment he, in point of fact, accepts the principle for which I contend. He admits that care should be taken by this auction clause to protect the interests of the public, but he wishes to throw on those who represent the public the onus of proving the necessity in each particular case. There is another amendment before the House to which I referred in my opening statement a fortnight ago. There is an amendment which says in effect that the auction clauses are to be recognized as a matter of public policy, but they are not to be enforced in every case. The committee may insert them if they think proper, but if they do not they are bound to state to the House the reasons why they have come to that conclusion. That shifts the onus on to the gas companies. I confess I think that when a general rule is laid down those who propose an exception to it should state their reasons, therefore I think that this amendment ought to be accepted. But I am not at all prepared to adopt the amendment of the honourable and learned member for Cambridgeshire, because, while it accepts the principle as sound, it proceeds in operation to make it as unsound as it can possibly be, and I think it can scarcely be worth the paper on which it is printed. I have only a word or two more to say, which I might spare the House, but I see the honourable member for Sheffield in his place. He was not here in the early part of the discussion, and so did not hear what was said as to this being a constitutional proceeding, and I may, perhaps, be allowed to recapitulate to the House what I have said. I have pointed out that the provisions in the Companies Clauses Act, which it is supposed the Standing Order might come in collision with, is one which provides only for such cases as shall in express terms incorporate that Act in their Act. It is not an Act of general application. It requires that any company who are to avail themselves of it shall incorporate its clauses, or those parts of the Act which they think proper, in their Bill. We are laying down a rule that this may be done by a Standing Order. I apologize to the House for having detained it so long in this matter, but I think it is a question of such great public importance that I should hardly have been justified in making the proposal I have if I had made a less lengthened statement. I can only assure those gentlemen who are interested in gas companies that I do not contemplate anything which might diminish the value of their property, and I trust that they will find that my proposals will not only add to the value of their property, but that they will also be for the interest of the public.

Mr. KNATCHBULL-HUGESSEN: After hearing the speech of my honourable friend a fortnight ago, the question struck me, why is not this matter a proper subject for a Bill? In my opinion a change of this kind should be carried out only by a Bill which, having passed through both Houses of Parliament, should receive the sanction of the Crown, and I ask the House whether there is not great constitutional danger in having a Standing Order to supersede an Act. My honourable friend proposes that the auction clauses shall be inserted in every Bill. I do not know whether that provision will be good or bad for the gas companies, but I want to know why the Select Committee to whom the Bill is referred should not decide whether the clauses should be inserted or not. And it seems to me that my honourable friend has a certain distrust of his own proposition, because he has accepted an amendment which says that there shall be added to the Standing Order the words “unless the committee on the Bill shall report that such provision ought not to be required, with the reasons on which their opinion is founded.” The committee on a Bill will do one thing or another. They will either adopt the provision or not, but the amendment says that they shall state their reasons. Well, that is a somewhat new provision, and for my part I object to these innovations, and unless it can be shown that there are very good reasons for it, and I do not think my honourable friend has made out a good case for it, I do not think it should be adopted.

Colonel BERESFORD said it struck him that this was a proposal which was more worthy of an arbitrary Government than of an English House of Commons. His honourable friend said that this Standing Order would not repeal an Act of Parliament. He said, on the contrary, that it would repeal all the Acts that had been passed on the question up to the present time, and that without giving the parties affected the opportunity of stating their reasons against it. This was a very serious question when they looked at the enormous amount of capital involved, not only as regarded gas companies, but as regarded other companies of a like character. On a former occasion the Chancellor of the Exchequer said: “It is a stringent

measure to deal by a Standing Order with such matters as this, and I think that to pass a Standing Order of this sort without further legislation is rather an arbitrary step.” He (Colonel Beresford) said that such a clause as that now proposed would be unjust to nine out of every ten gas companies in the kingdom. It might be agreeable to those companies who for a long time had paid their statutory dividends, but it was unjust to those companies who wanted to raise additional capital. In fact, this was an attack on capital, and if this Standing Order were allowed to pass, he warned all members of the House who had any interest in railway and other companies, that the same legislation would be applied to them as a matter of course. A change of this kind, if made at all, should be made by Bill, and he did not see why the House should depart from the usual course.

Mr. GOLDNEY: In reply to the observations of the last speaker, and as showing the absolute necessity of some such Standing Order as that proposed by the Chairman of the Committee of Ways and Means, I may state that in 1867 I had the honour and pleasure to sit on a committee on gas legislation, of which Lord Cardwell, then Mr. Cardwell, was the chairman. We sat from the 10th of May till the 3rd of August taking evidence, and the result was a very elaborate report, drawn up by Lord Cardwell, the chairman, as to the principles which should guide gas legislation, which was generally accepted by the gas companies. Looking at the enormous capital possessed by the gas companies, it is almost impossible to affect them by competition. In 1868 the City of London Gas Act was passed, and in 1869 a Bill of the Imperial Gas Company was passed by the committee, and brought down to this House for the third reading, without any of the provisions which the committee of 1867 sought to enforce for the protection of the public. We held that that Bill should be sent back to the committee, with instructions to insert these clauses; but three members of that committee stood up in this House, one after another, and said they had never heard of these resolutions which had been so deliberately agreed to, and that if they had been brought under their notice they would have passed a very different Bill. I say that that of itself shows the absolute necessity of the attention of committees being directed to the great principles on which legislation of this kind should proceed, and that it is absolutely necessary we should have something like consistent legislation, especially when we are dealing with questions of this kind. One of the standing recommendations of the committee was that when any future capital was to be raised, it was the bounden duty of Parliament to see that that capital was raised by bonds, or in some other way, at the cheapest rate, and not by the issue of new shares or stock. I think the resolutions of that committee show the absolute necessity of this House laying down certain regulations to be followed by the Select Committees on Bills, and, therefore, I heartily support the Standing Order now proposed.

Sir H. JACKSON: I think this motion involves two questions—one of law and the other of policy. Both points have been debated at some length. One seems to be perfectly clear; the other is a matter for consideration. On the question of law, I agree with the view propounded by the honourable member for Chester. It seems to me that every Select Committee should have the power of imposing on any gas company who propose to raise additional capital, the auction clauses or the sliding scale, or any other conditions, where they think the justice of the case requires it. And if that can be done in isolated cases by committees, I fail to see why the House should not adopt a general rule, which should be applicable to all cases, assuming it to be satisfied that the rule proposed is one which it is expedient to adopt, and if the Standing Order is protected by the proviso suggested by the honourable member for the borough of Cambridge. But that brings me to the real question, and that is, is this Standing Order one that it is expedient for the House to adopt? Now, I venture to say that, if we look into this question, it is quite easy to ascertain what the grievance is, which, it must be admitted, is felt in almost all towns where there are gas companies incorporated by Acts of Parliament. The grievance is that these companies enjoy what is virtually a monopoly. There is no competition. Consumers are obliged to go to a particular merchant and buy the article they want at his own price. But the question is, how is that admitted evil best to be dealt with? Is it to be dealt with by Parliament saying, once for all, that additional powers, in the future, shall be given to the local authorities? If that is so, let Parliament say so, either by a Standing Order or by a Bill. If, on the other hand, you say that the present system is advantageous to the consumer, that the terms on which this privilege has been conceded have been shown by experience to be beneficial—in other words, that the limit of 10 per cent., which Parliament imposed years ago, when the manufacture of gas was to some extent an experiment, should be maintained—is Parliament to say that for the future no additional capital shall be raised but at a price less burdensome to the consumer than the 10 per cent. or the 7 per cent., which I believe is the rate at which new capital is generally raised? Let us look at the sliding scale, on which a good deal has been said. It has been adopted in order that the price to the consumer may be regulated; but my honourable friend, in trying to effect this object, seems to me to set about it in the most inconvenient way that could possibly be devised, because, instead of saying to the companies which have got these parliamentary powers, “We mean to limit the advantages which you are to derive from them,” what he says is, “We mean to interfere as much as possible with your internal arrangements.” I venture to submit that that is not the best way to carry out the object he has in view. Many companies would like to have power to raise their capital by auction. By all means, if they wish it, give them that power; but why force it upon them? Why interfere in the internal affairs of a company, in a way which, I do not say must, but which may, cause the greatest possible inconvenience? It seems to me that this is a reasonable objection to this proposal. If Parliament has created these companies with certain rights and expectations, it is a pity that it should stultify itself when, as I think, the object which the honourable gentleman seeks to attain might be gained by a different kind of regulation—either by a Bill or a Standing Order. I hope that the matter may be allowed to stand over for further consideration, and that the honourable member will not press it to a division, but will consider whether the same object cannot be carried out in a less objectionable manner.

Mr. HEYGATE: The honourable member for Chester has referred to the Leicester Gas Company. I have no shares in that company, but I may be permitted to say that the statement that this company had proposed to raise capital that was not required for the purposes of the town, is entirely unfounded. I do not know where my honourable friend got his information from, but I assure him that it is a suggestion that has not been made as yet by any of the opponents of the Bill. I do not know why that reference to the special case of Leicester has been made. He referred to it, in bringing forward this motion, as having been the means of causing an arrangement between the gas company of Leicester and the corporation; but I do not know how it can be argued that that is a reason for this measure, unless he means to suggest that this proposal was used as a means of enforcing unfair terms on the company. Now, I will not venture to contest the legal question which has been so often referred to by previous speakers. I have certainly been under the idea—and I confess that I am still under the idea—that the resolutions proposed by my honourable

friend are, in point of fact, a repeal of the understanding, if not of the actual Acts on which these companies were formed. A very large amount of money has been invested in gas companies by the industrial classes throughout England, certainly under the assumption that they were, at all events, to have the benefit which might accrue to them from the future issue of capital. And here let me say that many are under the impression that a certain dividend has been secured by Act of Parliament; but what these companies really secured by previous legislation was not a security for any dividend, but simply a limitation of that dividend. Well, if this is the case, if all this amount of capital has been created under the impression that any benefit that may be derived from the issue of new capital is to go to those who hold the shares. I think my honourable friend, even if he is right in saying that a Standing Order does not repeal a previous Act, would do well to consider whether it would not be better for him to proceed by Bill instead of by Standing Order. We should then, at all events, have the advantage of considering the matter more fully and fairly than we can now do. I do not promise that if he brings in a Bill he will have my vote. I have not yet heard that it is a politic measure, or one that is good for the country. To restrain the outlay of capital is a very objectionable thing. What would be the result of establishing a rule of this kind? Why, that no gas company would have an interest in extending the mains to outlying districts; but as soon as they got up to their existing capital, they would not lay out a single sixpence beyond it. Well, you may say that other companies would come in to supply this want; but that is not so easy, and if new companies did come in, they would not be able to supply gas so cheaply as the old companies. Therefore, I say it would be impolitic, and not to the advantage of the community at large, certainly not to the advantage of the outlying suburbs of towns, to establish such a rule as that now proposed. I say more. I say it is impolitic on higher grounds for Parliament to legislate in a manner injurious to the interests of these small capitalists. These gas shares are mainly held by the middle classes, and is it not better that they should put their money into investments of this kind rather than put it into Turkish and other foreign loans? It is to the interest of the country that we should encourage local investments of this description, and if it should happen that they return a good dividend, I think they should not be meddled with.

Mr. W. E. FORSTER: I do not agree with my honourable friend who has just sat down, nor with the honourable member who preceded him. I think that the Standing Order now proposed by the Chairman of Ways and Means, with the addition of the amendment of the honourable member for the borough of Cambridge, will be a settlement of the matter. But the question we have to consider is, whether it is desirable to aim at the object at which the Chairman of the Committee of Ways and Means does aim, and whether the Standing Order is the best way of doing it. Now, with regard to the object, I would not have ventured to trouble the House at all if I had not been referred to two or three times, and if I had not had some experience in gas Bills in the past year and the year before. My honourable friend opposite (Mr. Goldney) said he was a member of the committee of which Lord Cardwell was chairman. I had the honour of being a member of that committee too. In that inquiry we were dealing with the most powerful gas company in the kingdom—The Gaslight and Coke Company—and yet we found the change was accepted. The sliding scale was opposed quite as strongly as the auction clauses, but afterwards it was accepted; and, with regard to the auction clauses, so little was the feeling against them that they were not in any way opposed last year, when The Gaslight and Coke Company brought in a Bill, and when they were accepted at once, without, as I recollect, any real discussion on the matter. The doctrine of establishing a statutory limit of not more than 5 per cent. for future capital was hardly mentioned in the discussion. The foundation of the discussion with these large companies was this—they had set to work to do a large and important business in the Metropolis, and by going to Parliament for additional powers it was thought that the matter could be placed on a better footing by an arrangement that would guarantee 10 per cent., certainly enable them to obtain 10 per cent., and a price was fixed which, generally speaking, would give 10 per cent.; but the question came up, "You can make gas much cheaper, and you ought no longer to have this large price, but you ought to be reduced to a lower price;" and a regulation was then made that if, on the one hand, the company thought they should not get 10 per cent., or if, on the other hand, the consumers thought they would get more, there should be an inquiry. Well, on that question we had to consider whether that was the best mode of dealing with the matter, and we came to the conclusion that it was a clumsy way of doing it. The proprietors were perfectly sure of obtaining 10 per cent., but they were not to have more, and that might lead to extravagance. The committee thought they would try to introduce the principle of hope and fear by tempting them with a sliding scale, by which, if they could make gas at a lower price than what was fixed, they could have a higher dividend, and if they charged a higher price they were to have a lower dividend. The auction clauses did not come before us. We were dealing with a Bill of the Metropolitan Board of Works, which did not contain the auction clauses, and therefore we had not the opportunity of considering them. The opinion, I think, of us all was that the auction clauses would be of great advantage. The position of the companies is this—they are pretty sure of 10 per cent. by the sliding scale, and, in some cases, a little more. Their dividend, at any rate, was a round 10 per cent., and if they can get anything like that dividend for future capital it is to their interest to be as extravagant as possible, in order that they may divide 10 per cent. on future capital; and the payment of 10 per cent. instead of 5 on future capital will, of course, prevent a reduction in the price of gas to the consumer. Now, that is the state of the case, and I think it only fair to say to gentlemen who have got this good property—"It was given you as a monopoly, and the least that we ask of you is that if future capital is raised you must give the benefit to the public." My honourable friend the member for Leicester says there is no inducement to lay out more capital. Well, I give the practical answer that the largest company in the kingdom do not think so. But I may also say that there is this very evident object, that it strengthens their position, and enables them to be more sure of getting their dividend on their original capital; and if, indeed, they were to follow the opposite suggestion of my honourable friend, and say, "We will not supply the outlying districts," the result would be that they would be obliged to be in competition with another company, who would lay down mains. My honourable friend the member for Sandwich (Mr. Hugessen) seemed to think that this was a novel mode of dealing with private companies; but there are Standing Orders with regard to railways quite as imperative as this. It seems to me that, as it is now worded, it is merely a strong suggestion to a committee to put in these clauses, unless there are some special reasons to the contrary. I can hardly conceive such reasons. I say that the Standing Order is more to the interest of the public than a Bill, because a Bill would apply to only one company, whereas the Standing Order applies to all companies, and it is a better mode of effecting the desired object than by having recourse to a Bill.

Mr. ROEBUCK: I have been told since the last debate that I did not quite see the force of the statement of the honourable gentleman, the Chairman of Ways and Means, that a Standing Order does not override an Act of

Parliament, that there is no general Act of Parliament on the subject, but that this is a mode of procedure quite in accordance with the rules and orders of the House. It appears that there are three parties interested in this question. There is, first, the public; then there are the companies; and next the individual shareholders—and the interests of the individual shareholders are not always coincident with the interest of the companies. By the mode of proceeding proposed, the interest of the public and the interest of the companies will be consulted, and not simply the interest of the shareholders. I cannot suppose there can be any difficulty in passing the resolution, which, by serving the interest of the companies, will enable them to sell gas cheaper, and thus serve the interests of the public. I shall support the resolution.

The ATTORNEY-GENERAL: I think it desirable that there should be no doubt as to the legal position of the matter, and with regard to the question as to whether this proposed resolution infringes an Act of Parliament, it was suggested, when this discussion came on some days ago, that it was an unconstitutional measure, and that, in fact, the House of Commons had no power to pass such a resolution. My honourable and learned friend the member for Dewsbury laid down that doctrine, and with the greatest possible confidence appealed to you, sir, and in answer to his inquiry you seemed to me to have at that time very satisfactorily and completely laid the ghost, so to speak, of that constitutional difficulty. But still there seems to be some lurking doubt in the minds of some gentlemen who have taken part in this discussion, and there may be a lurking doubt in the minds of some who have listened to the discussion, whether there are any legal difficulties in the resolution, and I think it desirable to say a few words on that subject. Now, it appears to me that the Chairman of Ways and Means has explained the matter very clearly indeed. Assume for a moment that there was in existence some Act of Parliament that provides for the case—that enacts that, when additional capital was raised, that additional capital should be offered to the shareholders of the company. Even supposing that there was an Act of Parliament having a provision of that sort, I cannot conceive how a resolution of this House, that it should be an instruction to a committee sitting upon a gas Bill that a provision of a different sort should be inserted would be any infringement or contravention of that Act of Parliament, because the committee would insert the clause according to their instructions, and the Bill would come down to this House and be dealt with by the House, would then go from this House to the upper House, and might be dealt with there, and in the last stage it would receive the Royal Assent. It would pass through all the stages of legislation. The instructions of the House would not contravene the Act of Parliament or interfere with its provisions, but it would be the legislation of Parliament which might or might not interfere with the former legislation of Parliament. But it is not necessary to consider the matter in this aspect, because it is perfectly clear that there is no Act of Parliament in existence, such as that which is suggested by my honourable and learned friend. The Act of Parliament which was relied upon by my honourable and learned friend, and was the foundation of his constitutional difficulty, was the Companies Clauses Amendment Act of 1863; and all that Act of Parliament does is to frame, so to speak, a number of miscellaneous clauses, and to state that those clauses may be inserted in Bills which shall come before committees, if the committees choose to insert them; and, therefore, the committees that sit upon gas Bills may or may not, just as they please, insert in those Bills the provisions of this Act of Parliament, and if they do incorporate them, then those provisions will become law. Therefore, it really stands thus: that there is no Act of Parliament whatever to be infringed; there is nothing compulsory on a committee to adopt the provisions of the Companies Clauses Amendment Act, 1863, and this Standing Order cannot, by any possibility, infringe the Act of Parliament. It has been asked, "Why do you not proceed by way of Bill?" I will ask in return, why proceed by Bill when what you want to accomplish is so much more easily accomplished by Standing Order? If you refer to the Standing Orders with reference to Railway Bills, you will find that Standing Orders 153 to 160 are instructions such as are proposed by the Chairman of Ways and Means; and when this has been done over and over again—when there are precedents—why should it not be done in these cases? There seems to be but one argument apart from the legal difficulty, and it is this. You say that the shareholders have some kind of right to have offered to them the additional capital. What right have they? They certainly have no legal right, and why should they have even a hopeful expectation of it? Does it follow that because the House has dealt with them too leniently in previous cases that it should continue to do so? The real truth of the matter is this, that these gas companies have a monopoly; and it is requisite that Parliament in some way, either by a Standing Order as is proposed, or by an Act, should protect the consumer.

Sir CHARLES ADDERLEY: I will not detain the House more than by saying a word or two as to the intentions of the Government. The Board of Trade suggested that the auction clause should be introduced into the two Bills for regulating gas companies last year by the committee over which the member for Bradford presided, they thought that was no less than an act of justice to the public; and it appears that the companies generally throughout the country have adopted the auction clause. The poverty of the gas companies in their earlier undertakings led Parliament, in 1847, into the extraordinary act of practically fixing for them an artificial profit. The Act of 1863 is simply a Clauses Act, in the nature of a Standing Order. A committee might suggest that clauses in that Act might be inserted in a Bill, and unless they are so inserted they have no force whatever. The section of the Act of 1863 which stated that new capital shall be offered to shareholders at par, cannot be looked upon as applicable to gas companies which have already had so large an advantage given them by the Act of 1847, securing to them a dividend of 10 per cent., and giving them an absolute monopoly. It is only when the committee on a Bill think fit that the clauses in the Act of 1863 which state that new capital is to be offered at par to shareholders are incorporated into a Bill, and this cannot be construed into the right of shareholders to have such a bonus added to their shares. This was no part of the original bargain with the gas companies; and though it is argued that it is a bonus given by Parliament to them, that position is clearly untenable. Holding these views, the Government are prepared to accept the motion brought forward by the honourable gentleman the member for Chester, and the addition that is proposed by the honourable member for the borough of Cambridge. The Government are willing to add words further, to this effect, that where additional capital is offered by auction, and the bid of a proprietor is equal to the highest bid of a non-proprietor, the proprietor shall always be declared to be the purchaser. I think that a fair offer to the shareholders of gas companies.

The House then divided on Mr. Rodwell's amendment, to leave out from the word "capital," in order to add the words, "it shall be an instruction to the Select Committee to consider the expediency of provision being made for the offer of such capital by public auction or tender at the best price which can be obtained."

For the amendment	84
Against it	256

Majority against 172
Mr. MARTEN moved to add the words, "unless the committee on the Bill

shall report that such provision ought not to be required, with the reasons on which their opinion is founded."

Mr. RAIKES said he hoped the House would accept the amendment. He thought it would ease the operation of the Standing Order, and make it less drastic.

The amendment was agreed to.

Mr. BRISTOWE moved another amendment to add at the end the following words:—"In the case of every such Bill it shall be competent to the committee so to regulate the price of the gas to be charged to consumers that any reduction of an authorized standard price shall entitle the company to make a proportionate increase of the authorized dividend, and that any increase above the standard price shall involve a proportionate decrease of dividend." He said this was in the interests of the consumers, but was fair to all parties.

Mr. RAIKES said he quite agreed with the amendment. He thought the sliding scale was a great improvement on the previous arrangements. He thought there should be a general power to all committees to insert the sliding scale in any Bills that came before them.

The amendment was then agreed to, after which the Standing Order, as amended, was put and carried.

SATURDAY, APRIL 21.

The petition of the Great Western Railway Company against the Bristol District Water Bill was withdrawn.

HOUSE OF COMMONS COMMITTEE.

TUESDAY, MARCH 20.

Before Mr. ASHETON, Chairman; Messrs. SMITH, BELL, and DUNDAS; Mr. BONHAM-CARTER, Referee.)

RAMSGATE LOCAL BOARD BILL.

(Continued from page 590.)

At the conclusion of Mr. Balfour Browne's speech,

Mr. POPE said he proposed to call his witnesses on behalf of the gas and water companies and reserve any remarks he might have to make until the close of the evidence.

In reply to the Chairman, Mr. MICHAEL said the Bills of the two companies would be taken together.

Mr. H. Curling, examined by Mr. MICHAEL.

I am Chairman of the Isle of Thanet Gas Company, and also of the Ramsgate Water-Works Company. I have been for 30 years a shareholder in the gas company, and for 20 years the chairman. I have taken an active part in the management of the company, which was commenced under the provisions of an Act in 1824, with an original capital of £12,000, with power to raise an additional £4000. The company had five miles of mains laid at first. The cost of the works and mains was £13,500, but the extras brought it up to £15,411, leaving for working capital £589. There were 800 £25 shares, upon which no dividend was paid for the first two years. In 1826 there was a dividend of 2½ per cent.; in 1827 none; in 1828 and 1829, 5 per cent. In 1830 the directors hoped to have declared a dividend of 10s. but in consequence of expenditure upon the works the dividend was only 8s. per share, or 4½ per cent. The profit-rental at that time was £920 3s. 4d. From 1830 to 1847, 5 per cent. was paid. In September, 1847, the directors recommended that the paid-up capital should be henceforth considered to be £20,000, upon which 5 per cent. should be paid. They had then expended £5280 out of profits for enlarging and improving the works, of which £3024 had been spent at Ramsgate, and £2256 at Margate. In 1847 the consumption of coals was 1726 tons; the gross receipts £3253 11s. 8d., and the expenditure £1985 16s. 7d., leaving a profit of £1267 15s. 1d. Between the years 1847 and 1862, 5 per cent. was divided. In 1862 a resolution was passed that the capital should be considered as £24,000, £11,523 having up to that time been taken from profits for the enlargement and improvement of the works—at Ramsgate, £5899 and at Margate £5624. Since that time 10 per cent. has been paid upon £24,000. The company have had no reserve-fund, and had no power to create one. They formed a surplus fund of the profits left after paying the dividends, but that was all expended upon the works. Since 1862 the total amount spent on improvements has been £52,339 19s. 1d.—£24,693 17s. 1d. at Ramsgate, and £27,646 2s. at Margate. We seek by our Bill to capitalize £48,000 as improvement stock. In reality that represents a balance of £61,143, so that we lose £13,000 in not applying to Parliament to capitalize that money before. The gas was originally charged for at so much per light, but on the introduction of meters the price was 12s. per 1000 feet; that was about 35 years ago. The price was subsequently reduced down to 4s. per 1000, but in August, 1872, it was raised to 4s. 6d., owing to the coal famine, and in May, 1873, to 5s. In January, 1875, it was reduced to 4s. 6d., and in July of that year to 4s. Before the price was raised the company were paying 13s. 8d. per ton for coals, but the cost rose to £1 1s. 7d. in Ramsgate, and £1 1s. 11d. in Margate, and subsequently to £1 11s. 7d. per ton, which was more than double their former price. The present price is 19s. in Ramsgate, and 20s. in Margate, including dues. The price of coal rose in May, 1872, but the charge for gas was not raised until August. Our price has always been less than in neighbouring towns. The price of coke varies very much. The average price per chaldron last year in Ramsgate was 9s. 3½d., and in Margate 10s. 5½d. There is not a very active demand for coke, and to get rid of it we make contracts with manufacturers in the county of Kent, if we can, to take large quantities. In 1872 our coke averaged 10s. 7½d. per chaldron; and in the coal panic year, when coals rose upwards of 114 per cent., coke only fetched 17s. 5½d., or 63 per cent. in excess of the previous year. Last year the average gross price of coke at Margate was 10s. 5d., and at Ramsgate 9s. 3½d., but that price is not now maintained. The lowest contract price this year was 7s. per chaldron, but that is for a large quantity, and to be taken away monthly. We have done all we could to get the inhabitants to consume the coke. The charge for the public lamps has always been less than that to private consumers. The present rate at Ramsgate is 3s. 10½d. per 1000, with 10 per cent. discount. We advised the local board to burn the gas by meter, and we believe they have been very well satisfied, as we have heard no complaint since. There are 257 public lamps in Ramsgate, 62 in St. Lawrence, and 226 in Margate. In the latter town the lamps are paid for by the year, but they are put out two hours sooner than in Ramsgate, which makes the charge appear less. In fact the charge was calculated on the same rate as Ramsgate, with a discount of 10 per cent. With respect to the wind blowing out the lamps, that is no advantage to the company, as the gas escapes. [Witness read two letters, one from the local board, asking that the pressure might be increased, and the reply from the gas company, to the effect that the pressure was regulated by the local board themselves, so that each lamp might burn 4 feet per hour, and that they might increase the pressure at their own pleasure.] The pressure on the mains is double what is required to burn 4 feet per hour. Care has been taken to keep the gas free from sulphuretted hydrogen. The gas is purified with oxide of iron; it is tested every day, and the test-papers are preserved. The directors received nothing for their services during the first 12 years. In 1836 they received £100 and the sum was increased at various times till 1861, since which time it has been £515 per annum. There are seven directors. We erected separate works for the

supply of Margate and Ramsgate, which have been enlarged out of the profits as the business increased. We have at Ramsgate about three acres of land, partly in Ramsgate and partly in St. Lawrence, and have every modern appliance for making gas. When Mr. Stevenson asked to see the works, I took him over them, and also over the water-works. The maximum make of gas in 24 hours in mid-winter has been 270,000 feet. There are ten miles of mains in Ramsgate and three in St. Lawrence. The number of consumers in Ramsgate is 1679, and in St. Lawrence 151. The population of Ramsgate in 1871 was 14,182, and if it has since increased at the same rate as in the previous ten years it would at present be 15,522. I estimate the visitors in the town during the season at 13,131. A large number of excursionists come and go again on the same day. There were 3147 houses in Ramsgate and 1106 in St. Lawrence. The rating of Ramsgate has been altered very much. From 1871 to 1876 it was £66,007 10s., and in December it was raised to £76,357, but it has since been reduced to £72,846. The number of houses being built is not large. Since 1871 we have relaid four miles of mains. At Margate the works cover nearly three acres, and are also supplied with all modern requisites. The maximum make of gas there is 180,000 cubic feet in the 24 hours. The population of Margate in 1871, was 14,005, and the number of houses 3374; but it increases very much in summer. The number of consumers is 1445. The average number of lamps lighted during the past year was 250; the total number reported "bad" was 263, and reported "out" 284. The total number of complaints in Ramsgate was 252, from which 87 must be deducted for false reports of fittings; the legitimate number of complaints being 165. There had been very few complaints at Margate. When the directors received a deputation from that town, the principal grievance appeared to be that the directors met at Ramsgate, to which we replied that there was a manager at Margate, to whom any complaints might be made. We do our best to keep the lamps in such a state of repair as to prevent them being blown out, but in the streets leading from the cliffs there is a strong gully of wind.

WEDNESDAY, MARCH 21.

Mr. Curling recalled, and further examined by Mr. MICHAEL.

The water company were incorporated in 1835, with an original capital of £10,000, and with power to raise an additional £5000, all in £10 shares. Up to January, 1847, the amount actually paid up in cash was £9000. Our first outlay was £7850, and these works were constructed under the advice of Mr. Easton, sen., who is now dead. No dividend was paid during the first two years; 5s. per £8 share was paid in 1837, or £3 2s. 6d. per cent.; in 1838, 8s. per share, or 5 per cent.; and in 1839 and 1840, 12s. per share, or 7½ per cent. In 1840 the rates charged for the water were lowered, and in the following three years a dividend of only 10s. was paid, or at the rate of 6¼ per cent. In 1838 the water was analyzed by Dr. Bostock, who reported that, upon the whole, it might be regarded as of considerable purity, and in all respects adapted for domestic purposes.

By the COMMITTEE: That was the water from the Southwood well—the first that was sunk.

Examination resumed: In 1849 the directors reported that £1341 6s. 5d. had been expended out of the profits of the undertaking in the extension of pipes, and enlargement of wells and buildings, all rendered necessary to meet the demands of an increasing population; and the directors recommended that a sum of £1000 be carried to capital account, and that in future the dividends be calculated upon £10,000. At that time the shareholders also resolved to supply certain poor inhabitants gratuitously, and that was done for several years. The rental increased from £1387 13s. 8d. in 1846 to £1868 12s. 2d. in 1850, when a dividend of 16s. per £10 share was declared, being at the rate of 8 per cent. Up to that time the directors had received no remuneration for their services, but in that year £100 was allotted to them. In 1851 the dividend was raised to 20s. per share, or 10 per cent.; but in 1852, from the increased expenses incurred in the supply of water, which was still given gratuitously to the poor by means of fixed standards, the dividend was reduced to 16s. per share, or 8 per cent. In 1853 the directors came to the conclusion that the supply of water was not sufficient for the demand, and Mr. Easton recommended a new well to be sunk and fresh adits to be made, which was done, and in 1854 the dividend was reduced to 14s. per share, or 7 per cent. In 1855 the directors were advised to purchase land and erect works at Whitehall, at an estimated cost of £5000, which was raised by the issue of £10 shares. During the years 1855 and 1856 no dividends were paid to the shareholders, but in 1857 and 1858 a dividend of 5 per cent. was paid. In 1859 we paid 6 per cent., and laid by £200 to form the commencement of a reserve-fund. In 1860 we paid 6 per cent., and added £259 19s. 1d. to the reserve-fund. In 1861 we paid 7 per cent., and added £316 0s. 4d. to the reserve-fund. In 1862 and 1863 the dividend rose to 8 per cent., and in the latter year we added £276 13s. 2d. to the reserve-fund. In 1864 we, at a cost of £2606, erected a new engine, capable of raising 600 gallons of water per minute. In 1865 and 1866, notwithstanding a new assessment of the property in Ramsgate, a dividend of 8 per cent. was declared; and in 1869 it was at the rate of 9 per cent., and, in addition, £146 10s. 8d. was added to the reserve-fund. In 1870 we paid 10 per cent., but in that year it was found necessary to obtain an additional supply of water by lengthening the adits, at a cost of £1955 8s. 8d.; and in 1871 the adits were still further lengthened, at a cost of £1001 4s., but these expenses were met out of the reserve-fund. In 1873 a new reservoir was constructed and covered in, capable of holding 650,000 gallons, the cost of which we have just finished paying, amounting to £3555 19s. We are entitled by our Act to charge 7½ per cent. on the gross value of the property, but that has never been done since I have been connected with the company. Houses rated below £50 are charged at the rate of 1s. 1½d. in the pound, or 5½ per cent.; from £50 to £60, 1s. 0½d., or 5½ per cent.; from £60 to £70, 11½d., or 4½ per cent.; from £70 to £150, 10½d., or 4½ per cent.; from £150 to £200, 10d., or 4½ per cent.; and above £200, 9d., or 3½ per cent. No extra charge has been made for water-closets or baths. When, owing to the increased demand, we commenced charging for the poorer houses, the scale was fixed at 6s. per year, or 1½d. per week, being at the rate of 3 per cent. on houses rated at or under £8 per year, whilst the Public Health Act limits the amount to 8s. per year, or 2d. per week—that is, when exercising compulsory powers of supply. Our charge to manufacturers, brewers, and so on, has been 1s. per 1000 gallons, but that has been reduced when we have made large contracts with railways, and in 1875 we reduced it to the local board from 1s. to 9d., on the understanding that they would take 3 million gallons. The local board have never applied for a supply for sanitary purposes, which we were unable to afford. The instance given by the local board of their being unable to obtain a supply, on one occasion, because the shipping was being attended to, arose because the turncock was engaged in trying whether a vessel was seaworthy, and could not attend to the wants of the board immediately. Since we were in Parliament last year, orders have been given for a new engine, at a cost of £4500, and also for a new well and additional pumps. In addition to that, we have purchased a valuable right of forming adits under another large piece of ground, and those works are all proceeding as fast as possible. We have incurred an outlay at the present time of £6000 or £7000, but there is a great deal more contemplated. We have taken power in our Bill in order to pay for those works.

All the houses have cisterns, which are filled daily, excepting 37 small houses, which draw direct from the main, by a tap from the areas. Since the supply has been given on the Sunday no complaint has reached the company of any deficiency in the lodging-houses, nor has it reached their collector, although he has been requested by the board to report whenever any one made a complaint. We do not allow, under any circumstances, a direct service from our mains to a water-closet. On the contrary, our inspector has repeatedly asked, when he has been sent round, over and over again, to all the small cottages, to see that there has been no communication made direct from the main to the closet; but when the drainage was first introduced among the smaller houses, the local authority gave orders for the water to be supplied to those closets without a cistern. As soon as that was found out by the company, they gave orders to have it removed, and I find that the inspector has only discovered five cases. When we fixed the sum of 6s. per year for the cottages, it was done in order that the poor might have the water at a cheap rate, and we allowed them to obtain a supply from a pipe and tap to save the expense of a cistern. Some years ago, during the time of the cholera, I made a report, stating that in a space of 11,244 square yards, 166 shallow cesspools were confined, being at the rate of 68 to an acre, but although eleven years have elapsed, sewers have not yet been laid in some of the streets in the centre of the town, notwithstanding memorials have been presented from the inhabitants. I also wish to state that the joints of the sewer-pipes have not been properly secured, so that their contents have escaped into the chalk tunnels in which they lie, and that diminishes the water at the outfall of the sewer. Instead of advising hand-pail flushing, which is amongst the very lowest classes of society the only effectual mode of dealing with water-closets, the local board put taps over the pans, which, as soon as we found it out, we had removed. We have power to superintend the connexion of the services with our main, and then we have power to go into the house to examine the cisterns and ball-cocks, and see there is no waste; but we have no further power over the fittings of the houses, and if any nuisance is created it would be under the control of the local board, according to the Public Health Act. With regard to the effect of chalk water on health, it is very well known that this water is more binding than laxative; it is also well known that the more our water has been used the more diarrhoea has diminished, and that is not only the case at Ramsgate, but it has been observed in the neighbouring towns of Broadstairs and Margate since they have acquired their water-works. There was a very active and able canvass made on the part of the local board against the water company, the result being that the numbers in favour of the local board were 1218, and the numbers against 777, leaving a majority of 441; but that only gives a couple of thousand votes out of between 4000 and 6000. At that time a new mode of voting was introduced, which was not understood, and a great number of votes were lost in consequence of the voting papers being irregular.

Cross-examined by Sir E. BECKETT: I should think the opinion of the town is about equally balanced. No doubt there were some of the ratepayers who took an active part in opposition to the local board obtaining the works of the companies. I can only account for the elections in February, 1876—11 out of 12 commissioners being returned in favour of the Bill of the local board—turning out as they did by supposing that the ratepayers thought it better to go in for the local board. There ought to have been an election again this February, but for some reason or other it has not come off, which would have conveyed a better test of the opinion of the town. The reason we applied to Parliament last year was in consequence of a considerable outlay of capital. We had had to borrow from our bankers, not having the money in hand, and some of my directors, who were aged men, did not like the responsibility, although I had been urging them for three or four years to apply for powers to raise more capital. There was also an agitation in the town to confiscate our property, and, in self-protection, that made us decide at once to apply to Parliament. Our Bills have been introduced because Parliament expressed an opinion last year that we ought to place ourselves under the regulations of the Water-Works Clauses Act and the Gas-Works Clauses Act, and we immediately went to work to make all the necessary arrangements for giving a constant supply, and for increasing the quantity of water we should require. We were not in the least influenced by the fact that the local board were going to bring forward a Bill; we, in fact, wrote a letter to them, telling them we had consulted counsel, who advised us that our powers were not sufficient for giving a constant supply, and that we were going to Parliament to seek for those powers.

Sir E. BECKETT: Why did you put that extraordinary statement into the preamble of the gas Bill, that you were willing to carry on that Bill if Parliament would allow you to capitalize the profit?

Witness: The Bill was drawn up by the parliamentary agents and the solicitors, but I was a consenting party to the paragraph being inserted, and I thought until now it was in both Bills.

Sir E. BECKETT: Supposing you do not get your capital "declared and readjusted," do you intend to carry on your works without a Bill?

Witness: We wish to do what is right, and we shall act under advice. I am here as a trustee for other people, and I should not like to act upon my own judgment upon anything of that sort. At the last sale of gas shares the price realized was £75 per share and that is the highest I am aware of; but very few shares have been sold, they have generally descended from father to son. The shares in the water company have varied from £20 to £31 10s. Our reason for applying to Parliament is that we wanted more capital than we could possibly get, unless we ceased paying dividends.

Sir E. BECKETT: But how does coming to Parliament and getting an Act give you any more capital? If the concern is not capable of paying interest upon its shares issued without the authority of Parliament, how is it capable of finding the interest upon its shares issued with the authority of Parliament?

Witness: The business is annually increasing, and requires to be fed with more capital; but we have not sufficient capital in the surplus profits to carry it on with. An Act will give us power of raising more money, and as the business increases the profits will increase, and that will enable us to pay a dividend upon the money which we raise. We have a floating capital of about £9100, which represents rents not collected, cost of material, and all the working capital that every manufacturing concern requires to keep it going. With regard to the meters at Margate, a great many people buy their own, while at Ramsgate they do not appear to do so. Our gas has always been tested for impurities, and for the last four or five years has been tested by a regular photometer in a dark room.

Sir E. BECKETT: About the water fittings. Do you or do you not represent that you have a sufficient control over those fittings to enable the company to cut off a man's fittings if he does not keep them in order?

Witness: If he causes waste of water, we have power to cut off his fittings. There is always waste of water in water-works, under all circumstances, but I do not think we have had a great waste. We have employed an inspector, I think, for the last 15 or 20 years. I was very sorry to hear Mr. Ellice-Clark reflect on Mr. Hindes (the then surveyor) for not having used sufficient water for flushing the sewers when he was in charge because he was a water director, and I always thought it was the duty of a water director to promote the expenditure of water as much as he could.

I was rather afraid that some reflection would have been cast upon me when I was in charge of the town in the cholera year, because I was the means of closing a great number of wells, and thereby promoting the use of the water-works.

Sir E. BECKETT: You seem to be quite sorry that you were not reflected on. If you have been giving such an excellent supply all this time, how do you account for the complaints which have been made by all sorts of people, sanitary and others?

Witness: I have not heard all sorts of complaints. The chief complaints that have been made here have been made of the local board for not enforcing a supply of water on the cottages. I am not aware that all the doctors in the town, with the exception of myself and one other, are on the side of the local board. I was astonished at the number of visitors being given as 50,000, because none of the witnesses gave any reason for stating that number.

Sir E. BECKETT: Did you suggest to your counsel to ask how they made this calculation?

Witness: I did; but I do not think Mr. Leigh heard me. I was really desirous of knowing the manner in which the visitors were counted, and made so numerous, because my attention has been directed to this matter ever since last year, and I have tried different plans of arriving at it. I reckoned the hotels according to the rating. If the higher rating is taken, 133 houses are rated respectively to the poor at £40 and upwards, providing accommodation for visitors, upon the average, of 18 for each house, and the hotels come in that average.

Cross-examined by Mr. WILLIAMS (for ratepayers and consumers in the parish of St. Lawrence, in opposition to both Bills): The gas-works are half in St. Lawrence and half in Ramsgate. The village of St. Lawrence is on the high ground, and, consequently, the pressure of gas is greater than in the lower districts. The price of 5s. 6d. is inserted in our Bill in case the price of coals should go up, but it does not follow that we shall charge that price. In my opinion the petitioners against the Bill of the local board think that the affairs will be better managed by myself and my colleagues than by the local board. The statement by one of the witnesses about the water in the mains getting mixed with tar is not correct. The fact was, that some of the ammoniacal liquor accidentally got into a main adjoining the gas-works, but it was detected immediately and removed. The main was washed out within half an hour, and precautions taken that such an accident should not happen again.

Mr. WILLIAMS: About the lamps blowing out. Have you taken any precaution in the construction of the covering of the lamps which you would not take in an ordinary town to prevent their blowing out?

Witness: I am not aware that the gales at Ramsgate are worse than those on the sea-coast generally, but we have adopted the same measures which have been adopted in other towns.

Mr. WILLIAMS: With regard to the water, do you, as a medical man, believe that the supply is sufficient in summer?

Witness: I believe that very few of us actually use more than seven gallons per day, and among the poorer classes I am quite certain that quantity is not used. It has been stated that the supply at Norwich is 14 gallons, but I do not believe the whole is used.

Mr. POPE: You need not trouble about that. If you have only seven gallons per head, it is not enough.

Cross-examination resumed: There have been possibly three complaints from some of the houses on the high level, above the level of our reservoir, and in consequence we erected a tank at a higher elevation, and then a forcing apparatus. At the Granville Hotel they have a constant supply, and, therefore, I do not see how there can be any complaints; they use the water by meter. A complaint was made on Feb. 4 last of the insufficiency of the meter, and a promise was made to pay £100 per annum in lieu of meterage. We replied that we would at our own expense put up a Siemens meter, but that we objected to supply water by contract, in consequence of the great waste which had occurred when the hotel was first opened. We have lately had a new engine erected at Whitehall, because the old engine was not of sufficient power, and not in consequence of the Bill of the local board.

Re-examined by Mr. POPE: The decision of the committee last year was as follows:—"The committee find the preamble of the Ramsgate Local Board Bill is not proved, and the committee wish to express an opinion that the Ramsgate Water-Works Company and the Isle of Thanet Gaslight Company should be brought under parliamentary control at the earliest opportunity." We immediately consulted with our parliamentary agent, and with our counsel, as to our powers, and with our engineer, as to the necessary rules and regulations we ought to adopt, and we then commenced to make preparations for our Bill of the present session.

By the COMMITTEE: Our practice, when complaints are made, is to attend to them directly. Mr. Ellice-Clark mentioned a case where a direct communication between the main and the closet was allowed to go on for a year, but he did not state where it was. I believe it was in Chatham Street, and if so it was put on by order of the surveyor, and found out by us three months afterwards. When sewers were introduced, not from any ill-intention, but from not knowing enough about it, some of the services were laid on to the closets, but as soon as they were found out they were altered. I have no doubt some of the houses are insufficiently supplied, but I consider that is the fault of the local board, in not enforcing the Act which gives them power to see that every house has a proper and sufficient supply of water.

Rev. W. Benham, examined by Mr. LEIGH. I have been vicar of Margate since February, 1873. The church, which is capable of holding 1200 people, is lighted and heated with gas. The supply for both purposes has, in my opinion, been sufficient. There have been no complaints of any sort from the congregation. I am told that ours is the warmest church in the town. About two years ago there was great reason to complain at the vicarage; I could not see to read, and had to use candles. The company said the pipes must be out of order, and I had them examined. The service-pipe was full of holes, into which I could thrust my finger, and the earth had fallen through. I had new pipes laid down, and have had no reason to complain since.

Cross-examined by Mr. VENABLES: I have not noticed any other improvement except that caused by the re-arrangement of the fittings.

Mr. A. L. Stride, examined by Mr. LEIGH.

I am engineer and general manager of the London, Tilbury, and Southend Railway. Until 1875 I was one of the district engineers of the London, Chatham, and Dover Railway, and had charge of the permanent way from Sheerness to Ramsgate. At Margate we arranged with the water company to supply the station with water, at a fixed annual rental, but the Ramsgate people said they had no data to go upon, and would prefer that we should take the water by meter. Instructions were, therefore, naturally given that the engines should water at Margate and not at Ramsgate, except in cases of necessity. When the line was first opened, in 1863, there was not much difference between the two waters, but after the alteration at the Whitehall works we found the superiority of that water over the other. That difference was soon found out by the engine-men, and they took the water at Ramsgate, notwithstanding orders to the contrary, whenever they could get it. As a proof of that, the consumption up to that time was 215,000 gallons per year, but for the year ending September, 1874,

it was 4,596,000 gallons. In consequence of that, I saw the directors of the Ramsgate Water Company, and put it to them that they must have sufficient data to go upon, as all our engines were evidently watering at Ramsgate. They met me very fairly, and agreed to take an annual sum, and I have no doubt that arrangement is still going on. The quantity was certainly ample at Ramsgate, the quality very good, and the supply constant. The pressure was so great that, four or five years ago, on my inspector's suggestion, I had all the leaden service-pipes taken out and iron ones substituted. That statement has been challenged by Mr. Veale, and it is true there were several short services left in from cisterns to urinals, refreshment-rooms, and so on; but so far as the service from the mains, that was all reinstated with iron some five years ago, because the lead pipes were always bursting. I do not understand why the man John Cook was called, because during the whole time I was there he was not either running in the district, or belonging to the place in any way. As regards the gas, I can only repeat what I said last year, that it was as good as that supplied to any other station in my district, and better than in many. I took steps last year to prevent any consumption beyond what was absolutely necessary, and I put a regulator on the meter.

Cross-examined by Mr. VENABLES: My object in artificially restricting the supply of gas at the station was to save the railway company's money. I do not know whether there is a special main to the station.

Mr. VENABLES: You said that the man named John Cook knew nothing about it; how if his name was Edward?

Witness: That would be another matter. Edward Cook was one of the worst offenders in what we called at that time stealing water, when the Ramsgate water was prohibited.

Mr. Veale was recalled, and said that the witness Cook was constantly employed upon that section.

Cross-examination of Mr. Stride resumed: The whole of that 4 million gallons increase in the year 1874 was caused by the men taking water without orders.

By the COMMITTEE: I do not say that any water out of chalk is so good as water out of gravel, but my experience is that the Ramsgate water is as good as chalk water can be, whether supplied by a local board or a private company.

Mr. R. Braine, examined by Mr. LEIGH.

I have been harbour-master at Ramsgate for the last eight years, and previously deputy harbour-master for eleven years. During the whole of that time we have been supplied by the gas and water companies. We consume about 50 million gallons of water during the year, for which we pay £50. Beyond that there is a large supply for two steam-tugs, for a dredger, for a drinking-fountain, and for a few urinals. For lighting the harbour there are 14 external lamps, two guide-lights on each cliff, and 13 lights in the offices and workshops. The average consumption of those 14 lights for the last four years has been 414,000 cubic feet, and the supply has been perfectly satisfactory. There has also not been a single complaint about the guide-lights. My house is within the pier gates, and we have plenty of pressure there in the evening, although at one time we did not get enough in the morning. I made a complaint about that, and it was found to be in consequence of the pipe from the main being corroded, and too small. I had a larger pipe put in, and since then it has been satisfactory.

Cross-examined by Mr. VENABLES: We have special mains for both gas and water, one branch of the latter being continued to the station.

Mr. W. G. Page, examined by Mr. LEIGH.

I am a wine merchant at Ramsgate, and am a large consumer of gas and water. I am one of the largest gas consumers in the town, my average consumption being between 250,000 and 300,000 feet. I have every reason to be satisfied with the gas, both as to quantity and quality. I have about 26 burners, and they are kept pretty well alight in the winter time to maintain the temperature even in the cellars. I have always found the pressure sufficient. I am also perfectly satisfied with the water. I am likewise in business as a house agent, and let a good many furnished houses of the best class, and have never had any complaints from the visitors who take those houses.

Mr. H. G. Vinlen, examined by Mr. LEIGH.

I am one of a firm of estate and house agents at Ramsgate, and have been connected with the office for 16 years. I am a consumer of gas and water to a considerable extent, and am perfectly satisfied with the quantity, quality, and price of both. As an agent I let a great number of houses of all classes, and frequently have to pay both gas and water rates for those houses. During all the years I have been connected with the estate agency business I have never had a single complaint with reference to either gas or water. I most heartily wish everything else was as satisfactory.

Cross-examined by Mr. VENABLES: I have read some of the evidence, apparently bearing on the water supply, and it appeared to be more or less a question of the fittings. I never found that either the gas or water company gave a refusal to anybody worth supplying.

Mr. VENABLES: The sanitary inspector and the medical officer have stated that they have seen cases of the greatest discomfort in lodging-houses, and other places, from there not being enough water to flush the closets, &c. Has that ever come within your observation?

Witness: I have never met with a case of that kind, except through deficient fittings, such as where the ball-cock has been out of order. I let, perhaps, more furnished houses in Ramsgate, at rentals from 16 guineas a week downwards, than any one in Ramsgate, and I have never had a single complaint with regard to the supply of water, and, if anything was deficient, they would apply to the agent.

Re-examined by Mr. LEIGH: The only communications I have had to make to the companies from time to time have been with regard to connecting the water, and any applications I have made have always been met in the promptest manner, and with the greatest punctuality and civility.

Mr. W. Millard, examined by Mr. LEIGH.

I have been a plumber at Ramsgate for ten years, and in that capacity have had to go to all parts of the town, at all hours of the day, to attend to complaints about the gas and water. I have always found the complaints about the water to arise from the fittings not working in a proper manner, or from the cisterns not being large enough. The complaints about the gas I have always found arose from the fittings—generally speaking from corrosion in the chandeliers, but sometimes in the burners or in the pipes. We occasionally find a house where they have 20 lights, and only what we call a 5-light meter, and the people imagine they will get enough gas through that meter.

Mr. W. Larkin, examined by Mr. LEIGH.

I have been in business as a plumber and gasfitter at Ramsgate for six years. I never found any default in the supply of gas to the town. I have been called in on account of complaints, and have found that insufficient fittings were the cause. I should certainly not advise people that it is inexpedient to use gas-stoves.

THURSDAY, MARCH 22.

Mr. G. H. Ogston, examined by Mr. MICHAEL.

I have had considerable experience in water analysis, and analyzed, both last year and this, the water from the two wells which supply the Rams-

gate Company. The analysis last year from the Whitehall well was as follows:—Total solid matter per gallon, 30.20 grains; chlorine, 3.58 grains; sulphuric acid, 1.04; nitric acid, 1.41; lime, 10.97; magnesia, 0.57; iron and alumina, 0.40; volatile matter, 2.20; and alkalies and carbonic acid not separately estimated, 10.03. The total hardness before boiling was 17°, and after boiling 5½°. The water from the Southwood well contained 34.20 grains of total solid residue per gallon; chlorine, 4.34; sulphuric acid, 1.43; nitric acid, 1.24; lime, 12.03; magnesia, 0.61; iron and alumina, 0.38; volatile matter, 2.22; alkalies and carbonic acid, 11.95. The hardness before boiling was 17.5°, and after boiling 6°. My analysis of the present year, taken on March 19, 1877, was as follows:—At Whitehall the total solid residue per gallon was 31.20; chlorine, 3.26; sulphuric acid, 1.38; nitric acid, 2.06; lime, 10.31; magnesia, 0.95; oxide of iron, 0.10; silica, 0.35; alkalies and carbonic acid, 10.38; and volatile matters, 2.41. The total hardness was 17.3°, and the permanent hardness 7°. At Southwood the total solid matter per gallon was 32.80; grains chlorine, 5.04; sulphuric acid, 1.28; nitric acid, 3.11; lime, 8.96; magnesia, 1.18; oxide of iron, 0.18; silica, 0.42; alkalies and carbonic acid, 9.63; and volatile matters, 3.9. The total hardness of that water was 17.8°, and the permanent hardness 6.7°. The waters are extremely pure, and perfectly fit for domestic purposes. There is no evidence of sewage contamination. It contains less ammonia, both free and albumenized than the London water, but it is, of course, somewhat harder. In my opinion there is nothing in it which would tend in any way to engender disease.

Cross-examined by Mr. VENABLES: The waters are very much the same this year as they were last. I should not expect a large demand to have any effect upon the quality of the water.

By the COMMITTEE: Chlorine is always present in larger quantities in chalk water than in river water, but the proportion in this case is a good deal less than is usual in chalk water.

Mr. E. Easton, examined by Mr. MICHAEL.

I am a civil and mechanical engineer, and have been personally engaged in the construction of water-works in about 45 towns. My father was the adviser of the Ramsgate Water-Works Company at their origination in 1834-35, and since that time he and I have acted as their engineers. The whole of the original proprietors were, more or less, connected with the town of Ramsgate. Under our first Act, the water was to be obtained from the chalk stratum of the Isle of Thanet. I believe my father was the first person to whom the idea occurred of obtaining water from the chalk in the particular way in which it is done at Ramsgate, at Brighton, at Dover, and many other places—viz., by sinking a well and driving adits, in order to intercept the streams which were in the fissures of the chalk; in fact, we were obtaining the rainfall after it had percolated in some way or other through the chalk. It is well known that the water of the chalk stratum, as regards purity, stands at the very top of the list of waters. Originally the works were at a place called Southwood, and there we had two wells, with tunnels connecting them, and for 20 years those works supplied the town with water. In 1855, in consequence partly of an unusual drought of water, and from the fact that we were drawing a good deal upon those wells, there was an infiltration of salt water, and it became necessary to construct new works, and then the company bought the land at Whitehall, and constructed the works from which they now derive almost their entire supply. The same plan was adopted there; wells were sunk, and tunnels driven towards the sea coast, and those tunnels have been extended from time to time as we wanted water. We have gradually gone on from one length to another till we have attained a total length of 2687 feet. The depth below the surface at Whitehall is 104 feet, and at Southwood between 170 and 180 feet. The water rises in the wells from 11 to 13 feet above the bottom. Of course, there is a limit to the amount you can obtain from a certain body of chalk, but practically, for the supply of such a place as Ramsgate, the supply is only limited by the extent to which you can drive your tunnels. In 1855 we were lowering the wells very considerably, and then the salt water came in. When we stopped pumping from those works the water began to improve, and at the present time, so long as we do not draw the water below a certain level, and so long as we do not keep it down to that level for too long a time, the water at Southwood is just as good as that at Whitehall. I should say we have hitherto used Southwood simply as a stand-by in case of a breakdown of the machinery, or a shortness of water at the other place, which at present we have not experienced. So far as I know, there is no fear of any sewage contamination in our wells. Up to 1851 the company had expended £15,000, and all the money expended upon works since that date has been so done under my direction. For several years it has been a matter of consultation between the directors and myself as to putting up a new engine in place of one which had been in use for many years, and just about the time of last year's committee I received orders to erect that engine, which has been done at an expense of £5000 in round figures, and a new well has been sunk at Whitehall for the purpose of ensuring a supply for many years to come. In addition arrangements have been made with the owners of some adjoining land, to enable an adit to be driven further into the country, and also cross adits under that land for the purpose of getting more water out of the chalk. At present our storage capacity is a covered reservoir capable of holding 650,000 gallons. I estimate the new works and necessary expenses will amount to about £15,000; and looking forward to an extension of mains, I do not think it would be safe to ask for less than £20,000 additional capital. The quantity of water we pumped last August was equal to 18 gallons per head for the 20,000 inhabitants, and 10 gallons per head for 13,000 visitors, which amounts in all to 500,000 gallons per day. In taking 18, or 20, or 25 gallons per head, we have always to take into account the amount of water which is wasted. That is a permanent quantity, and, unfortunately, engineers cannot prevent it. The real fact is that there do not go more than from 12 to 15 gallons per head per day through the service. At Brighton, where the supply is about one-third constant and two-thirds intermittent, we use, when the town is full of visitors, between 19 and 20 gallons per head. At Hastings the supply is about 18 gallons per head during the off season, but only about 12 gallons per head during the extra season. At Deal the supply is 15 gallons per head. The new engine was started at the early part of the present week; it will lift, at its ordinary speed, 48,000 gallons an hour, or in eleven hours the 500,000 gallons mentioned. We have, therefore, two engines at Whitehall now, each able to pump 500,000 gallons a day. If we put the whole of the pumping power to work, it would be equivalent to 1,700,000 or 1,800,000 gallons, and I have no doubt we shall be able to supply that quantity at least, under the arrangements we have made with the landowners. Taking into account that we make no charge for water-closets, the price at Ramsgate is less than in the average of towns in Great Britain, and about the same with respect to towns under similar circumstances—drawing water from the chalk. In my opinion, the consumers have been benefited through the company not previously applying for an Act to authorize them to raise a large amount of capital. If we had applied in 1855, there is no doubt we should have obtained an Act with the incorporation of the Water-Works Clauses Act of 1847, which gave a dividend of 10 per cent.

Mr. MICHAEL: If you had been under the operation of the Water-Works Clauses Act of 1847, and had earned profits sufficient to pay the 10 per cent. allowed by that Act, the company would have received £9322 more

than they have received, or than they seek to capitalize now, under the provisions of the Bill before the committee?

Witness: Certainly. There would have been also, under the Act of 1855, a borrowing power, which in those days was generally one-third of the capital raised—but which is now one-fourth—which would have been either £5000 or £3750, and that money would have enabled us, with the £15,000 which we should have raised, to have carried on our works to the end of 1875. We have since expended £5000 upon the new engine, &c., and have engaged to pay £1000 for the privilege of tunnelling under the new land, and to that must be added the costs of these proceedings, both last year and this. The Stockport Company raised £100,000 in 1861 under the Water-Works Clauses Act of 1847, and £50,000 in 1864, under the same Act. The Sutton Company also raised £20,000 in 1863, and £40,000 in 1871; Spalding raised £8000 in 1860, and £5000 in 1869; Falmouth raised £10,000 in 1847, and £10,000 in 1862; Lewes raised £6000 in 1833, and £13,000 in 1868. The only restrictions put in any of those Acts were those provided by the Act of 1847. I have not heard anything in the course of these proceedings which shows any *laches* on the part of the company with reference to the inspection of the fittings. It is not the business of the company—although they do it very often—to look after the fittings in the houses in respect of contamination, and so forth. The company have done all they could to keep the water pure, so far as the powers of their Act allowed them to go. We now seek power to give a constant supply, and we propose to insert in the Bill certain regulations, which have been very carefully drawn up by Mr. Bramwell and myself. In making those regulations the local board of Ramsgate would have a most powerful voice, because the Local Government Board would never authorize any regulations unless they had been discussed at a local inquiry. A most exhaustive inquiry was made last year in the matter of the Portsmouth Regulations, when the Portsmouth Corporation appeared before Dr. Pole, the arbitrator, and the whole question was threshed out in detail, in a sitting of many days, and the result was a code of regulations very much like that we have appended to the present Bill. Whatever regulations are made, there will be sure to be some difficulty in keeping the fittings in the poorer houses intact, but it will not be so much as some people imagine. The local board have ample power, under the provisions of the Public Health Act of 1875, to do what is necessary to ensure the health of the town.

Cross-examined by Mr. VENABLES: With the exception of Stockport, I have been engineer to all the companies I have mentioned. There is only one company with which I am connected, in which a limitation has been introduced into the Act, and that is the Brighton Company, and that limitation was put in under very peculiar circumstances. The works were originally started about a year before the Ramsgate works. Their Act was passed in 1834, and the original capital was £47,500. In 1853 a Bill was obtained by a new company—with which I was connected—for supplying the town with water in opposition to the existing company. The capital of the new company was £60,000, with a borrowing power of £20,000. The plea upon which the new company applied to Parliament was that the old company were supplying the place very badly, and that they did not supply half the population. We also said that we were going to give a constant service; and it was from those things combined that we succeeded. The old company, rather than compete with us, offered to sell, and in the next year, 1854, we bought them up for £92,500, or about double their original capital, and we then applied for an Act to raise £130,000 to buy up that company and to extend the works. We also asked for power to give an intermittent, instead of a constant, supply, but were opposed by the corporation, who were successful in striking out the clauses relating to the intermittent supply. At the same time the committee limited us to 8 per cent. on our capital of £130,000. In 1865, as Brighton increased, we wanted more capital, and obtained power to raise £80,000 additional, but still under the same limit of 8 per cent.

Mr. VENABLES: I admit there are some cases in which 10 per cent. has been authorized since 1860, but, from your general knowledge, should you not say that the amount authorized at 7 per cent. or a lower rate must have been much larger than that authorized at 10 per cent.?

Witness: I should say it has been the policy of Parliament since the years 1862, 1863, or 1864, to limit the dividend upon the extra stock. But it was not so in 1855, when the Ramsgate Company ought to have applied for more capital. We expended very little capital between 1867 and 1870, but in that year we spent £6000; in 1871, £7000; in 1872, £9000; in 1873, £10,000; in 1874, £12,000; in 1875, £15,000. I maintain that the consumers were saved a good deal of money by our adopting the course we did, as compared with what they would have had to pay if we had applied to Parliament sooner. The object with which our works were made was to take the adits parallel to the sea-shore, and to intercept the stream flowing through the chalk into the sea. The reason I advised to acquire the new land was that I desired in future tunnelling to go farther from the sea. The new adit would, first of all, go northwards, and would be a sort of culvert to bring down the water we should get from the new land.

Mr. VENABLES: Then it looks to me as if you would be getting the same water before it comes into your present adits?

Witness: No; because our present adits extend to the eastward. We should have almost all the land to the west of the railway for new ground; and besides that, we do not get the whole of that water which falls upon the chalk, by means of these intercepting adits. I know we can get more water by the adits that we have driven parallel to one another within a distance of about three-quarters of a mile. The works of the Brighton Company were transferred to the corporation in 1871, and I am now the engineer to the corporation. The circumstances of the transfer were these:—Owing to unfortunate private matters of my own, I was not giving, perhaps, the attention to the business that I ought to have done, and a breakdown took place in the machinery, in consequence of which the upper parts of Brighton were left without water, and there was a great outcry. The corporation had always been trying to catch us napping, and they took the opportunity to put on the screw, and frightened the directors so that they agreed to sell straight off. The corporation undertook all the debts of the company, and gave up the reserve-fund of £6000, which was divided amongst the shareholders. The £10 shares were then paying 7 per cent., and the company got the maximum dividend of 8 per cent., capitalized at 20 years purchase. The Brighton Corporation have just expended £35,000 in extending their works. I think the town is better off as regards the supply of water, because the corporation are making the profits which the company would have made; but I do not think the local board of Ramsgate have shown the same aptitude for taking over works of this description, and managing them, as the people at Brighton did, or as the people of Birmingham have done. I believe it is quite true, as has been stated, that the company have always been in advance of the local authority in sanitary matters. Then, again, the advantage in the matter of laying on fresh services to houses would not attain the importance here that it did in the other two cases—and Birmingham especially—because we are now supplying some 3940 houses, out of 4000 in the whole of Ramsgate. I remember the evidence given by Mr. Ellice-Clark, and the medical officer, about the great grievances which had been suffered for want of water, and it is a pity those grievances had not been mentioned to the company formally, as they ought to have been. With regard to the number of water-closets having no supply of water, that is one of the points

on which the local board have shown a great want of supervision over sanitary matters. With regard to the Stockton case of last year, the water company did not appear before the committee with clean hands. We proved in that case that they had not the water which they ought to have had, and, after being told by the committee that they ought to go to another source, they persisted in going to the old source, which had been rejected by the committee before. The two cases are not in the slightest degree parallel to one another.

Mr. VENABLES: But your evidence was to the effect that it would be for the public good, on grounds quite unconnected with the special case of Stockton, that the corporation should have the supply?

Witness: Yes; and I say so again. My opinion is the same upon the general principle, that it is for the advantage of communities that the corporations should have the water-works.

Cross-examined by Mr. WILLIAMS: Under the Bill of the company we have no power of going to Minster, and I should not go there if we had. It would be more difficult to get water there than at Ramsgate, and I have reason to think it is not such good water there. We have had it for a long time under contemplation to give a constant supply, and we should like to do it.

Mr. WILLIAMS: That is exactly what we complain of about your company—they always have so many things in contemplation, and never do them.

Witness: The reason is that it is impossible to do them. When we write to the local board to ask their assistance in bringing in a Bill to give us the power which is absolutely necessary to give a constant supply, and also to readjust our capital—for that is necessary as well—then they apply for a Bill themselves. I am aware that some correspondence passed between Mr. Wastall, of Queen Street, and the company, in reference to a constant supply, in consequence of the firm with which that gentleman was connected having erected one of Rowbottom's patent water-engines, but the directors were unable to comply with that request.

Mr. PORE said the constant supply had been granted during the present year.

Cross-examination resumed: In my judgment the people of Hove are very well off under the supply given them by the Corporation of Brighton. I am also aware that there is a petition from certain ratepayers in St. Lawrence, in which they state substantially that they are of opinion that the company can do for them better than the Ramsgate Local Board.

Mr. WILLIAMS: Will you tell me how you distinguish between the people of St. Lawrence and the people of Hove, and why, when the people of Hove are well off under the Brighton Corporation, the ratepayers of St. Lawrence will not be well off under the Ramsgate Local Board?

Witness: Because the Corporation of Brighton have always distinguished themselves by being foremost in all matters which would improve the sanitary condition, &c., of their town; and they have wisely, in my opinion, carried out the principles and the policy of the water company which had the works before them.

Re-examined by Mr. MICHAEL: In these matters every individual case must be judged upon its own merits. In the case of Birmingham there were hundreds of houses supplied with water from surface wells, which was an abomination, and the corporation had found it impossible to close those wells, and evidence was given as to the necessity for the transfer of the water-works in order to remove the excessive mortality resulting from that state of things, but there are no such circumstances in the present case. As to the question of profits, supposing what has been shadowed forth by the local board were carried out, I think it would result in an increase of the rates; there would be no profits. I do not think there is much inclination to purchase the works of companies which are not paying. Under the 51st and following sections of the Public Health Act a local board have the power to enforce from a company a proper and reasonable supply of pure and wholesome water for sanitary purposes, and if it is not given, after a procedure which is there laid down, the board have power to provide water-works of their own. The Ramsgate Local Board actually commenced proceedings under those sections by giving the company notice, and asking if they were able and willing to give such a supply. By the present Bill we ask for powers to make regulations which shall enforce continuously the carrying out of that which the local board say is necessary, and those powers we must have, otherwise we cannot give a constant supply, nor can the board themselves. If we obtain our Bill we shall be able to erect works sufficient to supply at least 20 per cent. more population than there is now in Ramsgate.

Mr. VENABLES read various extracts from the Public Health Act of 1875, and said his contention was that the local board had no power to supply water from the works of the company, but merely to call upon the company to do it.

Mr. MICHAEL said the Act provided that if the company were not able and willing to give a proper and sufficient supply of water, there was to be an arbitration to determine any difference, and to regulate the supply; and in the case of the company then failing to give the supply as directed, then the local board could construct water-works of their own.

Mr. VENABLES: But then they could only apply that water to sanitary purposes.

Mr. MICHAEL said that was not so; they would have all the powers of a water company. The Act of 1875 was expressly passed because there was a great *lacuna* in the other Sanitary Acts, and the Public Health Act incorporated all the clauses of the Water-Works Clauses Act, and placed a local board in the same position as a water company, giving them the same rights and immunities, and clothing them with every power to make rates and collect rents.

Mr. BONHAM-CARTER: How about the position of the consumer under the provisions of your Bill before the committee?

Witness: We asked in our Bill for £19,000 of improvement stock, but Lord Redesdale reduced that to £15,000, with 5 per cent. interest, instead of 6 per cent. We shall still be entitled to pay back dividends upon the £15,000 up to 10 per cent., having the Water-Works Clauses Act incorporated. That is £1500 a year; and there will be the £15,000 which Lord Redesdale gives us at 5 per cent.—that would be £750 a year. Then we are asking for £20,000, which is to be expended in prospective works to meet the increasing wants of the district, some of which we shall have to call up immediately; but we do not suppose we shall get 10 per cent. upon that—we have reckoned 7 per cent. Under our present Act we can pay any dividend we like, and so long as we are not charging the consumers more than is charged as the average of other places, and so long as we are doing our duty, I cannot see why we should not divide what is earned.

By Mr. LEIGH: Calculating the population at 22,000, and the cost of the works at £30,000, that would be something under 30s. per head of the population, and I need not say that is a small amount for capital spent upon water-works.

By the COMMITTEE: With reference to the evidence given by Mr. Latham, that he never knew more than 300,000 gallons per day to be given off a chalk area at the minimum period, so that if the area was $2\frac{1}{2}$ square miles, it would not be possible to obtain more than 750,000 gallons of water in 24 hours, I must confess I was not able to follow that gentleman in his calculations. On the contrary, my experience at Brighton—which is a very large one—is different; and the matter has been

most thoroughly investigated by me, for I read a paper at the British Association on the Brighton Water-Works, and another before the Institute of Mechanical Engineers, and the result of those investigations was totally different to Mr. Latham's. The adits are on the same level, because you go under the water and collect it, and the adits form underground reservoirs. On the average at Brighton they are about 8 feet 6 inches by 4 feet 6 inches, and they hold very nearly 500,000 gallons when they are full.

Mr. E. Syrett, Mr. J. Hake, and Mr. G. Wilson gave evidence confirmatory of that of previous witnesses with reference to the satisfactory supply of both gas and water. In the course of the examination of Mr. Hake, he stated that he had been deputy-superintendent and superintendent of the Ramsgate Fire Brigade for nine years, and always found a sufficient supply of water, and the fires averaged nine or ten in the year.

Mr. H. E. Jones, examined by Mr. MICHAEL.

I am a member of the Institution of Civil Engineers, and engineer to the Commercial Gas Company. I have been consulting engineer to the Isle of Thanet Gas Company for about two years, but my father, with whom I worked, was consulting engineer before that time for a period of some 10 or 11 years. The business of the Ramsgate Company extends itself at something like 8 per cent. per annum, and the works have been carried out in that proportion to meet the increased supply. The works both at Ramsgate and Margate have been for the most part remodelled during the last 15 years. The mode of conducting the business there is such as to ensure the best kind of gas. At both the stations the company have something like 40 per cent. more retorts and more carbonizing power than they have full employment for, even in the depth of winter. The purifying plant, both for removing ammonia and sulphur, is in every respect what it ought to be. They have, in fact, all the modern appliances for producing gas efficiently and economically. The unaccounted for gas is under 10 per cent., and that is a very low average, seeing that the works are separate, and that each station has a frontage of its own, on what may be called outlying and unremunerative districts. The pressure on both towns varies at night from 15-10ths to 16-10ths of an inch of water, and in the daytime it is something like 8-10ths of an inch. The pressure inserted in all modern gas Acts is from sunset to midnight 8-10ths, and from midnight to sunset 6-10ths, so that we have been practically giving double the quantity demanded by modern legislation. The reason why we put on that pressure is that many of the fittings in the houses are very old fashioned, and that small lights have been added without a reconstruction of the internal fittings. The fittings also become corroded, and then we have complaints from the consumers about not having enough light, but when we go to attend to those complaints we find ourselves quite helpless, because we can only suggest that an alteration should be made in the fittings. That, however, costs money, which the consumer does not care to spend, and the complaint is allowed to go unremedied, but that is not peculiar to Ramsgate. The illuminating power has been, on an average, something like 14 candles. The company have always employed the best Newcastle coal, and that, unless thoroughly mismanaged, will yield a gas of that quality. We have a continuous test for sulphur at both works; at Margate we have a jet photometer, and at Ramsgate a jet, and also a Bunsen photometer. The sulphur has been kept down to something like 30 grains per 100 feet. Of course we extract the ammonia from the gas, because that is a valuable product to sell. The price of gas at both places has been very low, with the exception of the two years of the coal famine. Before that time they were charging 4s., while two London companies were charging more, and it is much more profitable to supply gas in London than in a town like Ramsgate. The price obtainable for coke has not been remunerative. Coke regulates the price of gas perhaps more than the price of coal; and in towns like Ramsgate and Margate, where there is no trade or manufacture whatever, it is always a drug. It accumulates on our hands sometimes in mild winters, and we do not know what to do with it. It will, sooner or later, come to giving it away, rather than letting it lie. Comparing the price of gas with that of neighbouring towns, I find that while we have been charging 4s., Dover has been charging 4s. 3d., Folkestone 4s. 9d. and 4s. 6d., Eastbourne 5s., and Hastings 4s. 7d. and 4s. 5d. The reason we have charged less was that we have been taking such a small amount out of the price of gas for the shareholders profit. I should think the works represent a capital outlay of £85,000, and the charge upon the gas for profit has only been £2400 a year. I have no doubt but that in the future there will be an increase of consumption, requiring an increase of capital upon the works, and I think the amount inserted in the company's Bill is hardly enough. I do not think the money the company have asked for will carry them on anything like eight or nine years. Placing this company on all fours with others, I assume the company would have had something like £50,000 at 10 per cent., and £95,000 at 7 per cent., and the dividend upon those amounts would have been £7450 a year, which the shareholders would have been entitled to receive.

Mr. MICHAEL: You know the works of the company well, could they have been constructed for a less sum than for £80,000 to £85,000?

Witness: No. Mr. Stevenson stated that he would allow for such works from £600 to £700 per million cubic feet of their annual productive power. They are absolutely making 110 millions, and they are competent to make in most particulars something like 140 millions.

Cross-examined by Mr. BIDDER: I have not been engaged in the management of the gas-works, but in advising the directors upon extensions and alterations of the works. I have heard the late Dr. Letheby say that a proportion of ammonia being left in the gas was rather serviceable, but it is removed because it is very profitable to do so. There is no difference between the illuminating power of the gas at the works and that at the burner. Previously to our having the Bunsen photometer, we had an inferential photometer, which gives the illuminating power by the indication of the height of the flame. It does not state the definite quality, but it does so approximately, and with very great delicacy; it is not affected by any deviations. When the manager has once ascertained that his gas is satisfactory with the jet at a certain height, if he keeps the jet at that thereafter he is safe.

Mr. BIDDER: Does not the result of the illuminating power derived from the inferential photometer depend to a great extent upon the pressure with which the gas is forced through the instrument?

Witness: It does not, because without you look at the pressure to start with it is no use attempting the experiment at all. If you increase the pressure you get a different result, and the whole thing is worthless.

Mr. BIDDER: That is the very thing I am trying to arrive at—that the whole thing is worthless.

Witness: You cannot improve the illuminating power by putting on the pressure.

Mr. BIDDER: If the pressure is greater at the works, the result would indicate a greater illuminating power, and if it was less, it would indicate a less illuminating power?

Witness: I cannot tell you that. Your question is put as if you did not understand the instrument at all.

Mr. BIDDER: I do not understand it.

Witness: Then you had better not ask me such a question as that.

Mr. BIDDER: I am instructed that if the pressure at which the gas is

forced through the instrument is increased, the result in illuminating power indicated is also increased?

Witness: No; you get a longer flare, if that is what you mean, but no one would pretend to call that any indication of the illuminating power. The return from the photometer is always taken with the pressure relative to the height of the flame; the two things are always taken into account. I believe the report of the illuminating power has been kept in the manager's carbonizing book.

Mr. BIDDER: Why is it necessary in your case to have a pressure which is double that which is prescribed by modern Acts?

Witness: Because in nine out of ten houses the apparatus is not in good order, and, although at considerable loss, we are obliged to put on this heavier pressure.

Mr. BIDDER: Is there not another cause—viz., that the mains are too small?

Witness: The best proof that the mains are not very small is that we get this pressure all over the district, with a very little loss from the initial pressure that we employ at the works. Of course those consumers whose fittings are good have too much pressure, but they have their taps to reduce it. The pressure has been tested at various points, and the observations have been recorded by the manager of the works.

Mr. BIDDER objected to the evidence of the witness being received, and submitted that the manager himself ought to be called.

The CHAIRMAN said he thought they ought to have the evidence of the gentleman who made the observations.

Mr. MICHAEL said that the manager might not have made the observations himself, and it would therefore be necessary to call the men who did so.

The CHAIRMAN said the committee would receive the evidence for what it was worth. They might look upon it that the witness produced the record which was kept at the works.

Mr. BIDDER submitted that it was not evidence at all.

Mr. MICHAEL said that no questions had been asked of Messrs. Stevenson and Penny, the engineers who had been examined for the local board, as to the purity and illuminating power of the gas, and all they had had was the loose statements of a photographer who tested gas for sulphuretted hydrogen by nitrate of silver in daylight, and the gentleman who exhibited photometers in his shop-window.

After some further discussion,

Mr. MICHAEL said he would settle the question by undertaking to call the manager of the Ramsgate works on the following day.

Mr. BIDDER (to witness): Do you see any objection, supposing the Bill were to pass, to put up to auction the new capital, and introduce what are called the auction clauses?

Witness: I do not think it is fair to deprive the shareholders of all interest in the extension of their business. I do not see why you should appropriate such a thing in a gas company any more than in a railway company.

Mr. BIDDER: You think that the gentlemen who originally found the £16,000 should not only have their 10 per cent., and then 5 per cent. on the capitalized profits, but that they should have the right *ad infinitum* to invest money at a good per centage in extensions for the future?

Witness: Yes, distinctly, always taking the risks of the trade. My proposal, as to the interest the company should have for any extension of capital, is 7 per cent., and, doubtless, those 7 per cent. shares would realize a considerable premium. I do not know of a gas company since 1865 being allowed 10 per cent. on capitalized profits.

Mr. MICHAEL: We only ask for 5 per cent. on the capitalized profits, and 7 per cent. on the new capital.

Mr. BIDDER: You ask for £24,000 at 10 per cent.

Mr. MICHAEL: That is old capital.

Mr. BIDDER: But £8000 of that is capitalized profits. You never found more than £16,000 in money, and you are asking for 10 per cent. upon that.

By the COMMITTEE: When I said that no company out of London were bound by the sulphur clause, I was speaking generally. I believe they are so at Newcastle, and I rather think at Birmingham.

(To be continued.)

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

TUESDAY, APRIL 10.

(Before Vice-Chancellor MALINS.)

BRÖNNER v. HUNTBACH.

Mr. GLASSE, Q.C., Mr. HIGGINS, Q.C., and Mr. ROMER appeared for the plaintiff, and Mr. PEARSON, Q.C., and Mr. HUMPHRIES for the defendant.

The plaintiff in this case, through his agents, Messrs. Greene and Son, of Cannon Street, London, applied for an injunction to restrain the defendant, who resides at Manchester, from advertising or offering for sale as Brönners's burners, any gas-burners not manufactured by the plaintiff, and also from selling any gas-burner not manufactured by the plaintiff, having any colourable imitation of the plaintiff's trade mark, "Brönners's Patent." It appeared that the defendant had bought the gas-burners in question from one Julius Ungar, against whom the Vice-Chancellor had already granted an injunction.

The VICE-CHANCELLOR granted a perpetual injunction as prayed.

QUEEN'S BENCH DIVISION.

TUESDAY, APRIL 17.

(Before Justices MELLOR and MANISTY.)

REGINA v. THE COLNE VALLEY GAS COMPANY, LIMITED.

Mr. WILLS said this was an indictment tried at the last Leeds Assizes before Lord Coleridge, when the jury returned a verdict of guilty. He now moved for a rule *nisi*, calling upon the prosecution to show cause why there should not be a new trial on the ground of misdirection. The defendants were a company without an Act of Parliament. The indictment was preferred against them by another gas company, formed under an Act of Parliament in the same district. The defendants were indicted for an obstruction in breaking certain roads and streets for laying down their pipes. Three instances of obstruction were proved, but they were very slight. The work commenced at eleven o'clock, and was concluded at three o'clock in the morning. No one saw them at work but the police, in two of the three instances—one when the policeman had to diverge and walk round the works, and the third obstruction was caused by the prosecution sending a body of men to prevent the defendants men from proceeding with their work.

The Court granted a rule.

COMMON PLEAS DIVISION.

THURSDAY, APRIL 19.

(Before Justice DENMAN and a Common Jury.)

CROWTHER and ANOTHER v. STREET.

This was an action to recover £88 6s. for making surveys and preparing plans in connexion with the Beverley Water Bill, 1874.

Mr. FRENCH said that the plaintiffs (Messrs. Crowther) were surveyors, and the defendant was described as the promoter of the Beverley Water Bill, which failed to pass through Parliament. In November, 1873, in compliance with the report of Messrs. Hawksley, Mr. George Crowther, a member of the plaintiffs firm, proceeded to Beverley, where he received instructions from Messrs. Robinson, solicitors and local agents to the scheme, to make surveys and prepare plans of the district for the purposes of the Bill. Messrs. Robinson showed him the general outline of the scheme, and desired him to survey the neighbourhood where the works were intended to be constructed, and also to take levels for a distance of about three miles, so as to get a sufficient elevation from which the water could be supplied by gravitation. He did all this, and prepared the plans in time to be deposited by the 30th of November, in compliance with the parliamentary Standing Orders. His charge for the work performed was £70, and the remaining £18 6s. was money actually out of pocket in railway fare, travelling, &c. He had since claimed payment, but the money was not forthcoming.

Plaintiff having given evidence in support of the learned counsel's statement, the jury returned a verdict for the sum sued for, the defendant not appearing.

Judgment for the plaintiffs.

BIRMINGHAM POLICE COURT.—THURSDAY, APRIL 12.
(Before Mr. KYNERSLEY, the Stipendiary, and other Magistrates.)
CONVICTION FOR GAS-STEALING.

William Scattergood, lamplighter, Herbert Road, was summoned, at the instance of the Corporation of Birmingham, for having, on the 24th ult., fraudulently abstracted gas, for having unlawfully connected a pipe with his meter without having given 24 hours notice of his intention, and for having unlawfully prevented his meter from duly registering the quantity of gas supplied.

Defendant pleaded guilty.

Mr. JESSE HERBERT, who appeared to prosecute, said that three summonses had been issued against the defendant, but there was virtually but one offence. Defendant was a lamplighter in the employment of the corporation, and was a consumer of gas. He had connected a pipe with the main in such a way that the gas was not registered in the meter, and he had also joined another pipe in such a way that the gas was burnt direct from the main. Mr. Herbert did not press for the full penalty on all three charges, which would have amounted to £9, inasmuch as the defendant had long been a servant of the corporation, and had discharged his duties faithfully and well. Something, however, must be done to prevent this practice, which was now getting common.

The MAGISTRATES ordered the defendant to pay a fine of £5 and costs, on the charge of fraudulently abstracting. They remarked that defendant had used the knowledge which he possessed, as a servant of the corporation, for an improper purpose, and they had, therefore, notwithstanding the recommendation of the prosecution, no alternative but to treat it as a very serious offence.

Miscellaneous News.

METROPOLIS GAS SUPPLY.
BERMONDSEY VESTRY.

At the last meeting of the Vestry—Mr. G. ELKINGTON, the surveyor, presented the following report on the supply of gas to the public lamps:—

To the Vestry of Bermondsey.

Gentlemen,—In compliance with the resolution of the Vestry passed on the 5th of March last, I beg to submit the following report with reference to the means of obtaining a better supply of gas to the public lamps:—

The parish is now lighted by three companies, the number of lamps in their respective districts being as follows:—

Phoenix Gas Company	64
South Metropolitan Gas Company	240
Surrey Consumers Gas Company	504

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When the Metropolis Local Management Act came into operation in January, 1856, the greater part of the district was supplied by the Surrey Consumers Gas Company under a contract, dated Oct. 7, 1851, entered into with the Commissioners of Bermondsey Improvements, the leading provisions of which, relating to the supply of gas were thus stated:

"To supply a sufficient quantity of proper gas, such gas to be pure carburetted hydrogen, free from sulphur and ammonia."

"Each burner to consume 5 feet of gas per hour, at least, with a 4-inch width of flame, and shall, in all respects, give as good and brilliant a light as those supplied by the South Metropolitan Gas Company, and as any other lamps that now are or may at any time hereafter be supplied in any parish of the Metropolis."

"That every branch and service-pipe used for such lighting shall be kept fully charged with gas, and the stopcocks so turned on as not to impede or prevent any such branch or service-pipe being filled with gas."

"To trim, clean, and light."

"To clean once in every week the lamps and lanterns."

"To paint once in every year."

"To forfeit and pay 10s. for every occasion on which such lamp shall be found so not lighted or remaining extinguished or burning with less illuminating power than ought to be, provided that the company shall not be liable to pay such sums in cases when the causes of failure shall be beyond the control of the company, their agents or servants."

"The price paid £4 per lamp per annum."

This arrangement continued in force until the year 1861, when fresh contracts were entered into by the vestry with each of the three companies for a period of seven years up to Midsummer, 1868, unless determined by either party at six months notice, the principal provisions thereof relating to the supply of gas being varied from the previous contract in several respects, and being thus stated:

"To provide and supply to all the public lamps a sufficient quantity of pure gas."

"To provide and lay all such lamps, burners, lamp-posts, brackets, also all such mains, pipes, syphons, and other apparatus as shall be necessary for the purposes of the said gas supply, and to keep the same in good repair and working order."

"To set light to and extinguish all the lamps."

"To cleanse and keep properly cleansed all the said lamps."

"To paint once in every year."

"The burners to be either bat's-wing or fishtail burners, made so as to consume 5 cubic feet of gas in every hour."

"The illuminating power to be such as required by the Metropolis Gas Act, 1860."

"To forfeit and pay 6d. for every occasion on which such lamp shall be found so not lighted or remaining extinguished, or burning with less illuminating power than ought to be, provided that the company shall not be liable to pay such sums in cases when the causes of failure shall be beyond the control of the company, their agents or servants."

"That the mains and service-pipes shall be kept regularly cleansed and freed from all stoppage and obstruction, and that all stoppages, obstructions, and defects in any mains or service-pipes or other apparatus for supplying gas shall be removed or remedied within twelve hours after the same shall have been discovered or made known to the company or their servants."

"The price paid £4 5s. per lamp per annum."

The contracts with each of the three companies remained in force until Midsummer, 1868, since which date no new contract has been entered into, the parish being supplied by them respectively on the same terms, with the exception of the South Metropolitan Gas Company, who voluntarily allowed a discount of 12½ per cent. for a considerable period, and who allow at the present moment a discount of 7½ per cent.

On comparing the terms of the two contracts, it will be noticed that those of 1861 were less stringent than the conditions of the previous contract in 1851, especially as to the amount of penalty, but as it was urged that the provisions of the Metropolis Gas Act, 1860, would operate as a sufficient protection to all local authorities, I beg to direct your attention to the five clauses which specially refer to the matter, viz:—

"Metropolis Gas Act, 1860.

"7.—If at any time complaints as to the quantity or quality of the gas supplied by any company be made to the said Secretary of State, by memorial in writing, from the Metropolitan Board of Works, or any Vestry or District Board of Works, signed by their clerks respectively, or not less than 20 inhabitant householders paying rates for, and supplied with, gas by any such company, it shall be lawful for the said Secretary, at any time within one month after the receipt of such complaint, to appoint a competent person as inspector, to inquire into and concerning the grounds of such complaint, and to report to the Secretary thereon."

"22.—The gas company shall well and effectually light all public lamps in all streets which they are required by the local authority to light; and shall, according to the terms of their contract, supply to the local authority so much gas as they require for their public lamps, provided that the gas company shall not be compelled to light any street with lamps at a greater distance from each other than 75 yards."

"23.—The local authority may provide and keep in repair their own public lamp-posts and lamps, and apparatus connected therewith, and, in case of their electing to burn by meter, light and extinguish the lamps, and defray the expenses thereof."

"24.—Every gas company shall, unless prevented by necessary repairs or unavoidable accident, at all times keep all their branch or service pipes fully charged with gas, and the stopcocks so turned as not to prevent the branch or service pipes from being at all times filled with gas."

"37.—The gas company shall not charge a higher price, by the one thousand cubic feet, for gas supplied to any local authority, than the lowest rate, by the one thousand cubic feet, from time to time charged by them to any private consumers, otherwise than by special contract in writing, in the district supplied by the gas company."

For the information of the vestry I have ascertained the prices paid in certain other districts, viz:—

Rotherhithe	£4 5 0	The Surrey Consumers Co. light, clean, paint, and repair.
St. George's Southwark	4 5 0	The Phoenix Gas Co., ditto.
Ditto ditto	4 4 0	South Metropolitan Gas Co. less 7½ per cent. discount, ditto.
Ditto ditto	4 14 9	London Gas Co., ditto
St. Olave's Board of Works	4 5 0	Surrey Consumers Gas Co., the lighting, cleaning, repairing, and painting carried out by the St. Olave's Board of Works.
Lewisham Board of Works	4 12 0	Phoenix Gas Co. light, clean, paint, and repair.
Ditto ditto	4 3 4	Crystal Palace Gas Co., ditto.

As regards the manner in which the several companies have performed their respective contracts, the Vestry have not received any complaints of the Phoenix or South Metropolitan Gas Companies, who fairly and efficiently supply their districts, and fulfil the obligations imposed by Act of Parliament.

The supply of gas, however, to the public lamps on the part of the Surrey Consumers Gas Company is most unsatisfactory and inefficient, complaints of a diminished quality of light having been repeatedly made to the vestry for years past, and the representations made to the company in consequence having been treated with disregard or indifference. It is to be regretted that this company, originally established, after much public agitation, in the express interests of consumers, should now abuse its monopoly by ignoring those interests, and charging a higher rate than other districts.

I assume it to be well established that every public lamp should be enabled to burn 5 cubic feet of gas per hour, and I believe the fact to be notorious that such is not the case, arising either from instructions issued to the company's men not to turn on the burners to the full extent, or from defective services and apparatus. There is, in my opinion, a most serious want of supervision in dealing with the necessary details connected with the lamps, whether as respects the services, the reinstatement or renewal of burners, the cleaning, mode of fixing, the manner of turning on, and other items which it is the duty of the company to carry out. Complaints have also been numerous, as to the hours of lighting and extinguishing the lamps. The number of cubic feet which ought to be consumed annually at each lamp, if lighted from sunset to sunrise, is 21,900.

With reference to the means of obtaining a better supply in accordance with the vestry's resolution, the question must be dealt with on two grounds—quality and quantity.

First as to Quality.—By the provisions of the Metropolis Gas Act, the vestry are authorized (if not indeed required) to construct a testing-room, and to appoint a chemical examiner or gas engineer. The proposal to do so in Bermondsey was negatived by the vestry on a former occasion, but it is obvious that the vestry are entirely precluded from taking any action to ensure the illuminating power being such as is defined by the Act, unless this course is adopted.

The St. Olave's Board of Works have complied with the Act by erecting a testing-room in Vine Street, and appointed a gas examiner (Dr. Vinen), who reports regularly the result of his observations. The entry for the week ending March 10 was

Maximum light	12.25
Minimum "	11.61
Average "	11.95
Maximum pressure	15.10ths
Minimum "	6.10ths

I respectfully submit to the vestry the propriety of reconsidering this matter, bearing in mind that it affects not only the quality, purity, and illuminating power of the gas supplied to the public lamps, but also of the gas supplied to all private consumers within the district. The policy and necessity of doing so may be influenced by a consideration of the following figures, viz:—

these rivers by the Chelsea, West Middlesex, Southwark, Grand Junction, Lambeth, New River, and East London Companies was consequently polluted with organic matter, although not to so great an extent as in December and January last. All these companies delivered efficiently filtered water except the Southwark, which sent out slightly turbid water containing moving organisms and coloured fibres. The water supplied from artesian wells to the inner circle by the Kent Company, and to the outer circle by the Colne Valley Company and the Tottenham Local Board of Health was wholesome, bright, and palatable, and of most excellent quality for dietetic purposes. The water delivered by the Kent Company, and by the Tottenham Local Board was hard, and therefore unsuitable for washing, but that supplied by the Colne Valley Company was softened by Clark's process before delivery, whereby its hardness was reduced to less than one-fifth of the original amount, and the total solid matters from 38 to 12 parts in 100,000 parts of water. Seen through a stratum two feet deep, the Kent, Colne Valley, and Tottenham waters were clear and colourless. The remaining samples presented the following appearances—Chelsea, West Middlesex, Grand Junction, and Lambeth, clear and very slightly green; Southwark, turbid and brownish green; New River and East London, clear and very slightly yellow.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Mat- ters.	Or- ganic Car- bon.	Or- ganic Nitro- gen.	Ammonia.	Nitrogen, as Ni- trates and Nitrites.	Total combined Nitro- gen.	Chlo- rine.	Total Hard- ness.
Inner Circle.								
Thames—								
Chelsea	30.20	.241	.023	0	.319	.342	1.55	20.3
West Middlesex	29.86	.231	.018	0	.312	.330	1.58	19.7
Southwark and Vauxhall	31.00	.219	.027	0	.311	.338	1.55	20.0
Grand Junction	31.16	.215	.025	0	.280	.305	1.55	20.3
Lambeth	32.50	.208	.019	0	.361	.380	1.70	20.9
Other Sources—								
New River	30.12	.209	.018	0	.322	.340	1.55	20.9
East London	31.80	.228	.018	0	.287	.305	1.70	21.8
Kent	38.90	.055	.007	0	.358	.365	2.35	24.8
Outer Circle.								
Colne Valley	12.30	.053	.021	.009	.366	.394	1.38	4.7
Tottenham Board of Health	45.80	.020	.006	.005	.443	.453	3.20	23.9
Corporation of Birmingham* ham	28.60	.231	.069	.002	.143	.213	1.40	20.0
Corporation of Glasgow†	2.20	.164	.005	.003	.004	.011	.69	1.4

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of the Andersonian University, Glasgow.
Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

Major Bolton reports that the state of the water in the Thames and Lea was fairly good during the month of March, the water taken in by the companies for distribution having considerably improved. The water in the River Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was fairly good during the month of March. The highest flood state of the river was 1 foot 10 inches above the (6 feet) summer level, and the lowest was 4 inches above summer level. The highest temperature of the water taken at Seething Wells was 48°, and the lowest 39°, while the highest temperature of the air at the same place was 50°, and the lowest 26°. The condition of the water in this part of the river was good on three days, indifferent on 16 days, and bad on 12 days during the month. The highest flood state was 2 feet 7 inches above, and the lowest 1 foot above summer level. These observations were made daily at 9 a.m. The rainfall for the month was 1.95 inches.

Dr. Whitmore's report on the composition of the Thames companies and other waters supplied to Marylebone during March:—

	In Grains, per Gallon.		In Parts, per Million.		In Degrees.	
	Total Solid Matter.	Loss by Incineration.*	Chlo- rine.	Free Ammo- nia.	Hard- ness.	Hardness after boil- ing Fifteen Minutes.
West Middlesex	20.00	0.88	1.14	.01	.08	2.9
Grand Junction	21.28	0.92	1.16	.02	.08	3.1

* The loss by incineration represents the amount of organic and other volatile matters contained in the Imperial gallon (70,000 grains) of water; the total solid matter, minus such loss, consisted chiefly of carbonate of lime, with small quantities of other equally harmless salts.

The water of both companies, as seen through a glass tube 2 feet in length, was clear, bright, and colourless.

SHEFFIELD UNITED GAS COMPANY.

The Forty-fourth Ordinary Meeting of Shareholders was held on Friday last—Mr. F. T. MAPPIN in the chair.

The following report and accounts were submitted:—

The profits for the half year ending the 31st of December last were £29,160 11s. 7½d. Out of this your directors propose the payment for such half year of the usual maximum dividend, namely:—

Dividend on £135,000, class A stock, after the rate of 10 per cent. per annum.	£6,750 0 0
Dividend on £209,053 10s., class B stock, after the rate of 10 per cent. per annum.	10,452 13 6
Dividend on £99,700, class C stock, after the rate of 9 per cent. per annum.	4,486 10 0
Dividend on 12,937 new ordinary £10 shares (second issue), £3 per share paid up, after the rate of 9 per cent. per annum, being 2s. 8d. and two-fifths of a penny per share, or	1,746 9 10½
Total	£23,435 13 4½

After payment of such dividends there will be a surplus of £5724 18s. 3d., which being added to the reserve-fund will raise that fund to £50,955 19s. 6d. It will be in the recollection of the shareholders that, in the report made to them this time last year, the board intimated that they had decided from June 30, 1876, to make a reduction of 1d. per 1000 feet in the company's charges for gas supplied to all consumers. The policy of this company's directors has always been to reduce the charges for gas from time to time, as early as, in their judgment, circumstances would justify such a step; and taking into account the sum which, out of profits made during the year 1876, was (notwithstanding the reduction made in June of that year) added to the reserve-fund, your board are glad to announce that they have determined, from the 30th of June next, to make to all consumers a further reduction of 2d. per 1000 cubic feet. The directors have to regret the loss of one of their colleagues since they last met the shareholders, by the death of Mr. Samuel Parker, whose sound judgment rendered him

at all times welcome amongst them. His place at the board has been filled up by the appointment of Mr. Henry Stephenson, of Endcliffe Vale. No other special circumstances have occurred, since the last general meeting, calling for notice in this report, which your directors will consequently conclude by expressing the hope that the reduction above announced will meet with the approval both of the shareholders and the public.

Dr.		Capital Account, for the Half Year ending Dec. 31, 1876.		Cr.	
Class A stock, fully paid up	£135,000	0	0	Land, buildings, parliamentary, and other expenses, works, and machinery (including mains to June 30, 1855)	£413,398 12 6
Ditto B do.	209,053	10	0	Mains from June 30, 1855	67,749 17 3
Ditto C do.	99,700	0	0	Meters	29,434 1 3
12,937 new ordinary £10 shares (2nd issue), £3 per share paid up	38,811	0	0	Balance	11,381 18 8
Amount raised on mortgage	39,400	0	0		
	£521,964	10	0		£521,964 10 0

Dr.		Revenue Account.		Cr.	
Half year's gas and meter rents, due this day	£65,607	19	7	Half year's expenditure in the production of gas	£58,884 6 3½
Amount arising from the sale of coke, tar, waste lime, and ammonia water	18,623	11	0½	Paid mortgagees & bankers for interest during the half year	584 2 3
Amount realized from the manufacture of sulphate of ammonia, sale of gas-fittings, and work done (after deducting all charges) and house and other rents	4,397	9	6½	Balance	29,160 11 7½
	£88,629	0	2		£88,629 0 2
				Dividends payable May 1, 1877	£23,435 13 4½
				Balance to be carried to reserve-fund, May 1, 1877	5,724 18 3
Balance brought down	£29,160	11	7½		£29,160 11 7½

Maximum price of gas, 3s. per 1000 feet.

Dr.		General Balance.		Cr.	
Balance of revenue account	£29,160	11	7½	Ledger balances, and accounts owing to the company	£57,068 12 10
Ledger balances, and accounts owing by the company	48,276	7	11½	Stores in hand	19,480 0 4
Balance of capital account	11,381	18	8	Balance due from bankers	12,268 8 8
	£88,818	18	3	Balance due from cashier	1 16 5
					£88,818 18 3
Reserve-fund, invested June 30, 1876					£40,824 11 1
Amount transferred from revenue, Nov. 1, 1876					3,504 10 2
					£44,329 1 3
Interest to Dec. 31, 1876					902 0 0
					£45,231 1 3

The CHAIRMAN, in moving the adoption of the report, said he thought the profit the company had made during the past year—£29,160—must be satisfactory to the shareholders, as, after paying maximum dividends, they were enabled to carry £5724 18s. 3d. to the reserve-fund, which would make that fund amount to £50,955 19s. 6d. This had had the attention of the directors, and, after consideration, they thought they saw their way to make a reduction in the price of gas to the public on the 30th of June next of 2d. per 1000 feet. The quality they hoped would not be affected by the price being reduced, but they were determined that it should be better, if possible, than it had been. The working for the year had been varied, and had been affected to the advantage of the income, by the increase in the gas-rental of £713. The meter-rents had also increased, the tar had considerably increased, and the chemical-works had been satisfactory. It had also been affected by the decrease in the expenditure upon coals, stores, wages, repairs, labourers wages, and renewals. It had been affected adversely by an increase in the repairs of mains and service, local rates and taxes, to the amount of £1593, salaries, law charges, depreciation of meters, and dividends to shareholders for £1523, consequent on the reduction in the price of gas in June last. These, no doubt, were very good days for gas companies, and their profits appeared in almost all cases to be satisfactory. Some advantage had been given to the shareholders by almost all the companies in the kingdom, and this had directed attention to the prosperity of gas companies, for they found that Mr. Raikes, the Chairman of Committees in the House of Commons, had introduced a motion for a Standing Order that in future all capital authorized was to be offered to the public by auction. This he proposed to consider on March 27; it was postponed to April 6, then to April 17, and now stood for discussion that day. Now this proposal could not be viewed in a favourable light for gas shareholders established under an Act of Parliament which limited their dividends, and placed them under stringent obligations. No doubt the House of Commons had the right and power to make alterations in any Act of Parliament in the interest of the public, but he thought it was very much to be objected to that Acts of Parliament should be altered by a simple Standing Order, and he thought that the Government—if they wished to make this alteration—should bring a Bill in, and have it fully considered and debated upon. He (the chairman) did not see why gas companies and water companies should be first dealt with in this way. Other companies would follow, no doubt, if this was carried; but he did not think that a hard and fast line was good either for consumers or for companies. There were many circumstances that might arise in gas companies; they might not be successful, as the Sheffield Company had been; there might be, and were, certain conditions imposed upon them, such as supplying districts at a distance from their works, and which they might not be able to see their way to do in the hope of obtaining a remunerative return on their capital. Therefore there would be no inducement for those companies to extend their mains unless they saw some benefit to themselves as well. Besides, in Sheffield it had been beneficial to the consumer to have the price of his gas reduced, and the quality kept up as it had been, and the directors had attained this by giving a benefit to the proprietors and shareholders of the company. Considerable attention had been paid by the directors, not only during this year but for many years past, and they had endeavoured to manage the concern to the best advantage. They knew that, as they reduced the price of gas in Sheffield, they were enabled to pay a larger dividend upon the shares which were recently created. Therefore they had sufficient cause to object to so large an infringement upon the Companies Clauses Act of 1863, which provided for all additional capital to be allotted *pro rata* to existing shareholders, and he did not think that a Standing Order, affecting the large interests that it did, should be passed without being fully considered as a Bill before Parliament. For some little time the officers of the company had had their attention called to the exhibition of gas apparatus, and it was their intention to make an exhibition of the burners that were used by a large majority of the public—those burners being supplied by the gas company. It would show the consumers how much the satisfactory and economical use of gas was in their own hands, and dependent upon the adoption by them of good or bad burners. The condition of the company's works was satisfactory, and they were somewhat extending. The directors had, within the last few days, let a contract for the construction of a new gasholder, which they hoped would be completed and ready for use by the next winter.

Mr. J. GREAVES seconded the motion.

Mr. J. WILSON urged the desirableness of increasing the mains in the centre of the town, as there was a deficiency of supply in that portion of their district. In the months of November and December last the supply of gas in Shalesmoor, Snighill, and Gibraltar Street was very short, and much inconvenience was occasioned to the customers thereby.

The CHAIRMAN remarked that the size of the mains had considerably enlarged in some parts of the town. Complaints were formerly made from Shalesmoor and Snighill, but after the alterations took place no complaints had been made.

The motion was put and carried unanimously, and the dividends recommended in the report were declared.

Mr. J. BARBER: Will the proposed reduction in the price of gas bring with it increased dividend to the new shares?

The CHAIRMAN: It will not bring any increased dividend to the new shares.

Mr. HOBSON: You have got 9 per cent. instead of 7½.

The CHAIRMAN: The reduction last year did bring an increase of dividend but the present reduction will not.

Mr. F. E. SMITH: What reduction does increase the dividend? Is it not 1d. or 1½d. further?

The CHAIRMAN: Should we supply the public at 2s. 9d., I believe the dividend will be increased to 10 per cent., which will be the maximum.

Mr. WILSON moved a vote of thanks to the chairman, which was seconded by Mr. ROOME, and carried unanimously.

The CHAIRMAN, in reply, said: It is satisfactory to a chairman to be connected with a prosperous and successful undertaking at all times, and I do not like to be connected with a bad one. If I am, I like to know the reason why, and as long as I am supported by my brother directors, and remain the chairman, I shall hope to conduct this company to the satisfaction of the shareholders.

SHEFFIELD WATER-WORKS COMPANY.

The Ordinary General Meeting of this Company was held on the 16th inst.—Mr. W. COCKAYNE in the chair.

The directors report was as follows:—

After payment of all expenses of the company, interest on debentures, and the sum of £32,855 10s. dividends on preference shares, there would, if the interest on the capital invested in the company's works and land not yet utilized for the supply of water (being the sum of £19,991 19s. 5d.) were charged to capital, and not to revenue, in accordance with the course adopted by the company in obedience to the order of Vice-Chancellor Malins made in 1872, remain a balance on revenue account of £20,053 12s., which would be sufficient to pay a dividend of 4 per cent. for the whole of the year 1876 on the ordinary shares, leaving a balance of £1579 12s. to be added to the surplus fund.

The position of the company's non-utilized works, and other circumstances, however, now being different from what they were when the order was made by Vice-Chancellor Malins, the directors have considered it incumbent upon them to abstain from making the usual intermediate dividend in November last, and to apply to the Chancery Division of the High Court of Justice to decide how far the former order is applicable to the present state of the company. This decision of the Court could not be obtained in time for the general meeting: the above sum of £19,991 19s. 5d. has therefore been carried to a suspense account, there to remain until such decision shall have been got. Should the Court decide that this sum is a proper charge against revenue, there will remain a balance of £61 12s. 7d. only, which would obviously be incapable of division, and which the directors would consequently recommend to be carried forward to the account of next year. Should the Court decide that the former order is still applicable, the directors propose to call an extraordinary general meeting of the company as soon as the decision is obtained, and it will be for that meeting to determine whether a dividend shall be declared, and of what amount, for the whole of the year 1876.

The directors have pleasure in stating that up to the 31st of March they had succeeded in renewing debentures of the company to the amount of £397,000 at the rate of 4 per cent. interest, and they have no doubt that the remaining debentures, which now bear a higher rate of interest will, as they become due, be also renewed at the rate of 4 per cent.

The directors propose to offer for sale in the course of the ensuing summer a large quantity of the land at Crooke's Moor, which they are advised by the company's engineer will not now be required in connexion with the supply of water to the town, as well as the site of Limerick Wheel, destroyed by the inundation of 1864, and the property connected with it.

The directors were glad to draw the attention of the shareholders to the fact that the water-rates for the year 1876 exceed those of the previous year by the sum of £348 8s. 5d., which is the largest normal increase yet obtained in any single year of the company. The directors trust that the shareholders will see in this fact evidence that, although many difficulties yet attend the undertaking, there is no reason for despairing of its ultimate success.

The company's engineers report as follows:—

"To the Chairman and Directors of the Sheffield Water-Works Company.

"30, Great George Street, Westminster, S.W., March 23, 1877.

"Gentlemen,—We have the honour to report that we have examined the storage reservoirs of the company, situate in Redmines, Rivelin, and Loxley valleys, and have found the embankments and other works to be in good and water-tight condition. There are now about 2500 million gallons of water in store, ready to meet the demands of the approaching summer.—We are, gentlemen, your most obedient servants,

"T. AND C. HAWKESLEY."

The directors are glad to be able thus to assure the shareholders that the ability of the company's works to meet the requirements of the town and district during the ensuing summer is found beyond reasonable doubt.

The directors have had to regret, during the past year, the deaths of two of their number—Mr. Charles Hoole, who for many years bestowed much time and thought on the affairs of the company, and whose services were of great value; and Mr. Charles Wardlow, who, though he had only recently joined the board, had evinced great interest in the affairs of the company, and a desire to become an efficient member.

The company, during the last year, laid pipes to the extent of about 7½ miles; the entire length of the pipes is now about 205½ miles.

The company now supply with water 56,200 houses, besides other property. This number of houses exceeds by 2000 those supplied in 1875.

The CHAIRMAN moved the adoption of the report. He said in that document everything of moment was so fully stated that there was very little for him to add. The first thing which was encouraging was the large increase of the annual income, and it had shown an increase of above £4000, instead of £3700 in 1875. He was glad to say this increase had been steadily going on with the increase of the town, and it might be expected to grow in a larger ratio. In 1873 the water-rates were £48,854, in 1876 they were £63,781, or an increase in three years of £14,927. Mr. Ashton, the manager, was doing all he could to make the water company a paying concern. The rents were collected quarterly, and were so well managed that the loss by bad debts was not quite 8s. 9d. per cent. on an income of £63,781. The advantage of this system was that the money was paid into the bank, interest was allowed on it, and generally they had a good sum to their credit there. If they could only rest for some time they would soon be able to pay the old shareholders, out of revenue, a dividend of 5 per cent. per annum.

Mr. S. ROBERTS seconded the motion, which, after some lengthy observations by Mr. ASHTON on the position of the company, was put and carried unanimously.

Thanks were then voted to the directors for their past services, and the CHAIRMAN acknowledged the same.

The outgoing members of the board were re-elected, and a vote of thanks to the chairman closed the proceedings.

Mr. E. J. SOUTHWELL, the secretary of the Commercial Gas Company, who for 25 years was vestry-clerk and clerk to the guardians of Mile End Old Town, has been appointed by the Local Government a guardian of the poor of Mile End Old Town.

PRESTON GAS COMPANY.

The following report and summary of accounts for the last financial year, prepared by the borough accountant, has been laid before the council:—

To the Finance Committee of the Corporation of Preston.

Borough Accountant's Office, March 21, 1877.

Gentlemen,—Having examined the accounts of the Preston Gas Company for the year ending Nov. 30, 1876, I beg to submit the following particulars:—

REVENUE ACCOUNT.

Income.

Gas-rents, less discounts and abatements	£45,890 16 1	
Meter-rents	2,648 18 7	
		£48,539 14 8
Residuals—		
Coke	£4,956 19 5½	
Tar	1,971 6 10	
Salts	1,506 3 11	
		8,434 10 2½
Sundries	222 5 5	
		£57,196 10 3½

Expenditure.

Manufacture—		
Cannel and coal	£20,443 4 10	
Wages	846 2 3½	
Water	153 13 9	
Lime	949 6 7½	
		£28,195 2 11½
Maintenance and repairs—		
Alterations and improvements	£3,149 17 9	
Mechanics repairs, and repairs of pipes	1,622 11 0	
Meter repairs and fittings	689 8 6	
Retorts and fire-bricks	427 12 3	
		5,113 0 9½
Management and establishment charges—		
Salaries	£2,336 3 4	
Rents, rates, and taxes	1,622 11 0	
Bank commission	50 0 0	
Sundries	525 3 9	
		4,533 18 1
Interest on loans	£1,772 5 11	
Less bank interest, &c.	101 17 8	
		1,670 8 3
		£39,512 10 1
		17,684 0 2½
		£57,196 10 3½

Dividends.

To Dividend declared for the year on £120,000, stock A (10 per cent.)	£12,000 0 0
Ditto ditto 69,000, stock B (7 per cent.)	4,830 0 0
	£16,830 0 0

RESERVE-FUND.

Balance to credit of general revenue account as reserve-fund, Nov. 30, 1875	£22,823 14 10½
Surplus profit added this year, after paying the above dividend	854 0 2½

Leaving the reserve-fund up to Nov. 30, 1876. £23,677 15 1

Being within £323 of the maximum allowed.

CAPITAL ACCOUNT.

The share capital was increased by a call of £9000, paid on Dec. 1, 1875, and an additional sum of £6900 has been borrowed on mortgage; making the total increase of share and borrowed capital, during the year, £15,900.

The capital account stood as follows, Nov. 30, 1876:—

Amount expended on the gas-works and plant, Nov. 30, 1875	£248,695 7 11½
Expenditure in 1876, viz.—	
Mains and service-pipes	£4,213 8 4
Meters	989 4 2
New offices in Fishergate, extensions at works, and purchase of property adjoining works	13,545 17 7
	18,748 10 1
	£267,443 18 0½

Proprietors capital—		
Stock A (10 per cent.)	£120,000 0 0	
Stock B (7 per cent.)	69,000 0 0	
		£189,000 0 0
Loans	49,729 8 6	
Premium on sale of stock B	88 12 3	
		238,818 0 9
Balance on capital account		28,625 17 3½
		£267,443 18 0½

SUPPLY OF GAS.

The quantity of gas supplied during the year has been as follows:—

To Ordinary Consumers.			
	Cubic Feet.	Per 1000.	
Preston and Fulwood	228,484,200	4s. 2d.	£47,600 17 11
Out-townships	3,884,300	4s. 7d.	890 3 0½
Ditto	10,232,100	5s. 0d.	2,558 0 6
Ditto	15,000	6s. 0d.	4 10 0

242,615,600, at a gross charge of £51,053 11 5½

Or an average of 50·50d. per 1000 cubic feet.

Upon which discounts, bad debts, and abatements amounted to 7,773 2 4½

Being an average of 15·22 per cent., or 7·69d. per 1000 cubic feet.

Leaving the net amount received for private consumption . . . £43,280 9 1

Or an average of 42·81d. per 1000 cubic feet.

To Street-Lamps.

	Cubic Feet.	Net charge	
Quantity supplied	15,662,200		2,610 7 0
Total consumption	258,277,800	And net revenue	£45,890 16 1

Or an average of 42·64d. per 1000 cubic feet.

The following was the company's position on Nov. 30, 1876, as per balance-sheet:—

Capital and Liabilities.		Property and Assets.	
Capital (10 per cent.)	£120,000 0 0	Works, mains, meters, &c.	£267,443 18 0½
Capital (7 per cent.)	69,000 0 0	Stores of cannel, coke, and sundries	8,774 19 11
		Debtors for gas and residuals	1,123 1 9½
		Balance in bank	813 8 11
Sale of stock B	£88 12 3		
Loans	49,729 8 6		
Reserve-fund	23,677 15 1		
Dividends due for half year ending Nov. 30, 1876	8,415 0 0		
Creditors	7,244 12 10		
	£278,155 8 8		£278,155 8 8

The proportions of material used in gas manufacture during 1876 have been 44·19 per cent. of cannel, and 55·81 per cent. of coal.

During the past year the consumption of gas in the borough and Fulwood has been 6,121,300 cubic feet more than in 1875, and in the out-townships 1,289,800 cubic feet more, being a total increase in sale of 7,411,100 cubic feet.

The quantity of gas used in the street-lamps was 294,600 cubic feet less than in the previous year.
The gross revenue shows an increase of £2158, and the net profits an increase of £1513.
The following shows the proportion of income and expenditure under the different heads, and the amount per 1000 cubic feet of gas sold:—

Income.			Proportion Per Cent.		Per 1000 Cubic Feet of Gas Sold.	
			on Total Income.			
			Total Income.			
Gas-rents	80.23	....	42.64d.			
Meter-rents	4.63	....	2.46			
Residuals	14.75	....	7.83			
Sundries . . . . .	.39	....	.20			
			100.00		53.13d.	
Expenditure.						
Manufacture	49.30	....	26.20d.			
Maintenance	8.94	....	4.75			
Management	7.92	....	4.21			
Interest on loans	2.92	....	1.55			
Net profit	30.92	....	16.42			
			100.00		53.13d.	

The actual cost of producing the year's saleable quantity of gas, including interest on loans, maintenance of works, and all other expenses in connexion with the working of the establishment, was 2s. 4½d. (28.88d.) per 1000 cubic feet, against 2s. 5½d. (29.65d.) in 1875.

The company's present position, as compared with nine previous years, is given below.

Year.	Expended on Works.	Gas Sold in Millions	Net Gas Rental.	Net Profit.	Dividend.	Added to Reserve.
1867	£166,915	176	£32,325	£14,458	£12,315	£2,143
1868	181,134	175	31,959	12,566	12,420	146
1869	201,321	169	31,081	11,686	13,207	£1,521
1870	206,799	180	33,199	13,874	13,890	15
1871	212,294	208	38,064	18,312	14,047	Added.
1872	223,710	225	39,953	20,372	15,150	£4,264
1873	226,974	222	39,341	17,854	15,570	5,222
1874	236,792	233	41,324	15,220	15,570	2,284
1875	248,695	251	44,536	16,170	16,042	Deducted.
1876	267,443	258	45,890	17,684	16,830	£349
						Added.
						£128
						854

From and after the taking of the meters for the last (December) quarter, there is a reduction of 10 per cent. in the charge for gas, which (with the discount off) makes the net price to small consumers 3s. 2½d. per 1000 cubic feet; and to consumers of over 2 million cubic feet per annum, 3s. per 1000 cubic feet.
(Signed) JAMES CARTER, Borough Accountant.

WOLVERHAMPTON CORPORATION WATER SUPPLY.

At the Meeting of the Wolverhampton Town Council, on the 9th inst—the Mayor (Mr. S. Dickinson) presiding,
The Water-Works Committee presented their report and balance-sheet for the past year. The report was as follows:—

The Water-Works Committee have pleasure in laying before the council the duly audited balance-sheet and account of income and expenditure of the water-works undertaking for the year 1876, from which it will be seen that during the year a profit of £1691 3s. 7d. has been made.

The capital of the water-works company at the time of the sale to the corporation on Jan. 1, 1868, consisted of the following items:—

Original share capital	£100,000	0	0
Five per cent. preference share capital	24,415	0	0
Loans and debt to the old company	86,246	0	0
	£210,661	0	0

The actual expenditure on the works and plant at the same date amounted to £210,327 10s., the balance being made up of the floating stock of fitting materials.

The expenditure on capital account now stands as follows:—

Amount to the 1st of January, 1868	£210,327	10	0
Additional expenditure in 1868	£127	11	3
" " 1869	407	6	0
" " 1870	598	12	2
" " 1871	360	9	1
" " 1872	248	18	9
" " 1873	151	14	11
" " 1874	3081	18	2
" " 1875	1642	9	0
" " 1876	1748	0	0
Extension at Sedgley, 1876	2233	11	0
Cosford Boring, 1876	1712	17	10
	12,312	8	2
	£222,639	18	2

The capital on which the corporation pay interest is as follows:—

Debentures at 4½ per cent.	£18,400	0	0
Debentures at 4 per cent.	80,630	0	0
	£99,030	0	0
Preference share capital at 5 per cent.	24,415	0	0
Original share capital at 4 per cent.	100,000	0	0
	£223,445	0	0

Alderman FOWLER, in moving the adoption of the report, said the council had also before them a detailed statement of the income and expenditure of the Water-Works Committee, extending over a period of nine years, during which time the works had been under the management of the Corporation. From this statement the council would observe that during the past year the total income of the committee had been £18,174, and that the working expenses, including repairs to engine, coals, taxes, salaries, and all other expenses of that kind, were £7408 10s. The interest upon capital was £9074 7s. 4d., making the total expenditure £16,482 17s. 4d., thus leaving a net profit to the town of £169 3s. 7d. This was the third year in which he had had the honour of presenting to the council a report from the Water-Works Committee, showing that the undertaking was not only paying its way, but was making a profit, and therefore there was good ground for believing that this was a normal state of things which they might expect to see continued in the future, and that the property thus acquired by the corporation was one which they had no reason to regret ever having purchased. The total amount of capital on which they had to pay interest was £223,445, and the rate of interest which they had to pay was only 4½ per cent. Now, when he told them that there were other corporations in the country who had bought water-works like themselves, for which they were paying 6, 7, 8, and even 10 per cent. interest on the share capital, he thought the town council and the inhabitants of Wolverhampton generally would be perfectly satisfied the amount of interest the corporation were paying, £4 2s. 6d. per cent., was very reasonable indeed. In fact, he doubted whether any other corporation in the kingdom had accepted water-works on more satisfactory terms. There were two very excellent features in connexion with the undertaking. The first was that the water-works, which now belonged to the corporation, had never cost the town a single penny. It was quite true that during

a period of two or three years the water-works were carried on by the committee at a loss, but during that time the committee borrowed the money which was required to make up that loss, and they paid the interest on the borrowed capital out of the annual revenue; so that this "terribly extravagant bargain," which some people said the town had incurred in taking to these water-works, all amounted to this—that after nine years (and during the whole of that time they had had the water-works in their own hands, and supplied the town with water without costing them one single halfpenny) they were now entering their tenth year, with every prospect of a continual profit for the benefit of the community at large. He would also mention that this satisfactory state of things had not been brought about, as had been stated outside, by the corporation having raised the rates charged for the water which they supplied. The Act of Parliament empowered the committee to charge their consumers at the rate of 7 per cent. on the rental. The corporation had never charged more than 6 per cent., although if the works had remained in the hands of the old company there was no doubt they certainly would, as they told the corporation at the time, have raised their rates very much higher than they were, and they would have been perfectly justified in so doing. He had prepared for the information of the council a detailed statement, which showed at a glance the quantity of coal consumed, and all the other incidental expenses of carrying on the works, and he would say, on behalf of the committee, that they should be very much indebted to any gentlemen who examined that statement if they could make any suggestion for carrying on the works at a less cost or with greater benefit to the inhabitants. The committee would be very glad to adopt any such suggestion if they could satisfy themselves that it was a practical one, and one which would result in benefit to the town, their only desire being to carry on the works as profitably as they could.

Mr. KENDRICK, who seconded the motion, said the success of the Water-Works Committee was beyond his former expectations, and he congratulated them that they had not only carried on the undertaking at a profit, but had supplied the town with a much better quality of water.

Several members addressed the council in terms of congratulation on the satisfactory nature of the report.

Alderman MAJOR said he well remembered that the question of purchasing the water-works was under consideration soon after he became a member of the council, and he supported the purchase on sanitary grounds, because he considered it desirable for the health and in the interests of the community at large that the water-works should be in the hands of the corporation. The terms offered to the council were so favourable that if they had not accepted them such an opportunity might never again have been afforded to them; and he did not know any other corporation in the country who had obtained possession of water-works like theirs for so low a sum as 4½ per cent. of the capital. Therefore, on commercial grounds, as well as sanitary ones, the speculation was a good one. As chairman of the Sanitary Committee, he had had samples of the water from the water-works and from various public and private wells in the town, sent to Dr. Hill, of Birmingham, for analysis as to their quality. The samples were not marked in any way to indicate to Dr. Hill the sources from whence they were obtained, but it was a significant fact that whilst Dr. Hill, in the report he sent back, strongly condemned the water obtained from the different wells, he spoke very favourably of the sample sent from the water-works. He wrote of it: "I don't believe this is well water at all, but it appears to me to have emanated from some stream or rivulet." Of course they had seen complaints about the water in the public press, and he had heard complaints made in the council chamber; but it struck him that the people who wrote about the water in the newspapers knew very little what they were writing about. There were times, of course, when the water appeared a little discoloured, and did not look well to the eye, but that was after a continuance of heavy rains, when the floods in the river brought down quantities of silt, but if the water was passed through a filter—and he always used a filter himself—it would be as good water as they could desire. In fact, the water they obtained from the river was the best quality of water he knew of; and he did not hesitate to say that there were few towns in the kingdom better supplied with water than Wolverhampton. As the council had been informed, the committee were now completing operations, which they had been making for some time past, to obtain a sufficient supply of pure water from artesian wells, by which the water would always be of one uniform quality and appearance, although he must say that his opinion in favour of the river water was so strong that he should prefer it. Another feature in the report to which he would refer was this—that there were upwards of 4000 houses in the borough that were not supplied with water from the water-works, and he ventured to say that, in nine cases out of ten, they obtained their supply from a very impure source indeed. The Sanitary Committee had never had occasion to obtain an analysis of water derived from any of the wells in the borough without finding that the water was condemned for drinking purposes. It would, therefore, come to this, if the various property owners in the town would not have a proper supply of pure water put on to their houses, the council would have to apply for power to prevent the use at all, for drinking purposes, of water obtained from private wells.

After some further conversation the report was adopted.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been a good deal of uneasiness in the local iron and coal trades during the week just ended. The amount of business done in pig iron has not been very extensive, and such sales as have been effected have been on a decidedly quieter basis. Smelters are, at the same time, likely to reduce their production, rather than submit to any considerable drop in selling prices. Rather more North and Mid Lincolnshire pig is coming into this district just now, but contracts for the quarter just begun are said not to be very heavy. All branches of the coal trade are very quiet, the incipient recovery of the steam coal branch being now seriously impeded by the war panic, and consequent heavy advances in North Sea and other freights. Locomotive coal is being sold at 7s. 6d. to 8s., and good steam coal at from 8s. to 9s. 6d. per ton at the pits of South Yorkshire.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Inquiries for gas coal continue to be made in this district, and consumers are evidently beginning to make preparations for next season's contracts. Of course it is too early, as yet, to offer any definite opinion as to the probable terms on which gas companies will be able to secure their supplies. Indeed, in the best informed quarters, opinions vary very considerably. By some, the realization of good prices is looked forward to; but although, as I have stated in a previous report, cannel and the best descriptions of gas coal may maintain their price, it is not at all improbable that in the commoner sorts of gas coal there will be sellers willing to take low rates to secure contracts. In other classes of round coal, with the exceptions of the common qualities for forge purposes, there has been a moderate amount of business doing, some of the best coal collieries being busy, and

prices are steady at 9s. 6d. to 10s. 6d. per ton for good Arley, 8s. 6d. to 9s. for Pemberton four-feet at the pit mouth; but common coal is weak and irregular. For good burgy there is a fair inquiry, and slack continues stiff in price. Good burgy at the pit is worth 5s. 6d. per ton, and slack is quoted at 3s. 9d. to 4s. 9d., according to quality.

The shipping trade has been a little more active so far as exports are concerned, but for coasting there is still only a poor demand.

The coke trade continues very dull, and although list rates nominally are without change, lower prices are being taken to secure orders.

For iron there has been scarcely any inquiry, but local makers still hold for late rates, as they find it useless to attempt, in the face of the present low price of north country iron, to attempt to meet the quotations now offering in the market. Finished iron is very flat, and the average quotations for delivery into this district are about £6 15s. per ton, and £6 17s. 6d. per ton for Staffordshire bars; light rails are quoted at £6 10s., and heavy ditto at £6 5s. per ton.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

During April the coal trade of the North of England, though there has been a great amount of external excitement, especially within the last eight or ten days, has fluctuated very little. The impending war has made no impression upon prices. It has occasioned a little more demand for the better qualities of steam coal, but beyond that the trade is pretty much where it was in the beginning of the month. As the Baltic has opened, any falling off in the demand for home consumption has been compensated by shipments for that sea. The trade goes on very steadily. Best gas collieries are working tolerably good time, as they have done all the winter. Second-class gas coals are not at all in such a favourable position. The market is over-supplied with them. Prices are low, and they will certainly not alter for the better during the months of the latter spring and the summer.

While there has been no absolute change in the position of the coal trade, the freight market has been considerably affected within the last week by the absolute certainty that there will be war between Russia and Turkey. Rates to Constantinople and Cronstadt have advanced £2 per keel, whereas the freights for corn from Odessa paid to unchartered steamers upon the spot have exactly doubled within the week, and there has been a considerable rise in freights from Sulina, and also from the Russian ports of the Baltic. The heavy advance upon these classes of freights have affected rates generally, though not to any material extent. They are all stiffer, and coasting rates have probably gone up 3d. per ton.

The general manufacturing trade of the North of England is in a very depressed state. There is little or no demand for iron, very limited inquiries for fire-bricks and cement, and the chemical market was dreadfully dull all last week, and prices were lower.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

It has been arranged that the fifth annual meeting of the West of Scotland Association of Gas Managers shall be held at Linlithgow on Thursday next, under the presidency of Mr. Levi Monk, of Lanark. An excellent programme of business has been provided by the committee of the Association. Besides a number of formal business items, there will be the president's address; report by a sub-committee on Messrs. Aitken and Young's patent process of gas manufacture, and remarks on that process as carried out at Hamilton Gas-Works; paper by Mr. D. B. Peebles, on "The Application of Electricity to Peebles's System of Controlling the Action of Gas Governors, and its Adaptation for giving Flash Signals for Lighthouses, Railway Signals, &c.;" discussion on the same; discussion on Mr. Monk's paper on "Twenty-Candle Gas as the National Standard Illuminating Power for Scotland;" and discussions which members may introduce on subjects connected with the manufacture, distribution, or consumption of coal gas.

Mr. Falconer King's report upon the analysis of the gas supplied to the City of Edinburgh on Wednesday, the 4th of April, was submitted to a meeting of the Town Council of Edinburgh, held last Tuesday. It stated that the Edinburgh Company's gas had an illuminating power of 30.7 standard candles; that there was no hydrosulphuric acid present, and that ammonia was distinct. The Leith Company's gas had an illuminating power of 29.5 candles, hydrosulphuric acid being entirely absent, but ammonia present.

The report on the Glasgow gas for the week ending the 14th of April shows that the average illuminating power ranged from 25.57 candles to 27.55 candles, the highest maximum being 28.03 candles at West Street Station (Tradeston works), and the lowest minimum 24.48 at St. George's Cross Testing-Station, where the supply of gas is sent from the Dawsholm works.

In a recent issue of one of the local papers there was published an interesting correspondence between Dr. Whittaker, a resident medical gentleman, and Mr. Ross, the secretary to the Glasgow Corporation Gas Committee, with reference to a rather novel claim set up by the former. It may be remembered that in the early part of last December there was sent into some parts of the city a quantity of gas that was offensive to the consumers, on account of the imperfect manner in which it had been purified. In due course, Dr. Whittaker, like other consumers, received his gas account; but observing that it contained no deduction for the time during which it was bad, he at once returned it to the gas office, and drew attention to the matter. Mr. Ross replied, and remarked upon the very peculiar objection raised by Dr. Whittaker; but he would not consent to make any deduction. The correspondence was continued, and the Doctor at once thought of contesting the point at law; but he was warned that the interest of the corporation was so great that it would be liable to bias legal judgment. I suppose he has paid his account with as good grace as possible under the circumstances. The point raised by Dr. Whittaker is certainly a very novel one, and it would be interesting to know if he has really any ground, in equity or in law, for an abatement.

The magistrates of Edinburgh, at the instigation of one of the Government inspectors, have recently resolved to make arrangements for having the gas-meters tested in one building, instead of five, as at present, so that the process of testing may be properly supervised.

There is some prospect that the Dundee Water Commissioners may arrange to send a supply of water over to Newport, in Fife, *via* the Tay Bridge.

Two large wooden ships have just left the Clyde with cargoes of cast-iron pipes for the Rio de Janeiro Water-Works.

During the past week there has been more firmness in the pig iron market, and prices have advanced; but there is no material improvement to report regarding the local coal trade.

PRESENTATION TO A RETORT FOREMAN.—On Thursday afternoon, April 19, a meeting of a pleasing and interesting nature was held at the Manchester Corporation Gas-Works, Medlock Street, for the purpose of presenting a testimonial to Mr. David Hughes, late retort foreman, on the occasion of his appointment to the position of manager at the Stretford Gas-Works.

Mr. Samuel Barratt, the station manager, in suitable and appropriate terms, on behalf of the workmen, presented Mr. Hughes with a beautiful timepiece, observing that it was the embodiment of a general desire shown by his fellow-workman to give him some expression of their respect and esteem, which he had so deservedly merited by his courtesy during his long service of 30 years, of which time he had been retort foreman for 16 years. He wished him success in his new sphere of labour, and all his friends joined in their good wishes for his future prosperity and happiness. Mr. Hughes, in acknowledging the gift, said that he felt unworthy of so much honour, but proud and gratified that his humble services had given such satisfaction, and were so well appreciated. After a few remarks from Mr. John Merrill, general foreman, and Mr. R. Griffiths, retort foreman, the proceedings were brought to a close with a vote of thanks to the manager.

EXPLOSION AT THE MANCHESTER CORPORATION GAS-WORKS.—Shortly after ten o'clock on Sunday morning last an explosion, attended with serious results, occurred at the Manchester Corporation Gas-Works, Medlock Street, Gaythorn. The particulars given below are obtained from a statement furnished to the police. About half-past nine o'clock the retort foreman discovered that the gas was escaping from a main running east to north of the No. 1 retort-house. With the assistance of other workmen, he set to work to remedy the defect, and, with the view of preventing any casualty, ordered that the charge of gas usually delivered at ten o'clock be delayed—an order which, it is to be presumed, was attended to. Whilst the men were repairing the defect in the main, the gas filled the aperture between the surface of the pipes and the covering, the latter consisting of a layer of bricks, and an upper one of flags, and the gas becoming ignited at the conjunction of the 2-foot main with the 4-foot main, which communicates between the retorts and the exhauster, the result was a terrific explosion. The flags and other material were projected along the whole length of the retort-house, and several of the workmen who were thrown down by the force of the explosion were injured. One man, named White, had his right ankle, left shin, and left thigh fractured; he sustained also a deep wound on the forehead, and a wound at the back. It is not expected that he will recover. Considerable alarm was caused in the neighbourhood by the explosion.—*Manchester Guardian*.

WAVERLEY ASSOCIATION OF GAS MANAGERS.—A correspondent writes: "The thirty-second half-yearly meeting of the above Association was held at Selkirk on Wednesday last, it having been agreed at the last half-yearly meeting at Melrose, and on the kind invitation of Mr. Robson, our esteemed secretary, that we should visit Selkirk, and have an opportunity of inspecting the new works recently erected there from his designs, and under his superintendence, for the supply of gas to that thriving and industrious Royal burgh. The weather being propitious, a numerous muster of members and friends took place at the works, and, guided by Mr. Robson, made a minute examination of the whole establishment. The retort-house came in for a large share of attention, and from its spaciousness, perfect ventilation, and abundant light, was pronounced by all to be a model of what a retort-house ought to be. The purifiers, condensers, new station-meter, and coal sheds (which were well filled even at this season of the year with first-class parrot coal), all came in for a large measure of praise. After congratulating Mr. Robson on the completion of such commodious works, and in having at his command abundant means, whereby he will be enabled to supply the 'Sutors o' Selkirk' with good and pure gas for many years to come, the members proceeded to the 'Fleece' Inn for the transaction of the business of the association. Mr. Thomson, of Dunse, took the chair. Mr. Robson, secretary, read over the accounts, and ended by stating that there was a considerable balance to the credit of the Association, an announcement which was received with a round of applause. Mr. Thomson's term of office having expired, Mr. Smith, of Hawick, was unanimously elected chairman for the ensuing year, and it was arranged that the next half-yearly meeting should take place at Melrose, on the first Wednesday of September next. The retiring chairman made a few neat and appropriate remarks, on the advantages and pleasure to be derived from meetings such as ours, and then called upon members, who had any observations to offer, or questions to ask, on any subject connected with the manufacture of gas, to do so. An animated conversation took place, on the anomalous state of the coal market, as shown by the endeavour of the coal proprietors and agents to raise the price of parrot coal, notwithstanding the great fall which has taken place in the wages of the miners. The seal of the dip-pipe next occupied the attention of the meeting; but, as none of the members had tested any of the plans which have been proposed for lessening it, not much could be made of it. The difficulty of working "stamped meters" was next alluded to, and thoroughly acquiesced in; and the difficulty was stated to arise from the short range of the float, and the low pressure of half an inch, which the Act required the meters to be tested at. The hour for dinner having now arrived, the company marched to the dining-room, where a sumptuous repast was partaken of. After which Mr. Smith, the newly-elected chairman, in a bumper proposed—'Success to the Waverley Association of Gas Managers,' which was enthusiastically responded to. Other toasts followed, and the chairman then proposed—'Success to our youngest brother, the Gas Managers Association of the North of England, expressing a wish that soon we may find it in our power to visit Newcastle, and pay our respects to the members in person.' This having been heartily responded to, the company broke up, and soon the trains were speeding them on their way—some east, some south, some west, some north; but all happy to meet, sorry to part, and wearying to meet again."

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1462.—LIVESLEY, J., Westminster, "Improvements in filters for water and air." April 13, 1877.
- 1470.—LINFORD, C., Leicester, "Improvements connected with gas-engines." April 14, 1877.
- 1480.—SHAW, J., Lockwood, York, "A new or improved union or joint for pipes." April 16, 1877.
- 1503.—MORGAN-BROWN, W., Southampton Buildings, London, "Improvements in duplex pumping-engines." A communication. April 18, 1877.
- 1507.—FELLOWS, G., Hackney, London, "A new and improved method and apparatus for 'after-flushing' water-closets." April 18, 1877.
- 1520.—SCOTT, J., Glasgow, "Improvements in regulating valves for liquid service cisterns, for water-closets, and other purposes." April 19, 1877.
- 1533.—LAKE, W. R., Southampton Buildings, London, "Improved apparatus for lighting and extinguishing gas." A communication. April 19, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 4032.—HENDERSON, R., Timsbury, Somerset, "An improved tap for measuring, regulating, registering, ventilating, and preventing the waste of fluids and liquids." Oct. 18, 1876.
- 4106.—LEONI, S., New North Road, London, "Improvements in the construction of boilers to be heated by gas." Oct. 24, 1876.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

LECTURES ON THE CHEMISTRY OF GAS MANUFACTURE.—The fourth and last lecture delivered by Mr. Vernon Harcourt has been necessarily postponed, but we hope to publish it next week.

C. B.—Ammoniacal liquor extracts-sulphuretted hydrogen better than pure water, but pure water will extract more ammonia than liquor.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 1, 1877.

Circular to Gas Companies.

THE great "sulphur" fight commenced yesterday, when the Bill promoted by the Crystal Palace District Gas Company came under the consideration of the Committee of the House of Commons. It will be remembered that the object of this Bill, as also that of another, promoted by The Gaslight and Coke (Chartered) Company, is to get rid of the obligation, whether imposed by statute or by order of the Gas Referees, to keep the amount of the "sulphur" impurity in gas within certain specified limits. The questions the committee will have to decide may be briefly stated as follows:—(1) Have the Gas Companies at the present moment, at their command, means and processes whereby they can, with regularity and certainty, keep the amount of "sulphur" impurity within any given limit? (2) If there are processes capable of achieving this result, are they such as can be employed without causing annoyance or nuisance? (3) Is the amount of sulphur present in gas as ordinarily purified, (30 to 40 grains per 100 cubic feet), a source of danger to health, or the cause of damage to property? To answer these questions in the negative and the affirmative, a vast amount of talent will be employed. We shall not, of

course, attempt to anticipate the evidence which will be given on either side. Some of it, however, we may say, must be similar to that taken before Sir J. Trollope's committee in 1866, the Bill then under consideration containing the first suggestion of Chemical Referees, who were to have the power of fixing a sulphur maximum according to circumstances. But the inquiry this year will, we have reason to believe, be of a much more extensive and exhaustive character than that of 1866, and a vast amount of information will be communicated, which cannot fail to be of the highest interest to Gas Companies.

There is one point to which we may refer, because it is not a matter of opinion, but of fact. There are now considerably over a hundred gas undertakings, regulated by Special Acts, in the hands of Local Authorities, and it is remarkable that only two of these Acts contain clauses restricting the amount of sulphur to be allowed in the gas. It will be remembered, too, that the Corporation of the City of London and the Metropolitan Board of Works have promoted Bills to acquire or set up gas-works; neither of these authorities, in their Bills, proposed to place themselves under restrictions as to the quantity of sulphur. The immunity claimed by a Corporation or Local Authority may be fairly claimed by a Gas Company; but the Committee must draw their own inferences from the facts and opinions which will be laid before them.

It is hardly necessary for us to say that our opinion respecting auction clauses is unchanged. We continue to regard them as a distinct violation of the established rights of existing shareholders. Nor are we more in love with the sliding scale, which we look on as something like a delusion to shareholders, and as not unlike a mockery to the public, who wish to be supplied with gas at the lowest rate possible. The two, however, taken together, seem to be accepted as a satisfactory settlement of the question of the day, and we need not persist in objections. We may remark, however, that the views put forward by Mr. G. W. Stevenson, in the letter we published last week, are somewhat peculiar. "Auction clauses," he says, "for new capital, a fair standard price for gas, subject to revision from time to time, and a sliding scale of dividend . . . supply the antidote for nearly all the complaints brought against Gas Companies," &c. Now, this idea of a revision of price in connexion with the sliding scale is worth looking into. We know—that is, we feel confident—if ever a Gas Company should pay much more than what we must call the standard dividend, the public would call out for a revision of price. Similarly, if the dividends of a Company fell below the standard, they, too, would demand a revision. But, in either case, what would become of the sliding scale? Surely, revision clauses and the sliding scale are a contradiction in terms.

It will be seen in our "Parliamentary Intelligence" that the Bill of the Ramsgate Local Board, which was thrown out by the committee, has been revived and recommitted, the Gas and Water Companies and the Board having, at the last moment, come to an agreement. We need not speculate on the causes which have brought about the arrangement. Mr. Raikes's new Standing Order may or may not have had something to do with it, and it may have been considered that the proposed Improvement Stock would be much reduced in amount. In any case, as the matter now stands, and subject to the approval of the committee, the Gas Company have agreed to sell, and the Local Board have consented to purchase, the Ramsgate portion of the Isle of Thanet Gas Company for the lump sum of £65,000, the Company still retaining the Margate portion. We do not suppose that any obstacles to the completion of the purchase will arise. The price agreed upon may be considered fair, if not liberal.

The shareholders in the Leicester Gas Company have unanimously approved of the sale of the undertaking to the Corporation on the terms proposed, so that nothing more remains to be done but to carry out the arrangement made.

The Bill of the Dukinfield and Denton Local Boards, containing clauses authorizing the purchase of the gas undertaking of the Company, has passed the committee, and the Ashton-under-Lyne Improvement Bill has also passed, but with the clauses by which the Local Board sought power to make a compulsory purchase of the Ashton-under-Lyne Gas Company struck out. The Gas Company were successful with their Bill, and, as the originators of auction clauses, we must say they deserved to be. If the choice is to lie between compulsory purchase and auction clauses, we shall certainly go in for the latter.

We cannot help thinking that some check has been given to the rising "enterprise," as some may call it, of Corporations, by the recent failure of the Corporation of Birmingham to raise a loan of a million and a half. It was to bear interest at the rate of 3½ per cent., and was offered at 93, but investors failed to

respond to the invitation. When the tenders were opened at the Bank of England, the amount subscribed was found to be utterly insufficient, and the loan is withdrawn for the present. The causes assigned for the failure are various. The price was too high, the interest too low; a delay, for which the Local Government Board are considered responsible, occurred; and, finally, a war panic had supervened. It has not, however, been suggested that the increasing indebtedness of Local Authorities is beginning to excite apprehension in the minds of thoughtful men. Before the tenders were opened, and doubtless before they were written, Mr. Selater-Booth had made his statement on the debts of Municipalities, and Mr. Chamberlain had commented thereon. The figures were ominous. At the close of the past year, the local debts amounted to just about a hundred millions. By the end of the current year it is estimated that they will amount to a hundred and five millions. A debt which increases at the rate of five millions a year cannot but be regarded as of serious import. A million and a half to Birmingham may be considered a trifling affair. The borough is well able to bear the burden, but as the money was to be expended on productive works, no burden would really have been incurred, except, we may say, for a sinking-fund, to pay off the loan, against which Mr. Chamberlain protests. Why, he asks, should loans to Municipalities be paid off? The answer is apparent enough; but to discuss this question in all its relations would lead us too far from the limited field we propose for ourselves. We only notice the failure of the Corporation of Birmingham because it may be followed by important consequences. The Public Works (Loans) Commissioners cannot fail to note this very decided expression of opinion on the part of the investing public, and they may possibly be induced to ask for money something nearer its market value for long investment. When a Corporation like that of Birmingham offer a loan at three-and-a-half per cent. below the market price of Consols, and fail to get the money, on what terms should a dead-and-alive place like Ramsgate obtain a loan?

We have received an abstract of the Gas Accounts of the Corporation of Salford, for the year ending the 30th of June last. The undertaking has been so far successful that it appears to have produced, on the year's working, a net profit of 10s. 7d. Without at all intending it, the Gas Committee have managed the undertaking on the principle we advocate, and we are bound to congratulate the Corporation on the result achieved.

We see, with pleasure, a movement in progress among the shareholders of the Alliance and Dublin Gas Company, to raise funds for a testimonial to their energetic Secretary and Manager, Mr. W. F. Cotton. He well deserves one from the hands of the proprietors. To have lifted that Company from the financial position they occupied, only a few years ago, to a ten-per-cent. paying concern, is no mean achievement. Mr. Cotton's efforts have more than doubled the market value of the shares, and the proprietors can well afford to be liberal.

Writing of personal matters, we may mention here that Mr. R. H. Patterson, the ex-Referee, has lodged an appeal in the House of Lords against the decision of the Lords Justices in the case of *Patterson v. The Gaslight and Coke Company*. This is a final appeal, and will, once and for all, decide the question of the validity of the plaintiff's patent for the purification of gas.

The West of Scotland Association of Gas Managers have just held a very successful Annual Meeting. While waiting for a full report of the proceedings, we may note that one of the most important communications made was the report of a committee appointed to investigate Aitken and Young's process for enriching gas. The committee speak of the process in very high terms, and the general opinion of the meeting was strongly in its favour. The report caused some revulsion of feeling among the members, and the retiring president, Mr. Monk, recalled the opinions he formerly expressed as to the advisability of reducing the standard of illuminating power in Scotland. With the short report before us, we do not appreciate his reasons. Westwood shale is not more likely than cannel to last for ever, and what then? Some other communications of much interest were made—all of which we hope to have the pleasure of laying before our readers—and the Association adjourned, to meet next at Helensburgh, under the presidency of Mr. James M'Gilchrist, of Dumbarton.

We may call the attention of our readers to a very useful publication which has just been issued in the shape of a "Gas and Water Companies Directory."* It contains a list of English undertakings, with the dates of their formation, the names of the chairmen, secretaries, and engineers of the several companies, the capital employed, the population within the limits, and other items of useful information. To Gas and

Water Companies, and all doing, or proposing to do, business with them, this compilation will prove of much value, and we wish the Editor every success in his enterprise.

A conciliatory letter to the Board of Trade, signed by two of the Referees, will, we should hope, go far to allay the irritation caused in the camp of the Chartered Company by the letter to which Mr. Phillips rather fiercely replied. Uniformity in working is, undoubtedly, desirable; and when it is seen that at one station an operation can be conducted without causing a nuisance, while at another a nuisance is produced by a similar operation, the Referees might fairly consider it just ground for comment—a proof of the want of a controlling mind.

The Stretford Gas Company have been the first victims of enforced auction clauses, but a modicum of mercy has been shown to old shareholders. The Company have obtained power to raise £61,000, and of this Mr. Raikes has allowed £11,000 to be allotted to existing holders, while the remaining £50,000 are to be offered by auction.

Water and Sanitary Notes.

In our innocence, we have more than once counselled Local Authorities to rely on the Local Government Board for guidance as to the mode in which they should dispose of their sewage. Our reasons for giving this advice have been various, and need not be recapitulated. Recent proceedings, however, before the Committee on the Improvement Bill of the Bolton Corporation seem to show that consulting the Inspectors of the Local Government Board may be a source of perplexity. The Corporation, we must assume, had more than one scheme before them for the disposal of their sewage, and the usual inquiry was held before Mr. Harrison, one of the Engineering Inspectors, who reported his approval of one of the projects. The Corporation apparently did not coincide with Mr. Harrison's opinion, for they called to their advice, in a private capacity, another Engineering Inspector of the Local Government Board, Major Tulloch, who, the other day, gave evidence against the scheme sanctioned by his colleague. Now, this sort of thing will not do at all. We hope the attention of the House of Commons will be called to the fact, that one Inspector in a private capacity has given evidence against a decision by another Inspector in an official capacity, and that we may get from the President of the Local Government Board some explanation of the duties and responsibilities of these gentlemen. To our minds, private practice on the part of the Inspectors is clearly incompatible with the quasi-judicial functions they are called upon to exercise. We might as well have judges practising at the bar, and criticizing the decisions of their colleagues.

The Select Vestry of Richmond (Surrey) appear to be in a worse mess than ever as regards the supply of water to the town; and the inhabitants, provoked beyond endurance, have resolved on invoking the interposition of the Local Government Board for the redress of their grievances. We hope no conflict of evidence on the part of the Inspectors will ensue. In the absence of the opportunity of personal observation, we have to rely on the reports of contemporaries, and from these it would appear that, in most parts of the town, water is now turned on for a few hours every other day—the result, as stated by one inhabitant, being that he had a supply of about fifty gallons a day for a family of twelve persons. One well on which the Vestry placed some reliance has already given out, and the pumping-engine has been removed to a shallow well, sunk in the sand in the Petersham meadows, the water from which is said to be pumped direct into the mains. The Vestry assert that the water furnished by this well comes from the "hills," in which case it must be surface water; others maintain that the well is filled by percolation from the Thames. In that case, the water is liable to contamination by sewage coming down the river from Kingston and other towns, and also—the intake, as we may call it, being within the tidal area—by sewage brought up by the tide from Barking and Crossness. No wonder the inhabitants protest. It is said that the reservoir has at last been filled; but, if so, it must have been with dirty surface water from the Leg of Mutton pond, which is not, as yet, considered fit for distribution. We do not pretend to be the apologists of the Southwark and Vauxhall Water Company; but we may express a strong opinion, that a greater *fiasco* was never made than this of the Select Vestry of Richmond.

We see, without astonishment, that the Liernur system, so favourably reported on by Mr. Haywood, the Engineer of the City Commissioners of Sewers, is not, at present, to be tried within the City of London, which is considered so completely sewered, that the Commissioners did not feel justified in going to any expense in making a trial of the system. We may, how-

* "The Gas and Water Companies Directory for 1877." Edited by C. W. Hastings. Marcus Ward and Co.

ever, point out that the projected application of the Artizans, &c., Dwellings Act to the neighbourhood of Golden Lane, as elsewhere, offers the opportunity of isolating the sewage of a considerable population at a small expense; while, under efficient engineering advice, recourse may be had to the main sewage conduits, if Captain Liernur's system should prove a failure.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXXIII.

SERVICE-PIPES (continued).

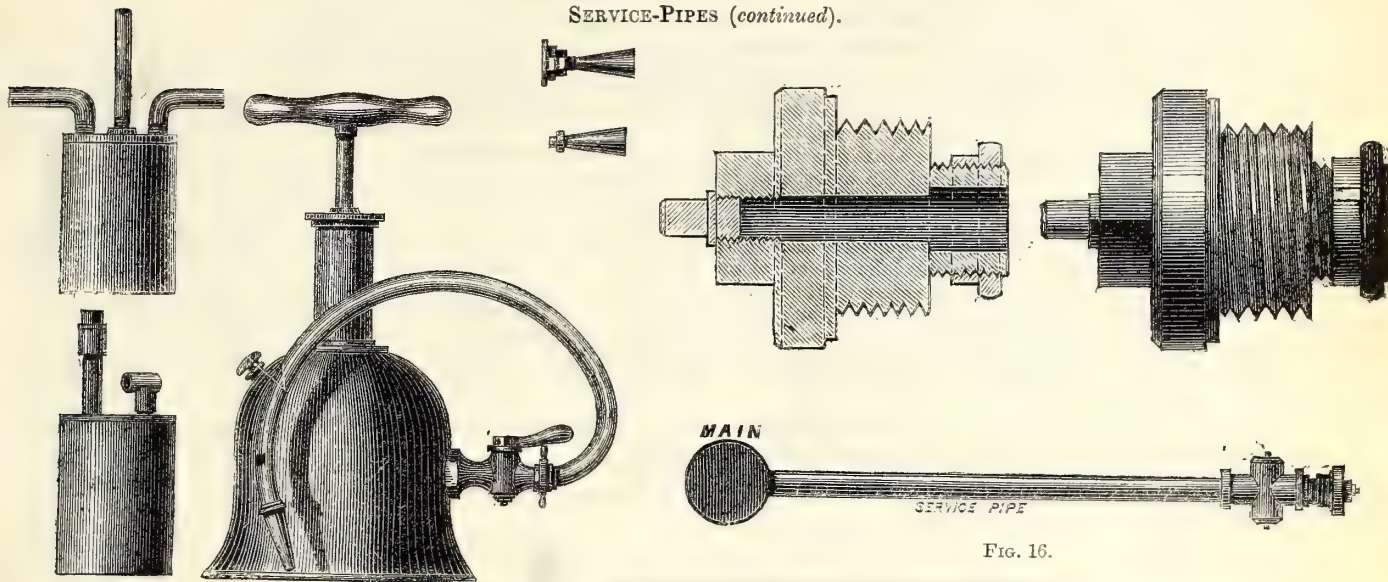


FIG. 14.

FIG. 15.

FIG. 16.

We spoke last week of the great importance of having uniformity of screw-pitch in the manufacture of service-pipes and fittings. The following table will be found useful in connexion with this subject:—

Pitch of the Whitworth Taps and Dies for Gas Tubing.										
Diameter of tube in inches.	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
No. of threads per inch.	28	19	19	14	14	11	11	11	11	11

No gas company, or local authority supplying gas, should allow the control and work of service-laying to pass from the hands of their own responsible servants into those of independent gas-fitters. The work is too important to be so delegated. Every division of a gas manager's duties calls for the display of skill and constant watchfulness, and the exercise of these qualities in this, as in other departments, is fully repaid.

In laying service-pipes, the socket supplied with each length should always be removed, the thread painted with red lead, and the socket replaced.

The holes in mains, for the insertion of the service-pipes, should invariably be drilled, not gouged or cut with a chisel, as is too frequently the rule. In drilling, when this is carefully done, the full thickness of metal is retained all round the hole, and this is true in outline; whereas in cutting with the chisel it is impossible to ensure a mathematically correct circle, or to avoid breaking pieces off the inner edge, thereby reducing the thread-area necessary for making a satisfactory joint.

Before inserting the pipe, a thin back or check nut should be run on the end, along with a galvanized india-rubber or felt washer, and when the service-pipe is screwed up, this nut is gently tightened against the main, its effect being to ensure a better connexion by causing a closer contact of the threaded surfaces than is otherwise attainable. To simply screw the service-pipe into the main is not a satisfactory method of jointing. A brass ferrule, having a shoulder and coupling screw, is used for the same purpose, but this adds to the cost without securing a better result.

It is desirable in service-pipes to have as few joints as practicable, and, therefore, the several lengths should be as long as can be conveniently placed.

The pipe, throughout its length, should be firmly bedded, to avoid settlement, with the risk of drawing the thread, or the danger of producing slack places and the lodgment of water.

The iron service-pipe should be carried through the wall of the building to be supplied, and the part within the wall painted with tar, to prevent oxidation; its end should then be carefully secured with a cap, rendered gas-tight with red-lead paint, until required to be connected with the stopcock and the meter.

It is advisable sometimes to insert a short piece of pipe—say 10 or 12 inches in length—having a long screw or running thread on one of its ends, near to the junction of the service with the main, for convenience in disconnecting the pipe, in case of an enlargement of the mains. This expedient obviates the necessity of much opening of the ground to reach the first joint in the service-pipe.

Wherever practicable, the service-pipe should have a slight rise from the main, and, when this cannot be accomplished, a small cast-iron syphon-pot or receiver, fig. 14, must be placed underneath it at the lowest point, to allow any water to drain into it. This may be either occasionally pumped dry with a hand pump, or a screw-plug may be inserted in the bottom of the vessel, which, on being removed, will permit the water to escape.

Abrupt-angled elbows should be avoided as far as possible, as tend-

ing to produce eddies, and interrupt the even flow of the gas; circular bends are preferable, wherever they can be employed; but bends of every kind should be dispensed with, if a straight length of pipe can be made available for the supply.

Most companies lay the service-pipe from the main, through the wall of the consumer's premises, free of charge, if the distance does not exceed 8 or 12 yards, except in the instance of passing through private property, when a charge is made for the work and materials.

The renewal of service-pipes, when they have been long in use, should be systematically carried out. The cost of doing this will be repaid by the diminished leakage.

Obstructions, such as naphthaline, grit, water, or rust, in service-pipes, are readily driven forward into the main by means of the service-cleanser of Messrs. D. Hulett and Co. This is represented in fig. 15, and consists of a strong bell-shaped vessel, to the top of which a force-pump is fixed. A strong flexible tube, tapered at the end, to fit into the pipe to be cleaned, is attached to a branch in the side, fitted with a stopcock. The pump or syringe is then worked, and the vessel charged with compressed air, and on the stopcock being suddenly opened, the rush of air removes the obstruction.

This service cleanser, at the suggestion of Mr. Mann, has been improved by fixing a bent pipe inside the air-vessel from the cock, by which it is made available for discharging about a gallon of water with great force through the service-pipes into the main.

The cleanser may also be used for the internal fittings of a house, but, in so applying it, care must be taken to remove the meter and the hydraulic slides previous to attaching the apparatus.

Another useful contrivance for the like purpose has been invented by Mr. Goldsmith, shown in fig. 16. It consists of a hollow brass nipple with shoulder, and screwed for attaching to the pipe socket. In using the cleanser, it is filled with ordinary gunpowder, and the opening is covered with a piece of thin paper, kept in position by a brass cap or collar. The cleanser is then screwed into the socket on the service-pipe, a percussion-cap placed on the nipple, which projects from the opposite end, and when exploded by a slight tap from a hammer, the powder is fired, and the obstruction driven out. The mode of application is shown above.

(To be continued.)

DEEP BORING FOR COAL.—At the meeting of the Institution of Civil Engineers on Tuesday, the 24th ult., Mr. G. R. Stephenson, President, in the chair, the first paper read was "On a Deep Boring for Coal at Scarle, Lincolnshire," by Professor Edward Hull, F.R.S. This boring was commenced about four years ago by a local company, to test the presence of coal in the neighbourhood of Lincoln—Mr. J. T. Boot, of Mansfield, being the engineer—and had been carried out by the Diamond Rock Boring Company. The total depth attained was 2030 feet; but as this depth was insufficient for the object in view, it was desirable that the bore-hole should be carried further down. The following formations, with their approximate thicknesses, had been passed through:—

	Depths. Feet.	Thickness. Feet.
Alluvial strata	1 to 10	10
Lower lias clay and limestone	10 „ 75	65
Rhetic beds	75 „ 141	66
New red marl and sandstone	141 „ 1500	1359
Permian beds	1500 „ 1900	400
Carboniferous strata	1900 „ 2030	130

Although the carboniferous strata had been reached, the cores brought up were of so peculiar a character as to leave it uncertain to what portion of the carboniferous formation they belonged; and, as the question of the eastward extension of the Yorkshire coal-field was one on which a boring at this spot was calculated to throw much light, it was important, both in an economic and in a scientific point of view, that it should be continued, until something definite had been determined.

FOULIS'S IMPROVED GAS-GOVERNOR.

Annexed is an engraving of a gas-governor recently patented by Mr. Foulis, M.I.C.E., Engineer of the Glasgow Corporation Gas-Works, the peculiar feature of which is that the outer bell or holder is dispensed with, the only moving part being the cone or valve.

The advantages of this are, that the size of the governor is very much reduced, the outer cone being smaller than an ordinary water-trap for the same size of pipe; the cost of construction is reduced to one-fourth, and, from the fewness and lightness of the moving parts, and consequent reduction of friction, the governor is exceedingly sensitive in its action.

The construction will be readily understood from the drawing. The outer case, A A, is of cast iron, closed at both top and bottom, and having a valve-seat, D D, cast in; C is the outlet, and B the inlet pipe. The cone or valve, E, is formed of two inverted cones, having a cylindrical prolongation, with the necessary float. The object of making the cone double is to neutralize the effect of the inlet pressure; or, in other words, to prevent the inlet pressure from having any influence on the action of the governor. In order further to attain this object, the triangular space formed by the two cones is enclosed by a continuation of the cylindrical portion of the valve. In this, slits are cut of sufficient area, and so adjusted that when the valve is full open the area of the portion of the slits below the valve-seat is rather greater than that above it, thus establishing an uniform pressure in the triangular space, and so equalizing the pressure on the two conical surfaces.

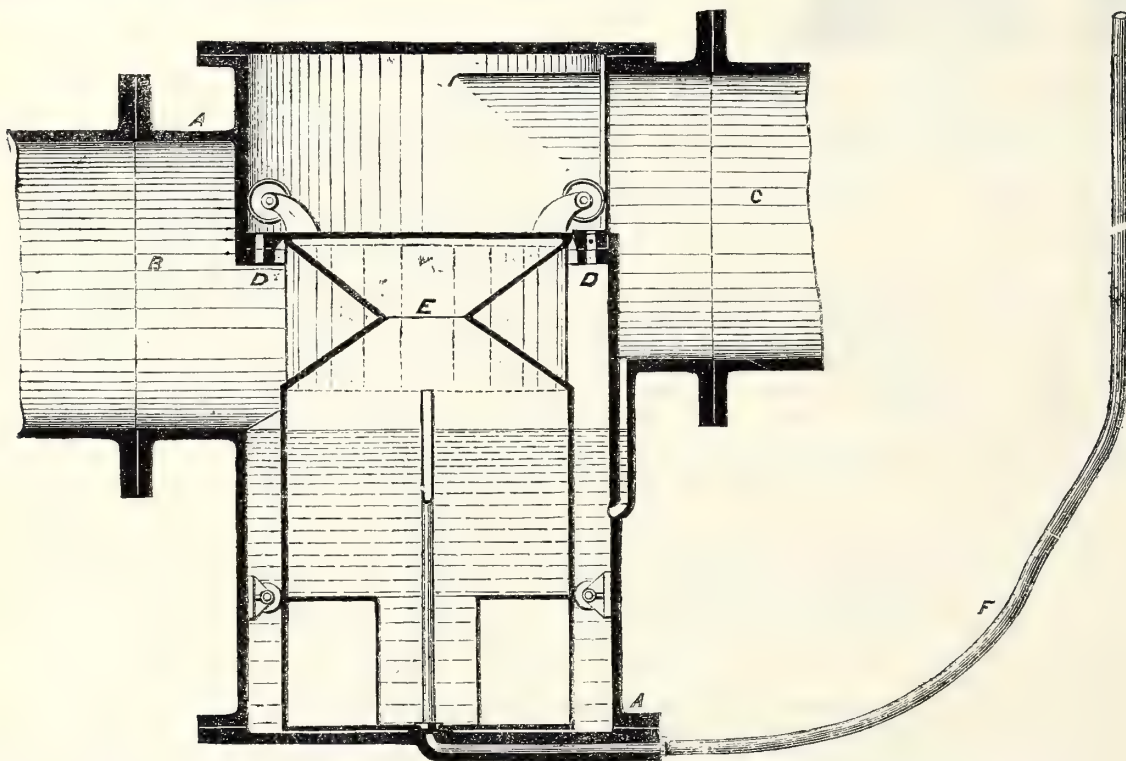
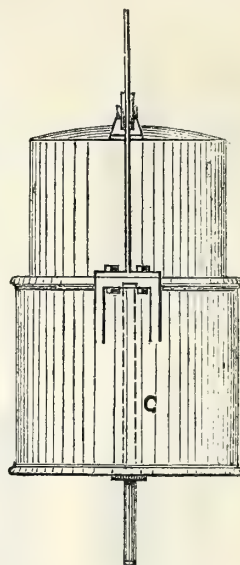
A small pipe, F, is led in at the bottom of the outer case into the interior of the valve. The valve is guided by three pulleys fixed on its top, and three pulleys fixed to the outer case at some distance from the bottom. By this arrangement the valve may be withdrawn on removal of the top cover.

The action of the governor is as follows:—Suppose that the weight of the valve is just balanced by the float, the valve will then be entirely under the influence of (a) the pressure in the small pipe, acting on the interior of the top, and (b) the outlet pressure acting on the exterior top. These two pressures must balance each other. Consequently, by altering the pressure in the pipe, F, the pressure in the outlet will be altered to a similar extent. The pipe, F, may be carried to any distance, and the pressure regulated by any means.

The method adopted of regulating the pressure in the governors already made, is to lead the pipe into a small vessel or holder, G, capable of being weighted at pleasure. This vessel and the interior of the valve are filled with air in preference to gas.

By loading the vessel to any pressure, a corresponding pressure will be maintained on the outlet of the governor, under varying conditions of inlet-pressure and outlet consumption.

The governor may be placed anywhere underground in the line of pipe, like an ordinary water-trap, the regulating vessel being placed at any distance in a room or office; or for street purposes it may be placed in a small chamber formed at the foot of a lamp-post.



Two of these governors (one 6-inch and one 18-inch) are now in constant use, giving most satisfactory results.

PARIS GAS COMPANY.

In another part of this JOURNAL we publish our translation of the report and statement of accounts of the Paris Gas Company, which will not be without features of interest to some of our readers.

Though given in great detail, the accounts do not furnish that reliable index to the interior working of the company which we are accustomed to in matters relating to our own metropolitan undertakings. For instance, all information as to the quantity of coal used and the gas produced and sold per ton is omitted, and, consequently, comparison on these essential points is prevented. Notwithstanding this, there are many items in the accounts which are not unworthy of comment, and to these we shall briefly refer.

Taking the capital account first, it is stated that the amount expended under this head to Dec. 31, 1875, was £6,120,451, to which must be added the amount expended on purchase of land and buildings, and in extension of works during the year 1876—viz., £360,524, bringing the total capital expenditure on Dec. 31, 1876, to £6,480,975, or 19s. 4½d. per 1000 cubic feet of gas produced; £3,360,000 of this is share, and the rest loan capital.

The quantity of gas produced last year was 189,209,789 cubic metres (about 6,679,105,000 cubic feet), being rather more than 7 per cent. in excess of the preceding year, an exceptionally mild winter preventing a still larger increase.

The receipts for gas figure in the accounts for the very respectable sum of £1,851,365, and this amount seems exceedingly high; but the price of gas in Paris, consequent upon the terms of the company's concession, sufficiently explains it.

The share of profits accruing to the city this year amounts to no less than £332,000, and the consumers are taxed to this amount for the benefit of the whole community. But since it prevents those ever-recurring conflicts between the Municipality and the company, to which we are so accustomed on this side the Channel, the investment is not perhaps such a bad one for the company as might at first sight appear, especially as they are saved all the expenses incidental to referees and sulphur questions, to say nothing of anxiety and trouble inseparable therefrom.

It is rather surprising to learn that the cost of production has increased during the past year, our experience at home being generally in a contrary direction; but the report states that part of this increased cost is due to a rise in the price of labour, and part to old coal contracts, some of which are still unexpired.

In spite of the mild winter, only a slight falling off in the revenue from gas coke, as distinguished from oven coke, is noticeable. The policy of the company, in making and selling, at cost price, heating apparatus specially constructed to burn coke, is much to be commended; 43,032 of these apparatus have been turned out from the company's workshops, and must have materially assisted them in disposing of what is, at the present moment, a comparative drug in this country. No effort in this direction seems to have been attempted here, but, if the present state of trade continues—and the most sanguine see few signs of improvement—some fresh markets will have to be found for this residual.

Tar and liquor in France, as at home, have become an important source of revenue, and in the case of the Paris Company, who work

their own, produced £140,000* in 1876, as against £134,000 in 1875. The interests of the officers and servants of the company have not been neglected, as will be seen by a reference to the accounts of the Sick and Pension Funds; but space will not permit more than a passing reference to them here.

Briefly summarized, the revenue of the company for the past year amounted to £2,739,516, and the expenses to £1,597,213, leaving a balance of profit on the year's working of £1,142,303, which, with a balance brought forward, is raised to £1,160,000. Of this amount £496,000 is reserved for dividend on the share capital, according to the terms of the concession, before the city participate in the profits; the balance, after this deduction is made, has to be shared equally between the city and the shareholders of the company, each taking, in the present instance, £332,000—no mean contribution to the magnificent revenues of the City of Paris.

The dividend for the past year, even after payment of this very substantial sum, is the largest the company have ever been able to declare—viz., 62 frs., being 2 frs. more than last year—and speaks well for all concerned in earning it, whatever differences of opinion there may be as to the policy of dividing so large a sum.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

MR. VERNON HARCOURT ON SULPHUR PURIFICATION.

SIR,—If some statements which have recently appeared in your columns are really true, I must cease from the vain attempt to acquire knowledge and experience.

During the last seven years I have been constantly at work at some practical problem or other in gas manufacture. I have visited a score of gas-works, and in some I have spent weeks or months of almost constant attendance. I have held inquiries into the management of provincial gas-works, have arbitrated on the price of gas for public lighting, and have reported upon the arrangements to be adopted in introducing the average meter system. And, after all, Mr. Phillips writes that I have not, nor has either of my colleagues, that "practical knowledge and experience in the manufacture and supply of gas," which a Gas Referee ought to have, and which have been attained by his directors.

Still I might hope that, in "laboratory experiments," 20 years of constant practice had made me fairly proficient. But this hope also is denied me by the contemptuous criticisms of Mr. Patterson, which you published in your last number.

The apparatus and experiments on which Mr. Patterson comments are described in recent numbers of your JOURNAL (pp. 503, 504, and 595), to which I must ask any of your readers who are interested in the matter to refer, since I cannot recognize in Mr. Patterson's account either my experiments or my conclusions. The particular error which has filled Mr. Patterson with astonishment is, that I have applied the solutions in question to the current of gas in an apparatus of which I give the following description:—

"I have set up here partly in illustration [of the modes of washing ammonia out of gas], partly because I venture to think the particular form a good one for the purpose, a small washer which I have made out of a piece of glass tubing. An obtuse double bend has been made in the tube at intervals of four inches, so that it consists of several portions which are parallel, and are now placed horizontally, connected by shorter portions which are inclined. . . . The gas does not bubble through the water, but only passes over its surface, and perhaps, therefore, the apparatus does not so much resemble a washer as a Coffey's still, with its shelves spread out horizontally."

Here was the error. "Let Mr. Harcourt pass the gas through these two liquid alkaline sulphides, and then he will find that they do absorb the 'sulphur,' and that most efficiently."

What apparatus did Mr. Patterson himself employ—a washer in which the gas bubbled through the liquid, or a scrubber which, as Mr. Patterson says in his letter, "is constructed precisely on this principle of passing the gas, not through water, but over an extensive watery surface"? Here is his answer:

"I used these solutions in a small tin scrubber, about four feet high, filled sometimes with coke and sometimes with pumice, through which the gas, as supplied to the public, was passed, after being freed from its CO₂."

As I have stated in the lecture from which I have quoted, I do not think it makes much difference whether the gas passes through the washing liquid or close over its surface. The important factors are extent of surface and rate of transmission; but it was a relief to find that Mr. Patterson, who is so keenly alive to the absurdity of attempting to remove bisulphide of carbon "by merely passing the gas over the surface of the purifying material," should himself "have conducted such experiments in such a manner."

The difference which is really astonishing is the difference in our results. The matter is of some importance at the present time. My experiments were made in the hope of finding some liquid which might be available as a substitute for sulphide of calcium. I tried those which had been recommended, and others which suggested themselves to me as worth a trial, and I was disappointed that my results were negative. If Mr. Patterson is willing to furnish me with an exact description of the manner in which his experiments were made, I will gladly repeat them, and, with your leave, communicate the results to your readers.

Mr. Patterson asks, "Would any gas engineer (or, one would have thought, any chemist) ever dream of purifying gas from H₂S by merely passing it over the surface of oxide of iron, or of extracting the CO₂ by passing the gas over the surface of lime?"

I must confess to the belief that both of these are perfectly practicable; and I hope that some gas manager who is troubled with the pressure thrown by his purifiers will try the experiment. I showed at the Society of Arts the almost complete removal of sulphuretted hydrogen on passing

* This amount does not include the sum of £12,240 for ammoniacal liquor, sold as such, and not converted into salts.

foul gas over the surface of ammonia in the little apparatus I have described.

Since reading Mr. Patterson's letter, I have made the experiment he suggests of substituting for a solution of the alkaline sulphides an equal bulk, similarly disposed, of solid sulphide of calcium. A thin layer of this substance was spread along the bottom of the tube described above, leaving the upper half of the tube, throughout its length, clear for the passage of gas, which was sent through at the same rate as in my previous experiments with the liquid reagents. Instead of the sulphide of calcium having no effect when the gas passed over it, the amount of sulphur was reduced from 32 to 13 grains in 100 cubic feet of gas.

In the lecture on which Mr. Patterson comments, I stated: "If coal gas or hydrogen, which has been charged with bisulphide of carbon, passes through a not excessive quantity of sulphide of calcium, the bisulphide of carbon is wholly removed." This I believe to be true; but coal gas thus purified still contains sulphur in other forms, amounting to not less than 7 or 8 grains in 100 cubic feet. Contact with heated surfaces also destroys the bisulphide of carbon in gas, but leaves the other sulphur compounds unaffected. Porous substances, such as charcoal, are the only agents which I have found capable of completely purifying gas from sulphur; and these impair the illuminating power. Analyses may err as well as purifying processes be imperfect. I doubt whether the amount of sulphur in ordinary coal gas can be reduced, by the most liberal and careful application of sulphide of calcium, below about 7 grains in 100 cubic feet. Accordingly, I cannot admit Mr. Patterson's account of my conclusion: "Mr. Harcourt, in his lecture, states that he believes the 'sulphur' can be wholly extracted by sulphide of calcium."

One other statement I must correct in justice to my colleagues. "No less than £3000 has been spent by the present Referees in experiments to discover some other means of extracting the sulphur." The experiment upon the effect of heating gas, which is stated to have cost the above-named sum, was made by Dr. Siemens and myself. My colleagues have no responsibility in the matter.

Having referred to this experiment, I wish to explain one or two points in answer to Mr. Phillips's recent description of it, which I think unfair. The actual cost of the experiment was £1030, without deducting the value of pipes, valves, purifying-boxes, and iron plates, which remained when the apparatus was dismantled. The remaining £2000, with which the experiment is debited, is the estimated difference between the cost of making gas for about four months at Horseferry Road, and the cost of making it at Beckton. I know of no reason why the experiment should have been made at Horseferry Road rather than at Beckton, or any other place where gas-making is not suspended in the summer. I was unaware of this main item of expenditure till after the conclusion of the experiment, and I disclaim all responsibility for it.

The superintendent of the works, in a final report to his directors, dated June 24, 1875, states:

"The experiments commenced on Aug. 5, 1874, and were continued intermittently until the 26th of October. They began again on the 15th of March of this year, and have gone on with some variation up to the present time. The actual time the heater was under fire was 48 days in 1874, and 68 days in 1875, making a total of 116 days."

Why does Mr. Phillips now state that the experiment "lasted during a period of nearly 18 months"?

The experimental apparatus was not set up where it could be permanently used for the purification of gas, and the only result aimed at was knowledge—first, as to the practicability of reducing the amount of sulphur in gas by heating it, without affecting its illuminating power; and, secondly, as to the best mode of doing this. The first point was completely established, and much light was thrown upon the second. The actual working of the apparatus was, in some respects, unsatisfactory; but I believe that its defects could be avoided in constructing a similar apparatus for permanent use. Whether any reduction of sulphur, beyond the removal of sulphuretted hydrogen, shall for the future be required, is now *sub judice*. If it is required, I see no reason to doubt that the heating process might be used successfully, and is capable of accomplishing as complete a purification of gas as can be effected by lime, continuously, and without any risk of nuisance.

Oxford, April 28, 1877.

A. VERNON HARCOURT.

QUANTITY OF BRICKWORK IN RETORT-SETTINGS.

"Dans une controverse les investives ne provient rien, sinon le manque de savoir-vivre de celui qui les emploie."

SIR,—In the JOURNAL of the 6th of February last, Mr. E. S. Cathels puts forth a demonstration of the correctness of his "magazine-of-heat theory," which may be, in his opinion, "the highest degree of evidence;" but he will permit me, I hope, not to share this opinion, and to doubt whether the examples he alleges in support of the "reservoir-of-heat theory" are relevant to the subject.

1. I never objected to chequered walls, but only to the opinion that they should serve any other end than to support the retorts.

2. If the objection to the accumulation of a medium between the shell of the boiler and the contained water were only a question of danger in burning the plates over the furnace, and not also a question of fuel (as Mr. Cathels opines), one might cover the outer side of the boiler-plates with fire-bricks, whereby the boiler would be more durable, and the danger of burning the plates would be avoided. But does Mr. Cathels believe that, by doing so, the fuel account would be equal or even less than if the boiler were not covered? I am sure that it would be larger.

3. It may be that filling-up blocks have a beneficial effect in steam-boilers; but as these blocks are placed in the boiler, clear from the bottom and sides, and as the chequered walls in retort-ovens are put on the outer side of the retort, thus producing a medium between the heat of the furnace and the coals within the retort, the reference to the rudimentary "Treatise on Steam-Boilers" is irrelevant to the subject.

4. The kakelung argument is, in my opinion, rather a proof against the "magazine-of-heat theory." Mr. Cathels says that only two hours after the fire is made the kakelung begins to get warm on the outside. That is a proof that the conducting property of the material is very small.

When, by some reason, a part of the material was suddenly cooled (as happens with the retorts by a new charge), it will last a long time before the outside will be hot again. That there will not be much difference in the temperature of the stove or the room ten hours after, is a proof that the kake lung has delivered but little heat to the surrounding air. Now, for a room, you may content yourself with a temperate, and at all times equal, heat (though it must be very inconvenient on a winter morning to wait two hours before you can warm yourself); but in a retort-furnace you want most heat directly after a new charge, when the inner part of the retort has been cooled by the same. The sooner the heat in the inner part of the retort is restored the better, and you cannot wait two hours as for the heat of the kake lung. Moreover, the closing of the flue after the wood has burned up is a reason why the kake lung argument is irrelevant to the subject.

5. I agree with Mr. Cathels as to the inequality of the duties which the furnace has to perform during the time the charge is "burning off," but I deny that the transverse walls act as compensating arrangements, and can retain the surplus heat when there is an excess, and restore it when there is a deficiency. With continuous firing, the heat in the interior of the retorts will always be lowest at the beginning of the process of distillation, when there is most need for it—the retort being cooled by the fresh charge—and highest at the end of the process, when there is the less need for it. How the "magazine-of-heat" defenders will prevent this I do not understand; and if they could prevent it they *should* not, as to the high temperature at the end of the process, for then they would have insufficient heat for the fresh charge, which requires the highest temperature.

Mr. Thomas Newbigger, in the JOURNAL of the 20th of February, doubts whether a retort of thin platinum would give good results. As to that I agree with him. The great expense is not the only reason to dissuade one from the experiment, the action of the ashes on the platinum forming silicium platinum, which would render the retorts very friable; but, theoretically, the material which best conducts heat would be most suitable for distillation. That iron retorts have given no saving of fuel has another reason than Mr. Newbigger will make us believe. The best temperature at which the distillation of coal proceeds being the cherry red, the temperature of the retort must be much above the cherry red in order to expose the mass of the coal in the retort to the required heat. This high temperature cannot be attained with iron retorts, because they would not resist, as fire-clay retorts do. Therefore, the process of distillation with iron retorts lasts longer, and less gas is produced. The greater duration of the process of distillation, because of the low temperature in iron retorts, is the reason why the use of these retorts gives no saving of fuel, as the conductivity of the material would lead us to expect. Notwithstanding iron retorts may be and are employed, where by some reason the heat produced for distillation cannot exceed a certain degree, which would be insufficient for clay retorts; as in Lowe's and Croll's arrangement of retort-settings, and in retort-settings which are heated with the gases of melt-kilns.

Such settings are a proof that a good conductor of heat traduces the heat more readily to the inner part of the retort, and that, but for the question of durability and fusibility of the material at the required and most advantageous heat for distillation, iron would be a better material than fire-clay.

The motto of this letter is addressed to Mr. Cathels, who surprised me by the invectives he accumulated against foreigners in the JOURNAL of the 27th of February, though I fear that the sense of this motto will be as hazy to his understanding as the wisdom of the proverb so frequently laid under contribution by him in his letter seems still to be; otherwise he would have apprehended what a bad compliment he pays to the Americans, and particularly to his friends, by the manner in which he writes. With regard to the proverb he quotes, I may remark that Mr. Cathels judges of the good manners of a man by the way he dresses. Now it may be Mr. Cathels's own manners, from this point of view, are irreproachable, but, having no photograph of that gentleman's pantaloons and hats, I have no proof that he has any good manners at all.

I am one of the foreigners who are so shamefully nicknamed by Mr. Cathels, and I am proud to declare that I do not apply to the tailor or the cook for good manners, as Mr. Cathels does. The mode in which Mr. Cathels makes his appearance as a champion for good manners is quite as ridiculous as that by which Russia takes the defence of humanity in Turkey.

As there are in this letter some communications personally directed to Mr. Cathels, I do not sign it, as my previous ones, with the initials of my name only, but fully.

Rotterdam, April 18, 1877.

C. T. SALOMONS.

SUGGESTED EXHIBITION OF GAS APPARATUS AT BRISTOL.

SIR,—The exhibition of gas apparatus at South Shields was certainly a step in the right direction, and to the promoters of it is due the credit of having originated a movement which must lead to the more extensive application of gas to the necessities of every-day life. I cannot help expressing regret that, owing to the distance and time of year, many like the writer were unable to avail themselves of the advantage of personal inspection of the interesting display. That such an opportunity may not be altogether lost, I venture to make a suggestion. As you are aware, the meeting of the British Association of Gas Managers will be held this year in Bristol. Why not the occasion be availed of, and let us have an exhibition for the West of England, the same as the South Shields one was for the North of England. Believe me, it would in no small way contribute to the importance of the meeting, and it would afford a means to the members of making some valuable notes.

I am certain that the highly respected engineer of the Bristol Gas Company, Mr. Fiddes, would give it his hearty support, and the Colston Hall is not second to any in the kingdom for such a display. T.

UCKFIELD GAS COMPANY.—The report of the directors for the past year recommends that a dividend at the rate of 8 per cent. on the £2000 capital, amounting to £160, be declared, leaving a surplus of £49 5s. 7½d. to be carried forward towards the further reduction of the debenture debt at the earliest opportunity.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, APRIL 23, 1877.

The Middlesbrough Corporation, the Rotherham Corporation, and the Warrington Corporation Gas Bills were read a second time and committed. The Falmouth Water and the London Corporation Bills were read the third time and passed.

TUESDAY, APRIL 24.

The Falmouth Water and the London Corporation Bills received the Royal Assent.

The Chairman of Committees informed the House that the opposition to the East Worcestershire Water Bill was withdrawn.

The Dundee Gas Bill was read a second time and committed.

The Londonderry Gas Bill was referred to a Select Committee, consisting of Lord Monteagle (chairman), Earl Manvers, Lord Delamere, Lord St. Leonards, and Lord Kenry; to meet on Friday, April 27.

THURSDAY, APRIL 26.

The Select Committee on the Londonderry Gas Bill was altered by the appointment of Lord Sherborne in place of Lord St. Leonards.

FRIDAY, APRIL 27.

The Examiners reported that the further Standing Orders applicable to the Longton Corporation Bill have been complied with.

The Kent Water and Stamford Water Bills, brought from the Commons, were read the first time, and referred to the Examiners.

HOUSE OF COMMONS.

MONDAY, APRIL 23, 1877.

The Kent Water and the Stamford Water Bills, as amended, were considered.

A petition in favour of the new Standing Order, "Gas Companies Additional Capital," was presented from Hastings.

The petition of John Giffard Riddell against the Newcastle and Gateshead Water Bill was withdrawn.

TUESDAY, APRIL 24.

The Blackburn Borough Gas, Water, and Extension Bill (Lords) was read the first time, and referred to the Examiners.

The following Bills were reported:—Perth Water; Alliance and Dublin Consumers Gas (Bray Supply); Carnforth District Water; Glasgow Corporation Water.

The petitions were withdrawn of the Great Western Railway Company against the Bridgwater (Corporation) Water Bill; of the Midland Railway Company against the Bristol District Water Bill; of the Hyde Gas Company against the Dukinfield and Denton Local Boards of Health Bill; and of the London and South-Western Railway Company against the Sunningdale District Water Bill.

WEDNESDAY, APRIL 25.

On the motion of Mr. ASHETON, it was ordered—"That the Ramsgate Local Board Bill be recommitted to the former committee."

The Louth Gas and Coatbridge Gas Bills were reported.

The petition of the Staines, Wokingham, and Woking Railway Company against the Sunningdale District Water Bill was withdrawn.

STRETTFORD GAS BILL.

Mr. RAIKES reported from the committee on the Stretford Gas Bill—"That the Bill empowers the company to enlarge and extend their gas-works, and to authorize them to raise £61,000 additional capital. The committee have divided the proposed additional capital into two parts, one of £11,000, or A shares of £10 each, the other of £50,000 B shares, also of £10 each. They have authorized the issue of the A shares of the company without restriction, in consideration of the smallness of the dividend which was authorized by the former Act to be paid on the larger portion of the original shares of the company. The B shares are to be sold by auction or tender in pursuance of the Standing Orders of the House, and they have inserted clauses in the Bill to that effect."

He further reported from the committee—"That they had examined the allegations of the Bill, and found the same to be true, and had gone through the Bill, and had made amendments thereunto."

THURSDAY, APRIL 26.

The Kent Water and Stamford Water Bills were read the third time and passed.

The Ashton-under-Lyne Gas Bill was reported.

Petitions were presented in favour of the Hanley Corporation Gas Bill from Inhabitants and consumers of gas in Hanley; and in favour of the Newcastle-under-Lyme Borough Extension and Improvement Bill from (1) Trustees of Newcastle-under-Lyme Burgesses Lands, (2) Owners, &c., in Newcastle-under-Lyme, (3) Owners, &c., and ratepayers within the district proposed to be added to the borough of Newcastle-under-Lyme.

FRIDAY, APRIL 27.

The Tudhoe and Sunderland Bridge Gas Bill, as amended, was considered.

On the motion of Sir CHARLES FORSTER, it was ordered that the minutes of the evidence taken before the committee on the British Gas Company (Norwich Station) Bill, in Session 1875, be referred to the committee on the Hanley Corporation Gas Bill.

The following Bills were reported:—Ashton-under-Lyne Improvement; Newcastle and Gateshead Water; Newport (Monmouthshire) Gas; North Cheshire Water.

A petition against alteration in the Blackburn Borough Gas, Water, and Extension Bill (Lords) was presented from Owners, &c., of property in Livesey.

HOUSE OF COMMONS COMMITTEE.

FRIDAY, MARCH 23.

(Before Mr. ASHETON, Chairman; Messrs. SMITH, BELL, and DUNDAS; Mr. BONHAM-CARTER, Referee.)

RAMSGATE LOCAL BOARD BILL.

(Continued from page 630.)

Mr. W. A. Valon, examined by Mr. MICHAEL.

I have been manager of the Ramsgate Gas-Works for seven years, and before that time was engaged at the London Gas Company and Commercial Gas Company's works for about 16 years. The minimum day pressure of gas at Ramsgate is 10-10ths, and the maximum pressure 20-10ths. We set the governor at the day pressure (10-10ths) at midnight, and then it is not touched again until an hour and a quarter before sunset the next day, when it is raised to 13-10ths. Three quarters of an hour after that it is raised to 16-10ths, and a quarter of an hour before sunset

to 20-10ths. The pressure is continued till the shops begin to close, at about eight o'clock at night, and then it is reduced to 17-10ths; at nine o'clock to 15-10ths; at ten o'clock to 13-10ths; at eleven o'clock to 11-10ths; and at twelve o'clock to 10-10ths. The pressure is taken every week at various parts of the town to ascertain that the mains are clear, and that there is no stoppage. [Witness produced the book in which they registered the pressures.] The works are midway between the levels of the town, and we are obliged to bring the gas down to the lowest point by a trunk main before commencing to distribute it. We use Newcastle coal, and the illuminating power is kept as nearly to a standard of 14 candles as possible. It is tested every day with a Bunsen photometer, but we have also a jet photometer, which enables us to see inferentially the state of the gas during manufacture. We keep a constant tell-tale, by which it can be seen whether any sulphuretted hydrogen is allowed to go into the gas after it has passed the purifier. A piece of moistened acetate of lead paper is kept under a glass globe, through which the gas passes, and the presence of sulphuretted hydrogen is at once detected. The ammoniacal liquor is sold, and at the request of the contractor we keep it up to the high standard of 16 ounces to the gallon, because of the great cost of carriage. We are obliged to scrub and wash the gas very much to get so high a standard. We strive to keep up a high standard, both for illuminating power and purity. About the 1st of last December there was a little sulphuretted hydrogen in the gas, but it was the result of an accident, and was remedied as soon as found out, and I do not think it has occurred since. I have constantly kept up the illuminating power to 14 candles or thereabouts, and, as far as possible, kept it clear of free ammonia. As a matter of experiment, I have used tests for the purpose of ascertaining the presence of sulphur compounds, and have found them, on an average, to be from 30 to 32 grains in 100 cubic feet.

Cross-examined by Mr. BIDDER: We did not keep a book recording the pressures before Jan. 30, 1874, because up to that time we had been making considerable alterations in the street-mains, and took the pressure from time to time, to know what sized mains to lay down. It was at my suggestion that the new system of recording pressure was initiated in 1874. I do not recollect that it was about that time that the local board began to agitate the question of gas supply. The book recording the tests for sulphuretted hydrogen was commenced on April 24, 1876. That was after the proceedings in Parliament last year. The tests were taken quite as carefully before that date, but were not recorded in a book. The pressures shown in the pressure-book were taken at different points in the district. We have not lately had many complaints of want of pressure. The very fact that we have been improving our mains all over the town shows that there have been complaints from time to time, and that they have been attended to. I think it must be very nearly two years ago since we had anything like serious complaints. Those complaints came from Pegwell and St. Lawrence, and we have been carrying out works to remedy them. We did a great deal more in 1871, 1872, and 1873, in the way of extension, than we have done during the last two years. The pressure recorded in the book may be taken as representing the pressure the customer gets.

Mr. BIDDER read an extract from the book, under the date of Oct. 15, 1875: "We have received from time to time great complaints from the end of the district at Pegwell Bay. I thought for some time the defect or deficiency was caused by bad fittings, or some obstruction in the supply-main; but I now find, on further examination, that the gas does not reach there, as the following pressures, taken last Friday, during full consumption, will show." Then follows a list of pressures, beginning with the Market Place, 16-10ths; Bromley Hill, 12-10ths; West Cliff Terrace, 10-10ths; Hillier's field, 8-10ths; at another place, 5-10ths; and at Pegwell, 3-10ths.

Witness said that the mains at Pegwell and St. Lawrence were then very weak, but they had been remedied since.

Mr. BIDDER questioned the witness with respect to a letter which was in the book upon the previous day, but was not there then. It was, he said, from Mr. Curling to witness, telling him to be careful and be upon his best behaviour on account of the agitation and application to Parliament by the local board.

Mr. MICHAEL said that the letter was private and confidential, and Mr. Bidder has no right to have read it.

Mr. BIDDER said it was in a book which was handed to him, and he denied that he had acted improperly in reading it. He would, if necessary, give evidence as to its contents.

Witness: I do not think Mr. Curling gave any reason, except that he said, "Let us be careful this year, as we are on our trial now."

[Witness was cross-examined at some length respecting certain entries in the book recording the illuminating power, from which it appeared that upon some occasions the illuminating power of the gas fell below 14 candles, and was once or twice as low as 12½ candles. In explanation he said it was impossible at all times to keep the gas up to one standard, but he always endeavoured to do so as far as possible.]

Mr. BIDDER read an extract from the manager's report-book, dated Jan. 1, 1877, in which the witness called the attention of the board to the necessity of some immediate steps being taken to provide additional gasholder room for the next winter, and which stated that had the town been supplied with as much gas as it could have taken during the Christmas week, the supply would have given out on the Friday night. (To witness: What do you mean by the latter statement?)

Witness: I mean that in Christmas week, as a rule, the consumers would always take a great deal more than they ought to take, if we would let them.

Mr. BIDDER: You acted as a prudent captain of a ship on a long voyage—you put the consumers on short commons?

Witness: No; I did not put them on short commons, but I gave what I thought was sufficient.

Mr. BIDDER: What is the process of putting a town on short rations? Do you diminish the pressure, or how?

Witness: When we are short of gas, we take the pressure off as soon as we find the gas is coming back upon us.

Mr. BIDDER: Then the people must go to bed, or light candles?

Witness: There is nothing of that sort; you are only saving the gas in your gasholder that you might otherwise get paid for. [Witness was further cross-examined with reference to various complaints recorded in the company's books as having been made by consumers, and which he explained had been remedied by laying down larger mains, &c.] With reference to the coke, we sell it in the town as far as we can. It is retailed at the works at 12s. per chaldron, but coal merchants are supplied at a discount of 2s. per chaldron, and if they take 25 chaldrons we sell it at 9s. per chaldron. The coke which is not sold in Ramsgate is got rid of by outside contracts. We are sending some now to Faversham and other places, at 7s. per chaldron, put upon the rail. The company have taken all the circumstances into consideration, and we cannot see that by reducing the price in Ramsgate, we should increase the sale.

Re-examined by Mr. MICHAEL: The company do not put down a 12-inch main merely to supply half-a-dozen customers. When a small main is not sufficient to meet the consumption, we take it up and lay down a larger one. The company are taking steps to have the increased storage power by Christmas time this year.

By Mr. BONHAM-CARTER: The company have no control over the fittings; the service-pipe even is paid for by the consumer; but that practice is very exceptional.

By the COMMITTEE: The coals we use come from the Pelton Colliery. The company get a good price for their ammoniacal liquor, and, therefore, they try to keep it up to 16 ounces per gallon. By getting strong ammoniacal liquor it does not necessarily mean that the gas has been freed from ammonia. It might mean the reverse. We are very particular about getting all the sulphuretted hydrogen away from the gas. The amount of sulphur is kept as low as possible, but we can find no other means of doing it, except by the use of lime, which is a very expensive and nasty process.

Mr. F. J. Bramwell, examined by Mr. MICHAEL.

I know Ramsgate well, and have inspected the works of the two companies. I have seen the two stations of the water company—the working station and the stand-by station. Chalk water is, in my opinion, very desirable water, and it is the only source of supply at Ramsgate that I know of, or have ever heard suggested. The local board did not propose in their Bill any other source of supply. I think 18 gallons per head daily a fair quantity for the resident population, and 10 gallons per head for visitors. I reckon a resident population of 20,000, and a maximum of 13,600 visitors when the town is full, and that gives the quantity required as 490,000 gallons. I believe, however, that, if the water is on constant service, that quantity will not be required, because I do not believe the visitors will take their 10 gallons, nor do I believe the inhabitants will take their 18 gallons. In company with Mr. Easton, we drew up the regulations which are to be submitted to the Local Government Board for their approval. With regard to the complaints which have been made respecting the pressure, I can only say that it is impossible to build a service reservoir higher than Providence has been pleased to make land to build it upon, and the company's reservoir is built in a very excellent locality with respect to high land. If persons build houses in the immediate neighbourhood, the only means of supplying them is by mechanical means—viz., pumping against loaded valves, and that the company have done. I presume that the pressures are considered sufficient, because I find that the local board, by their Bill, do not propose to give any more than the ordinary pressure that can be supplied by gravitation from the company's works. The gross annual income of the company is about £5000, which is equal to 4s. per head of the population, while the income of the London companies comes to 6s. per head. The income of the Ramsgate Company is barely 5½ per cent. upon the rateable value, while they are entitled to charge 7½ per cent. on the rateable value or upon the actual value, at their option. In carrying out the provisions of the Act, I think the company have exercised their powers most moderately. To prove that where a constant supply has been given the result has been a diminution of waste, I should like to refer to the case of Liverpool, where there has been a reduction of 6½ gallons per head of the population through changing from the intermittent supply to the constant. That has also been the case at Norwich and other places. I do not think the consumers' interests have been injured through the company not applying to Parliament since 1835, and I arrive at that conclusion in the following manner:—The company have a capital of £15,000, and they have increased the works out of surrendered profits by £19,000, upon which no dividend has been paid. The average dividend upon the £15,000 has been very much below 10 per cent., and in the result, as I stated last year, there was a profit to the consumers of some £10,500. Mr. Stevenson has found out that I omitted to deduct the £1000 that was written up within the capital sum, and I agree with him that in strictness, although it was within the capital, it ought to be deducted; that, therefore, would bring the saving down to £9500. If this money had been divided amongst the shareholders in those bygone years, they would have had the simple interest upon the money—that would have been in their pockets—whereas it has remained in the pockets of the consumers. But there is also a very great prospective advantage to the consumers which I did not state last year, and that is, that if the company had obtained a 10 per cent. Act, incorporating the 1847 clauses, they would have had £34,000 chargeable with £3400 of dividend in perpetuity, whereas now all they seek is £15,000 at 10 per cent., making £1500, and £19,000 at 6 per cent. (and I am told they are not to get that), making £1140—together, £2640—or a saving in perpetuity, even if they get what they ask for, of £760 per annum to the consumers. With regard to the gas, I can testify to the excellent manner in which Margate is lighted, both as regards the town, the shops, and the private houses. I cannot speak of the lighting of Ramsgate, as I have been there but rarely at night. I have inspected both stations of the company, and they appear to be well laid out. The storage at Ramsgate is a little limited, which puts the manager in rather an awkward position just about Christmas time, but the necessary steps are being taken to put up a new gasholder. The Bill now before the committee proposes to make the capital of the company £72,000—£24,000 old capital, and £48,000 capitalized. With reference to the total quantity of gas produced, that capital is very low—it works out to about £600 per million feet—especially when it is taken into consideration that these works have been growing, and made piecemeal, and that they are so far away from the source of iron-producing industry. The gas company have also been conducted in such a way as to produce benefit rather than injury to the consumers, by a non-previous application for further powers. I explained last year that I thought they had benefited the consumers to the extent of £19,000. Mr. Stevenson has again hit the blot, that I did not deduct the amount that they wrote up within their authorized capital, and I think he is enabled to deduct that £8000, leaving £11,000, instead of £19,000. Again, I should say that there was the simple interest upon the money to be considered, and that has been in the pockets of the consumers instead of in the pockets of the company. As to the future, I have taken £24,000 at 10 per cent., and the £48,000 at 5 per cent., and that will work out to £4800 a year. Taking that upon the actual sale of 100 millions, will give 11½d. per 1000 feet for profit. If these works had been made on parliamentary capital, bearing a mean dividend of 9 per cent., the amount of annual dividend would have been £6480, which would work out to about 16½d. per 1000 feet, as against 11½d.; and therefore the difference between the two is the saving to the consumers in perpetuity. In my opinion, these profits are not certain to continue; I have for some time past been expressing a gloomy view of them. I believe the time is fast approaching when electrical light will be a strong and active opponent to gas. It is being used in France, and has also been put up at Crewe, and there is good reason to believe that with coals at 20s. a ton to work the engine and make the electrical light, and gas at 4s. per 1000, the electrical light can be obtained at from one-fourth to one-sixth the price of gas.

Cross-examined by Mr. BIDDER: If the gas shareholders only considered themselves, it would be better for them to realize the money invested as soon as possible; but not if they considered the public. If they are compelled to sell, I think they have a right to be treated as though they could keep up their works. My figures concerning the water supply per head at Ramsgate are based upon the assumption that the maximum number of visitors in summer is 13,600, which figures I obtained from Mr. Curling.

Mr. BIDDER: You compared the water income between this district and London, and showed it was less per head. In point of fact, the amount of water given in London per head is very much larger, is it not?

Witness: I think it is about 32 gallons per head, on the average. The Chelsea Company stand as high as 38·9, but there are some down to 26·8.

Mr. BIDDER: At Ramsgate there is the railway, the harbour, and the shipping in the harbour, and although Ramsgate is not a very large town, there is a certain quantity consumed for manufacturing purposes?

Witness: I should think the latter would be extremely small, nothing being manufactured there but beer and soda water, to my knowledge. I appreciate what you say about the railway and the shipping, but I am sure my estimate is ample. I am aware that Liverpool is a town in which the proportion of water-closets is comparatively small, and that would make a difference in the consumption of water, and on that account Ramsgate would require a larger supply than Liverpool; but that is compensated for by people washing in the sea at Ramsgate, and not wanting to clean themselves afterwards.

Mr. BIDDER: Assuming that the company had applied to Parliament in the ordinary way for the authorization of their additional capital, how do you make out that the consumers are £11,000 better off? You say the company ask Parliament to give 10 per cent. upon £24,000, and 5 per cent. upon £48,000, making a total of £4800 a year. Then you say that if they had applied to Parliament they would have obtained an average dividend of 9 per cent., which would have been equal to £6480, which is larger than the annual dividend they are now seeking to have authorized. Are you not making rather a large assumption in assuming Parliament would have allowed them 9 per cent. upon all their capital?

Witness: I do not think I am. I am assuming that the company would have probably come in the year 1850, when they began to feel the need of new capital, and when the rates allowed by Parliament were higher than they are in 1877.

Mr. BIDDER: In the present case, out of the £72,000 all but £16,000 is coming out of the pocket of the consumer himself, whereas had the company applied to Parliament, and raised the capital under the authority of Parliament, they themselves would have had that amount of capital. So that there is the broad difference, that in the one case the consumer himself has found, let us say, three-fourths of the capital, and in the other case the shareholders would have to find the whole?

Witness: There is that broad difference in words, but not in figures; because the consumers, if the shareholders had found the capital, would have been compelled to pay the statutory dividends upon it, and also the back dividends; whereas, the consumers finding the capital, no dividend has been paid upon it from that time to this. The whole question is, have the company had more or less out of the capital by that process than they would have had by getting the consumer to pay upon the statutory dividend? and the answer is that they have had £11,000 less.

The CHAIRMAN said the committee could make use of the figures as well as the witness.

Mr. MICHAEL said he had finished the evidence for the two companies.

Mr. WILLIAMS then addressed the committee on behalf of certain inhabitants of St. Lawrence who had petitioned against the Bill of the gas company, and in support of that of the local board. He said his clients were placed at an exceptional disadvantage by the companies, the supply of gas for the public lamps and private houses, and the water supply to houses and at fires, having been very inadequate. He alluded to the difficulty experienced in getting a supply of gas for St. Luke's church, and contended that the company had been wanting in consideration for the requirements of the parishioners of St. Lawrence. With reference to what had been stated about St. Lawrence being taxed for the benefit of Ramsgate, he (Mr. Williams) said his clients had very little objection to that. They were pretty dearly taxed at present for the benefit of Mr. Curling's shareholders, and they had no objection to being taxed for the benefit of their neighbours, especially as there was an exceptional provision in the Bill that one-half of the profit should actually come into their own pockets. Ramsgate and St. Lawrence were practically one town, their interests were identical, and whatever was important for the welfare of the one was important for the welfare of the other. He submitted that the time was very near—and had practically arrived already—when Ramsgate and St. Lawrence would be one, and in passing the Bill, although nominally passed on the request of the inhabitants of Ramsgate, the committee would pass a Bill in which the inhabitants of St. Lawrence had a very great interest, and by which an inestimable benefit would be conferred upon them.

Mr. POPE, in addressing the committee on behalf of the gas and water companies, said that the Ramsgate Local Board, by bringing forward their Bill, were attempting to reverse a decision arrived at by Parliament last year, after the whole case had been carefully considered. That decision was, he submitted, not only in conformity with sound principles of legislation, but with the uniform practice of Parliament, which had never sanctioned the principle that because a local board, with an eye to profit as much as to the public advantage, chose to come and bring all sorts of cock-and-bull stories two years consecutively before a committee, it was the duty or the right of Parliament to confiscate the property of others for the benefit of that local board. Before anybody could justify an application for special powers in their own favour, and, above all, before they could justify an application for the sacrifice of private rights and property in their favour by special legislation, they must satisfy Parliament that the general legislation was so unsatisfactory, or so unsuited to their case, that they were obliged to appeal to special legislation because the general powers were insufficient. In 1875, acting on the principle that ordinarily it would be better for public bodies to have charge of the lighting and water arrangements for the communities over which they presided, Parliament enacted certain provisions, stating what powers it would give to public authorities where there were any existing interests with which those public authorities might desire to contract, and if it were possible for Parliament to give, by legislation, an indication of what its mind was, it was that the remedy, even for misconduct on the part of the company, was not confiscation, but was to enable the local authority, by competition, to procure for themselves what the company did not choose, or were unable, to furnish. It would be admitted that if it were a contest between a new company applying for powers, and a local board coming for powers to supply themselves, the committee would in all probability prefer the local board to the public company, because there were undoubtedly general advantages in placing the sanitary matters in the hands of the local authorities; but where there were existing interests, Parliament had rightly defined what their respective duties and respective privileges were. The committee were now asked, without any of the circumstances being altered—excepting that everything was being done by the water company to carry out what had been pledged for them to do—to reverse the decision of the previous year, and to hand over the property to the local board of the district. The learned counsel then quoted various sections of the Public Health Act, 1875, providing that local boards might construct water-works, but, in the event of there being an existing company in the district, they must first prove that the company were not able and willing to give a proper supply, and asked what the Ramsgate Local Board had shown, except that they had been negligent of their duty, and had not endeavoured to put in force the powers they already had. They applied for powers to purchase works which they said were insufficient, improper, and inadequate for the purpose, but there was not a single suggestion or power in their

Bill to enable them to make the works any better, and the only power they would have to carry out the improvements which they said ought to be carried out, was the power in the very Act which they had themselves refused to put in force. What was the duty of the local board, if there was an insufficient supply? According to the 62nd clause of the Public Health Act, if the surveyor of the local board reported that any house within their district was without a proper supply of water, and that such a supply of water could be furnished, the local authority could give the owner notice in writing, requiring him, within a specified time, to obtain such supply, and for that purpose he might enter into a contract with any water company supplying within the district. That gave the local authority absolute power to deal with the water supply. If the houses were insufficiently supplied, the owners could be called upon to supply them, and if they did not do so the local board could do it themselves. If the water company could not let them have the water, there was a provision that if an arbitrator said their demand was reasonable, and ought to be complied with, the local board could put in force the very powers which they said they were contemplating putting in force, for the purpose of obtaining it. It would have been impossible for Parliament to have devised more complete powers for the benefit of any local authority, not one of which had the Ramsgate Local Board thought fit to exercise, and they had, therefore, no title to ask for powers of compulsory purchase. The local board did not come forward and say, "Let us acquire the undertaking, and we will show you what additional works we are going to construct, so as to supplement the defects in the supply of Ramsgate," but the company did come forward, in conformity with their pledge of last year, and showed that they were prepared to do that which Parliament had suggested they should do. It was perfectly plain that Parliament was very careful to protect the interests of existing companies and the remedy it provided was competition on the part of the local authority, and not confiscation, even in the event of there being any misconduct proved. With regard to the proceedings of last year, it was quite true that the Bills were withdrawn, and the reason was, as he (Mr. Pope) told the committee at the time, that up to that period no case could be found in which Parliament had given compulsory powers to purchase a company, who were not before Parliament themselves, asking for privileges. The Bills were, therefore, withdrawn; but both of the companies distinctly stated that in the event of the confiscation Bill of the local board being rejected, they would pledge themselves to bring forward Bills to place themselves under parliamentary control as regarded quality and price, and which should give the local board an opportunity of discussing all the details. Accordingly, the chairman, in giving the decision, said: "We also reject the Ramsgate Local Board Bill, and we do it on the understanding that your pledge will be carried out, and that you will come with a Bill which shall enable Parliament to assume the control of you, and if there be any mischiefs to remedy they shall be remedied." That pledge was faithfully carried out, and the moment the companies left the committee-room they took the necessary steps for that purpose. If, then, the companies applied for their Bills in conformity with their pledges, while the local board applied without any new case or any new evidence, which Bill should receive the preference of the committee? If there were any mischiefs to be remedied, they could be remedied under the Bills of the companies. Was it true that the gas was insufficient in pressure or illuminating power, or that there was a want of a constant supply of water? If so, the companies were there to carry out all those objects, and what possible case was there to justify the local board in seeking to seize the property of the companies against their will, because that was what they were seeking to do? What did the local board want as a sanitary authority? They allowed Mr. Stevenson and their other engineer to leave the chair without being asked a single question upon that subject. Was it to be supposed that if there had been any real grievance they would have been content with such evidence as that of the witness who said he saw the gas coming up out of a hole, or the other witness who said he judged of the illuminating power by putting a photometer in his shop-windows? The local board did not suggest that they were going to make better gas or supply better water. What security had the committee, if they handed the works over to the local board, that they would not just be content to keep those works going, and pocket the proceeds in reduction of the rates, not increasing the supply one atom, because there was nothing to compel them to do so. They had been negligent of their duties hitherto, and what possible security was there that they would be more diligent in the performance of them hereafter? There must be a large additional expenditure upon the works in order to obtain the supply which was said to be necessary, and what possible difference could it make if that expenditure was made by a company, regulated as regarded their profits and dividends, and which undertook to make it, or by the local board, which did not undertake to do so, and who were to pay, according to their own theory, the full value of the works they would be obliged to take over. The first thing to start with was that the local board must pay the full value of the undertaking, and if there was any prospective value, that also must be paid for; and if that were done, it would extinguish all the difference between the $\frac{4}{5}$ per cent. borrowing, and the 7 per cent. dividend. A very important question was, what guarantee was there that the local authority—which had been so negligent hitherto—would ever carry out any of the powers which the committee might vest in them? The argument of his learned friend was that the Act of 1875 was the only thing they could appeal to to extend their works, but they could not have it both ways—either they had no powers, or if they had, they had not exercised them. The Act of 1875 was the only thing they would have; but there was not a word in their Bill about increase of works or increase of powers in any way. He (Mr. Pope) did not propose to go through the whole of the complaints that had been made, but he would ask the committee whether, when there had been sufficiently responsible witnesses in the box, there had not been an unanimity of opinion, or, at all events, an absence of condemnation of the quality either of the gas or water. Their doctors did not complain of the water, except the gentleman who talked about nitrate of lime, which appeared to have the peculiar faculty of producing diarrhoea in the summer, if not in the winter. Without, however, going through the whole of the evidence, did it amount to anything more than the foolish and idle gossip which always existed in a place where there was an agitation to obtain possession of a profitable undertaking? It spoke very well for the companies that, under all the circumstances, there had been so few complaints. It was well known that there were complaints at times against every company, but the remedy for those complaints was not to place the property of the companies in the hands of the local boards, but to put in force the powers which Parliament had placed in the hands of the consumers, or of the local authorities, to keep companies in proper order. It had been stated that these companies had been a long time in applying to Parliament, and that they had spent a large amount of profit on the works, and that that represented some injury to the ratepayer or consumer who had paid his share of those profits. Supposing it were true, was that any ground for the local board confiscating the property of the companies? That matter was discussed last year, and it was part of the case upon which the committee decided that the companies were to place themselves under statutory powers during the present year, and they were there for that purpose. They did

not even ask for the capitalization of the whole of the amount expended out of profit; they proposed to make the ratepayers a present of £13,000, because they only proposed to count as capital £48,000, out of a capital of £61,000, which had been actually expended. What difference on earth could it make whether the money which had been judiciously expended in increasing the gas and water works came out of the profits or out of borrowed money, the interest upon which must have been paid out of dividend, or out of calls upon shares, or in any other way. If the company were dividing 10 per cent., and then putting into capital profits which they earned over 10 per cent., he (Mr. Pope) could have understood an objector saying, "You have divided what you are entitled to, and therefore it will be cheaper to borrow the surplus at 4 per cent. than to make it a capital bearing dividend at 10 per cent." But supposing the companies were entitled to divide 9, and only divided 5 per cent., and put the remaining 4 per cent. into capital, what possible difference could it make whether they paid that 4 per cent. to somebody from whom they borrowed it or to themselves? In conclusion, he would ask the committee to adhere to the decision of last year, because it was just in point of detail, and right in point of principle; and he would also ask them not to depart from the lines of legislation which last year were again and again sanctioned, by enabling the local board to acquire powers to which they had no title, without having shown any ground to justify such an application as they had made.

Sir E. BECKETT, in replying upon the whole case, said that, so far from the decision of parliamentary committees being considered irreversible, it was well known that Bills had often been passed after they had been rejected not only once, but even four or five times. If it was intended that the decision of committees should be final, why had not Parliament made a Standing Order to prevent rejected Bills being reintroduced? But, so far from that being the case, care had always been taken, as far as possible, to avoid letting the same members sit a second time upon a committee on which they had sat once, in order that their actions might be unbiassed. With regard to the remarks that had been made respecting the Public Health Act, there was no doubt that that Act contained provisions which would be very valuable to the local board after they had obtained the gas and water undertakings, but those provisions were useless as a means for the acquirement of the works in the first place. The recommendation of the committee of last year, "that the gas and water companies should be brought under parliamentary control at the earliest opportunity," was made pretty early in the session, but it was not acted upon by the companies, who could, if they had been so disposed, have reintroduced the Bills they had withdrawn; but they preferred taking the chances of another year, because they thought the local board would be divided upon the matter, and that they would not be able to get up the steam for any further opposition. They discovered, however, that there was a large majority in the town against them, and, therefore, it was necessary to reintroduce their Bills in the present session, and that was an additional piece of misconduct. They ought to have offered the committee last year the same opportunity of regulating their powers, which they dared not withdraw from them now while the three Bills were before them. It had been stated, over and over again, that no fresh complaints had been made since the companies were before the committee last year. That was not true, but, even if it were, there would be a very good reason why, because they had seen a letter from the chairman to the manager, in which it said, "Remember we are on our trial." Luckily, however, there was evidence, and they had it from the best of all sources—viz., from the report of the manager himself to his directors on the 1st of last January, in which he stated that he had not power to give a proper supply, although they had been on their good behaviour. He (Sir E. Beckett) would not have cared if there had been nothing after last year, because his complaint was as to past misconduct. If, when a Bill was brought in against a company by a local board, the company were to be entitled to say, "We are beginning to do better, and we shall do better if you throw out this Bill," it is evident no body of men would introduce such Bills, because they would know it would be useless. For the last three or four years, even according to Mr. Curling's admission, there had been an increasing agitation in the town against these two companies, and yet they said, "These are the most ungrateful people that ever were; we have been spending a large amount for their benefit." People could generally see on which side their interest lay. There were ratepayers in Ramsgate as well as a water company and a gas company; and yet those ratepayers, having their eyes open to the tremendous benefit which had been conferred upon them, had been complaining of bad gas and insufficient water, and that the companies had been charging too much and dividing too much. His friend (Mr. Pope) said those complaints were merely idle gossip, such as he would undertake to get up against any gas or water company; but how could that be, when the committee remembered the kind of complaint made and not answered? They had had private people and hotel-keepers before them, who had said how bad the gas was; there was a meeting in 1874 about the high prices, and constant complaints had been made of the water supply being insufficient. What complaint could be made against a gas company or a water company that had not been made against these two companies? The duty of a gas company was to supply good gas at a low price, but had the Ramsgate Gas Company done that? Mr. Curling admitted that they had never tested it till within the last two or three years. Mr. Pope had said that Mr. Stevenson had not mentioned it, but the gas had been so bad that it was not a question of testing. It was only when they came to nice shades of division that testers were required to test the quality of the gas. With regard to the water company, he (Sir E. Beckett) would like to know what answer they had to make to the statements about the gross insufficiency of the water. They had tried a bold stroke about the matter. After witnesses of every description had said that they knew perfectly well that the population in summer was from 50,000 to 60,000, up came Mr. Curling, who said that "judging from the rate-book, I am sure there cannot have been that population." Was that worth attending to? Mr. Curling allowed no visitors for the cottages, although they, as well as the richer houses, were full; and upon that ridiculous contradiction of what the witnesses for the promoters unanimously said, the committee were asked to believe that the population was only two-thirds of what the local board put it at. If the committee should think that the water supply was not sufficient, what conceivable answer was there to the allegation that the water company had kept the town upon starvation allowance? Was that proper conduct, or in the slightest degree defensible? Mr. Curling had said they only wanted a steam-engine, but they had plenty of money to order it with. How had they spent their money hitherto? Mr. Curling wanted an Act of Parliament to give him a little money; but how did he get the £62,000? Was that by virtue of an Act of Parliament? A man who could get £62,000 without an Act could get a little more. Regarding the question of price, supposing the companies' Bills were passed, with an obligation to sell all their future shares by auction, would they not be just as well off if the Bill of the local board were passed, because there would be an end to the shareholders getting the benefits of those sales? Railway shareholders were continually receiving papers asking for tenders for unissued shares in such and such companies, but gas companies had not yet arrived at

that point of conscience. He (Sir E. Beckett) did not know whether, if the proposed Standing Order were passed, that conscience would be provided for them; but he asked the committee to provide it in the present case, and if that were done there would be an end put to their dividing anything more than the £2400 a year, which they could do at present. That £2400 a year the local board were perfectly willing to buy at an extreme price—either at the price which the market had determined, or at the price the committee might determine, or at an arbitration price; but, in consequence of the expense attending arbitrations, if the committee would settle the matter they would prove themselves to be public benefactors. It had been generally admitted that it would be better for the supply to be in the hands of the local board; even his friend (Mr. Pope) had said that if it were a new concern it would be far better for the population at large than the whole matter should be in the hands of the local authority. If it were to pass into their hands at all, what was the use of talking about confiscation when it was known that no committee or arbitrator ever dreamt of doing anything but giving a price which left the shareholders in a better position than they were before? Was not 4 per cent. guaranteed dividend on any decent concern, much more the rates of a town, equivalent to a precarious 5 per cent.? Supposing they had a guaranteed sum exactly equal to what they had been hitherto receiving as the maximum dividend, every share would rise 20 per cent. in value, for the reason that guaranteed shares were always worth at least 20 per cent. more than non-guaranteed ones. The learned counsel concluded by asking the committee to take care of the pecuniary interests of the companies in what they considered a fair way—not to give them more than a moderate amount, if any, of their past illegal profits, which had been capitalized—but to deal with the matter, on the whole, in such a way as would leave every shareholder with a fixed dividend equal to his present precarious one, or if they preferred it, to leave it to arbitration.

The room was then cleared. After deliberating for some time, the parties being called in,

The CHAIRMAN said the committee thought it very desirable that the parties should come to an agreement, and they would, therefore, reserve their final decision upon the preambles of the three Bills till the following Monday.

MONDAY, MARCH 26.

Mr. VENABLES said that, in consequence of the intimation of the committee, a meeting had taken place between the parties on the previous Saturday, but without any result, the companies having declined to state any terms upon which they were prepared to sell their undertakings.

Mr. MICHAEL said it was quite obvious that the companies, who were unwilling to sell, had no offer to make, but they asked Mr. Cooper whether he had anything to propose on behalf of the local board, and he said, "We have no offer to make other than that which has been already made." It was, therefore, perfectly useless to proceed, and the meeting broke up.

Mr. VENABLES said his clients were perfectly prepared to negotiate within any reasonable limits, and, having made their offer, they thought it the best plan to ask the companies for an offer.

Mr. MICHAEL said that at the suggestion of the committee, the companies wrote a letter, stating that they would be very happy to meet the local board, of course expecting that when an offer had been made and refused, they would have something else to propose; but they had nothing, except the offer which had been before made, and which was seriously less than the amount mentioned at the commencement of the proceedings. It was, therefore, absolutely absurd to ask for an interview.

Mr. VENABLES said the local board were perfectly willing, as to the amount of terms, to abide by any decision at which the committee might arrive.

The committee-room was then cleared.

After a short time the counsel and parties were again called in, and

The CHAIRMAN said: The committee have decided that the preamble of the Bill of the Ramsgate Local Board is not proved; they have decided that the preamble of the Ramsgate Water Bill and the preamble of the Thanet Gas Bill are proved. The committee had it in their minds to make amendments in the clauses of both Bills, referring to additional capital and improvement stock; but they cannot go into the clauses until after Easter, in consequence of a direction which they have received from the Chairman of Ways and Means, requesting them to put off the consideration of the clauses of all Bills of this description until that time.

Mr. BIDDER suggested that the committee should not report their decision until after Easter. He would also ask whether they would consider the propriety of passing the Local Board Bill, with a suspensory clause, the effect of which would be that, if the Bills of the companies were proceeded with and carried through, then the Local Board Bill would drop; as otherwise there was no guarantee that what happened last year might not happen again—viz., that the two Bills would be withdrawn, and matters left as heretofore.

Mr. MICHAEL said that proposition was a deliberate request to the committee to reverse the decision at which they had already arrived. The two Bills were withdrawn last session previously to their coming before the committee, and therefore it was utterly impossible for them to repeat that proceeding.

Mr. BIDDER contended that he was not requesting the committee to reverse their decision. His clients fully accepted the decision of the committee; but the clause simply provided for the event of those Bills not being carried through. His learned friend said it was impossible for the companies to repeat what they did last session. Why was it impossible? Who could make them go on with their Bills if they did not choose to do so? What was to prevent their withdrawing the Bills between the two Houses, or even after they had passed through the Committee of the House of Lords? Nobody could carry them forward to a third reading except themselves. If the companies meant to go on with their Bills, the clause would not do them the slightest harm.

The committee-room was again cleared.

On the parties being called in,

The CHAIRMAN said: The committee have decided not to insert the clause which has been submitted to them. At the same time they wish to state that they hope the parties will consider themselves held to the undertaking given by Mr. Michael, that they will *bona fide* proceed with their Bills through Parliament.

Mr. MICHAEL: I say that, sir, as strongly as I am empowered to do in words.

Mr. BIDDER: Whatever deductions in the capital are made? The committee have intimated that they intend to deal with the capital question after Easter, and they might deal with it in such a way that the companies would think it not worth while to go on with the Bills. I should like my learned friend to say that they are absolutely prepared to go on with their Bills.

The CHAIRMAN: We think that the present condition of affairs in Ramsgate is very unsatisfactory, and that it ought not to continue.

Mr. MICHAEL: I have no *arrière pensée* in the matter, and I say that we shall proceed with our Bills immediately the committee are prepared to take them.

Mr. BIDDER: I must ask for a more definite answer, because, if you look

at the gas Bill, you will see that the preamble is conditional upon the capital being as it is sketched.

Mr. BONHAM-CARTER said he thought an absolute undertaking should be given that, however the capital was dealt with, the companies would proceed with their Bills.

The CHAIRMAN: I think we cannot go any further than we have gone. Mr. BIDDER said his learned friend had given no undertaking whatever.

Mr. MICHAEL: I say that we are prepared *bonâ fide* to proceed with the Bills as soon as the committee are ready to go on with them.

The CHAIRMAN: Do you speak for your clients?

Mr. MICHAEL: Certainly; whatever I say I bind my clients by.

Mr. BIDDER: But, if the decision of the committee as to capital is such as the companies do not like, are they prepared to go to the House of Lords?

Mr. BONHAM-CARTER: Not merely to proceed before this committee, but to promote the Bills through Parliament.

Mr. MICHAEL: The chairman did not ask me that. I have answered the question in the sense in which it was asked.

Mr. BIDDER said that if the committee did what his learned friend did not like, he would not proceed a step further, and his clients would be left in the same position.

Mr. MICHAEL: We have had two decisions of the committee, and now my learned friend asks for the third. It is the most irregular proceeding which I have ever heard of in my life, and I appeal to the chairman of the committee, and also to the referee, whether they have ever heard any discussion of this kind before.

Mr. BIDDER: My learned friend carefully guards his words. He undertakes to proceed with the Bills before this committee.

Mr. MICHAEL: The committee cannot pledge me to anything more.

The CHAIRMAN: Mr. Michael would not do anything so foolish as Mr. Bidder suggests. As regards any proceedings before this committee, so far as the preamble is concerned, they are at an end.

Mr. BIDDER: My learned friend will not give you the slightest undertaking that if you deal with the capital in a way which he does not like, he will go a step further with the Bills.

The CHAIRMAN: It appears to me that Mr. Michael has given the committee the undertaking as plainly as any one can in words.

Mr. BIDDER: At any rate, sir, will you allow me to ask you not to report your decision until after Easter? There is no harm in that, because it may be that during the vacation the parties will come to terms.

The CHAIRMAN: We shall report the Local Board Bill.

TUESDAY, APRIL 24.

At the sitting of the committee this morning,

Mr. BIDDER stated that during the recess the parties had been in negotiation, and he was happy to state that at the last moment terms had been arranged between the Ramsgate Local Board and the companies, under which the undertaking of the water company, and so much of the undertaking of the Isle of Thanet Gas Company as related to Ramsgate, would be transferred to the local board, at prices already agreed upon. He believed that this arrangement would meet the approval of the committee, and he would ask for a short adjournment of the proceedings before them to enable the parties to make the necessary alterations in the Bills to carry out the objects in view. He should also have to ask the assistance of the committee, as it would be necessary to move the House to revive the Bill of the local board. Probably, too, the committee themselves might desire to insert some clauses in the Bills, in compliance with the Standing Orders of the House.

Mr. CHANDOS LEIGH concurred in the application for a postponement, inasmuch as only the Ramsgate portion of the gas undertaking was to be transferred, and the Bill would have to be altered with reference to Margate. The committee had suggested that they also might have some amendments to make, and his clients would like to come prepared next time to carry out their views.

The room was then cleared, and, on the parties being re-admitted,

The CHAIRMAN said: The committee are very glad to hear that an arrangement has been come to, and they think it right to say that they will consider it their duty to insert auction clauses in both these Bills when they come before them. In accordance with the wish of counsel we shall adjourn till Tuesday next.

Mr. BIDDER: Perhaps you will kindly further the application for the re-committal of the local board Bill.

The CHAIRMAN: We will do anything we can in that way. We intimated the other day that we should somewhat cut down the Improvement Stock in both Bills.

Mr. MICHAEL: As I understand, you propose to insert auction clauses in the gas Bill?

The CHAIRMAN: Yes.

Mr. MICHAEL: It will be subject to an application on our part to have sliding scale clauses inserted.

The CHAIRMAN: Subject to your application; but we give no decision upon that point now.

Mr. MICHAEL: I only say we intend to bring up clauses to that effect. It will be necessary to give evidence of the desirability of those clauses, and also as to the initial price at which the sliding scale should commence.

The CHAIRMAN: Yes. We do not pledge ourselves to a sliding scale at present.

Mr. DURNFORD said, as representing Margate, he ought to state this. In the local board Bill there was power to purchase the whole undertaking of the Thanet Gas Company—the Margate as well as the Ramsgate portion—and there was a provision that the Ramsgate Local Board should be compelled to sell to the Margate Corporation the works which supplied that town. But if the Bill was now altered, and the local board were authorized only to purchase the Ramsgate undertaking, unless the gas company were compelled to put a similar clause into their Bill with reference to Margate, his clients would be left at the mercy of the company with all their debts.

Mr. MICHAEL said the Margate Corporation did not think fit to oppose the gas company's Bill as originally introduced, and he did not see how they could now obtain a *locus standi* to oppose merely because the Bill, as altered, would refer to a part, and not to the whole, undertaking.

Mr. DURNFORD said he was quite aware that as against the gas company's Bill his clients had no *locus standi*; but he thought they would have a right to be heard against the local board Bill under the changed position of affairs, and, unless the board consented to make his suggestion a part of the arrangement, he should object to the revival of their Bill.

The REFEREE (Mr. Bonham-Carter) said, if the Corporation of Margate had originally opposed, their right to do so would be revived by the re-committal of the Bill, and

Mr. BIDDER admitted that whatever rights the opponents had against the Bill before, they would still have.

Mr. MICHAEL said this was a matter which they must settle with the promoters of the local board Bill.

The proceedings were then adjourned until Tuesday, May 1.

Legal Intelligence.

HOUSE OF LORDS.—THURSDAY, APRIL 26.

PATTERSON v. THE GASLIGHT AND COKE COMPANY.

An appeal was presented by the plaintiff in this case, and the company were ordered to lodge cases in answer thereto.

HIGHGATE POLICE COURT.—MONDAY, APRIL 23.

ALLEGED EMBEZZLEMENT BY THE ASSISTANT SECRETARY OF THE COLNEY HATCH GAS COMPANY.

William Henry Wood, 28, late assistant secretary of the Colney Hatch Gas Company, was charged with embezzling various sums of money, amounting in all to £900, which he had received on account of the Colney Hatch Gas Company.

It appeared that the prisoner, in addition to being assistant secretary of the Colney Hatch Gas Company, for whom he had to receive the money from the collectors, and pay it into the London and Westminster Bank, also held a good position in the Brighton and Hove Gas Company's service. In September last an audit of the books of the first-named company showed that a considerable amount had been embezzled. The prisoner, disappeared, and a warrant was issued for his apprehension, and placed in the hands of Detective Dalton, who found that he had sailed, under the name of Jackson, in the *May Queen*, with a young woman, whom he represented as his wife, for New Zealand, leaving behind him a wife and five young children. The detective also proceeded to New Zealand by steamship, and, upon the arrival of the *May Queen*, arrested Wood and brought him back to England. Wood handed over to the officer a draft for £450, some gold, a handsome gold watch, and a Colt's revolver. A letter from the prisoner to the chairman of the gas company was put in. In it he declared that "his greatest grief was that he was obliged to leave his wife and five little children to the tender mercies of the world," in addition to which he had "to part with a sorrowing mother." His defalcations he stated at £650, to repay which he had borrowed the money at a high rate of interest; but being, in consequence of his dismissal, a ruined man in this country, he "must start with his little capital in a fresh field," where he hoped to become sufficiently prosperous to make everything good.

Mr. W. H. Harding, the accountant and secretary, having been examined, the prisoner was remanded for a week.

Miscellaneous News.

THE GAS REFEREES AND THE BOARD OF TRADE.

The following letter has been addressed to the Board of Trade by the Gas Referees, in reference to a letter to the Board from the Secretary of The Gaslight and Coke Company, which has already appeared in our columns:—

17, Buckingham Street, Adelphi, W.C., April 19, 1877.

Sir,—We beg leave to acknowledge the receipt of a copy of a letter addressed to you by the secretary of The Gaslight and Coke Company on the 7th inst.

We notice with regret the hostile spirit manifested towards us in that communication, and as we believe this hostility to arise from a misapprehension of some remarks in our letter of the 5th of March, we desire to use the present opportunity of rendering our meaning unmistakable.

In witnessing the discharging of the purifiers, at those stations regarding which complaints of nuisance had been made, we were struck by the fact that in no two cases was the mode of working the same. At one station, the actual emptying of the purifiers was conducted under cover, and no unpleasant smell escaped; but the refuse lime was afterwards shot into barges, with no protection from the wind, and thus a decided nuisance was created. At another station, the conveyance of the refuse lime into barges was effected under cover, and without nuisance; but, during the actual emptying of the purifiers, the foul substance was freely exposed to the action of the wind. At other stations, no precautions whatever were taken, either in emptying the purifiers or in removing the lime.

It seemed to us that if the precautions which we witnessed at different stations were properly combined, complete success would be the result; and we also thought that the cause of the observed want of unity in the methods of dealing with the same problem at different stations, might be justly, and without offence, referred to the absence of a chief engineer, entrusted with the power of bringing into general use whatever special ameliorations the experience or ingenuity of the superintendents of the different stations had devised.

It was very far indeed from our intentions to "indulge in personality at the expense of the company's engineers," or to "disparage" them, nor do we believe that any language of ours is fairly open to this interpretation. We know how small a place such a question as that of discharging a lime purifier can occupy in the thoughts of the busy manager of large gas-works; and we are quite prepared to accept the statement of the secretary, that there is not "any other company, metropolitan or provincial," able "to show results of working superior to those which are achieved by the engineers of The Gaslight and Coke Company."—We are, Sir, your obedient servants,

(Signed) A. VERNON HARCOURT.
JOHN TYNDALL.

The Assistant Secretary, Railway Department, Board of Trade.

THE REGISTRAR-GENERAL ON THE WATER AND GAS SUPPLY OF THE METROPOLIS.

[From the Registrar-General's Annual Report.]

WATER AND GAS.*

The water London requires now comes from a distance, and is distributed by companies at a cost of £1,197,306; of which £445,768 goes in working expenses, and £751,538 in the profits of capital. The cost of the existing capital is at the rate of 6½ per cent.

London gets its gas through companies from the coal imported at a cost of £2,650,284 for the supply through meters. The working expenses are £2,506,061; but in addition to the meter-rents the companies get £780,781

* London Water and Gas Companies.—Total paid-up capital (including amount received on calls paid in advance), revenue, and expenditure of the Metropolitan Gas and Water Companies for the last financial year ended prior to April 1, 1876.

	Total Paid-up Capital (including Calls Paid in Advance).	Total Gross Revenue.	Revenue from Gas, Meter, and Water Rents.	Total Working Expenditure.
Gas companies	£ 11,005,591	£ 3,431,065	£ 2,650,284	£ 2,506,061
Water companies	11,486,566	1,197,306	1,180,939	445,768

from the sale of coke and from other sources, making the gross revenue £3,431,065; and the profit £925,004, that being the difference between the working expenses and the gross revenue. The profits of capital are at the rate of 8·4 per cent.

The capital engaged in the gas and water companies is £22,492,157; which realized in the year that ended on April 1, 1876, no less than £1,676,542. That was 7½ per cent. all round. Now, if this amount of capital were required to construct all the works necessary to supply London with the best gas, and pure soft water at high pressure, the capital could probably be raised at 4, or certainly at 3½ per cent. less than is now paid in dividends. If the capital were raised at 4 per cent., £776,856 would be set free; out of which, after the companies were adequately compensated, there would be a large revenue for education and for many municipal purposes. Such is the tax under which London suffers from the want, years ago, of an intelligent, enterprising municipal organization. Though the companies have no explicit monopoly, still they necessarily act precisely as a company would which had the supply of bread exclusively in its hands, or as a great candle company that supplied light would under the same circumstances; they would fix the prices of these necessities of life—bread and light—so as to earn the highest dividends.

It is not only the tax, which threatens to be perpetual in the case of virtual monopolies, but the difficulty of getting such improvements as the age demands in the character of the articles supplied. Water is now required in London soft, pure, aerated, and distributed on the constant system, in pipes, under pressure such as would pour floods of water through hydrants on burning houses and piles of warehoused goods. But that would involve expenditure and diminished dividends, to which no body of shareholders will willingly submit. So long as their customers are quiet they will supply the cheapest article at the highest price.

Dr. Frankland has continued his analyses of the London waters supplied by the several companies from the Thames, from the Lea, and from chalk wells. The results are full of interest, and are useful to the companies themselves.

According to these returns the eight companies supplied, on an average, 527,434 houses and establishments with 538,926 cubic metres (equal to nearly as many tons) daily.

METROPOLIS WATER SUPPLY.

REPORT ON THE ANALYSIS OF THE WATERS SUPPLIED BY THE METROPOLITAN WATER COMPANIES DURING THE SEVERAL MONTHS OF THE YEAR 1876.

By PROFESSOR FRANKLAND, D.C.L., F.R.S., &c.

[From the Registrar-General's Annual Report.]

Royal College of Chemistry, Jan. 30, 1877.

Sir,—I have to submit to you, in the accompanying tabular statements, the results of the chemical examination of the water supplied to London by the eight Metropolitan Companies during the year 1876.

The temperature of each sample at the time of collection, and the condition of the water as regards clearness or turbidity, has been recorded, and in all cases of turbidity a microscopic examination of the sediment deposited by the water on standing has been made.

Table A gives the temperature of the water as it flowed from the main at the time of collection. Classifying the waters in three groupes according to their sources, the following variations of temperature were observed:—

The temperature of the Thames water supplied by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies, varied from 1·0° C. (33·8° Fahr.) in January, to 21·5° C. (70·7° Fahr.) in July and August.

That of the Lea water, delivered by the New River and East London Companies, ranged from 1·5° C. (34·7° Fahr.) in January, to 21·2° C. (70·2° Fahr.) in August.

The Kent Company's deep well water showed a minimum temperature of 10° C. (50° Fahr.) in January, and a maximum of 17° C. (62·6° Fahr.) in October. The latter comparatively high temperature was observed only once, and was probably due to some accidental circumstance. Omitting this observation, the maximum was 14·5° C. (58·1° Fahr.)

Thus it will be seen that the temperature of the river waters varied according to the season, ranging through no less than 19·7° C. (35·5° Fahr.); consequently they were in imminent danger of freezing in winter, and they were rapid and unpleasantly warm in summer. The range of temperature in the deep well water was much smaller, and extended through only 7° C. (12·6° Fahr.); or, omitting the one abnormal observation just referred to, through only 4·5° C. (8·1° Fahr.)

Table B shows the amount of solid impurity contained in 100,000 parts by weight of water. This solid matter is composed of a great variety of substances, by far the largest proportion being entirely harmless when the water is used for dietetic purposes, but decidedly injurious when it is used for washing. A small proportion of the total solid impurity consists of organic matter. This is always objectionable, and at times, when present in river water, it is dangerous to health. The average proportion of solid matters in all the three classes of waters was nearly the same last year as in 1875, there being a very slight increase in the Thames and deep well water and a very slight decrease in the Lea water.

Tables C and D exhibit the proportion of organic impurity actually present in the waters, as represented by the two most important constituents of organic matter, carbon and nitrogen. The importance of these indications depends chiefly on the fact that the pollution of the Thames and Lea is to a great extent of animal origin. On the whole, the year 1876 was very favourable for the river waters. Up to the end of November the rainfall was greatly below the average, and in consequence much polluting matter, which would otherwise have been washed into the rivers, was retained nearer to its source. In the months of February, May, June, July, August, September, and November, the river waters contained very much less organic impurity than usual; indeed, in August and October the water delivered by the New River Company was chemically purer than the deep well water of the Kent Company, although the latter maintained its usual excellent quality. When, however, the heavy rains of December set in, the accumulated filth of the summer and autumn was swept into the neighbouring streams, the Thames overflowed its banks, washing the manure from cultivated land, and liberating the water from stagnant ponds and ditches. Thus during the last month of the year the Thames was laden with organic matters of the most objectionable origin, which were carried down to the intakes of the Metropolitan Water Companies; they passed through the filters and were distributed to consumers.

Since January, 1873, the Thames has never been in such a filthy plight, and although most of the water companies drawing from this river have greatly improved their subsidence and filtration plant since that date, no care, foresight, or appliance could convert the "puddle" (to quote an entry in the books of the West Middlesex Company) which entered the companies works into wholesome potable water fit for dietetic purposes. These uncontrollable and frequently occurring outbreaks render this river a very undesirable source of water for domestic use.

Taking the mean proportion of organic impurity in the Thames water delivered in London in 1868 as 1000, I find that in subsequent years, 1876 included, the following proportions were present:—

Year.	Proportion of Organic Impurity present in Thames Water as delivered in London.
1868	1000
1869	1016
1870	795
1871	928
1872	1243
1873	917
1874	933
1875	1030
1876	903

The greatest organic pollution in the water drawn from the Thames occurred in January, March, April, October, and December, when the water was not fit for dietetic purposes. Of the five companies drawing from this river the West Middlesex Company delivered as usual the best, and the Southwark and Vauxhall Company the worst water.

The Lea is a more manageable stream, it receives a much smaller proportion of polluting matter, and rarely overflows its banks; consequently the water drawn from this source by the New River and East London Companies, and distributed after efficient filtration to nearly one-half of the inhabitants of London, is of much better quality, even after exceptionally heavy rainfall.

The most serious pollution of the Lea occurred in March; but even on this occasion the water was better than that drawn from the Thames in any of the months just mentioned.

Taking, as before, the mean proportion of organic impurity in the Thames water supplied to London in 1868 as 1000, I find in that and subsequent years, down to 1876 inclusive, the following proportions in the Lea water delivered by the New River and East London Companies:—

Year.	Proportion of Organic Impurity present in Lea Water as delivered in London.
1868	484
1869	618
1870	550
1871	604
1872	819
1873	693
1874	583
1875	751
1876	562

Table E. The deep well water distributed by the Kent Company continues to be distinguished from the other supplies by containing a less proportion of organic matter, and, on this account, is again taken as the standard for comparison in the table. Taking the amount of organic elements (organic carbon and organic nitrogen) found in it during the past year as unity, the maximum, minimum, and average proportions in each of the other seven metropolitan waters supplied during 1876 were as follows:—

Sources.	Max.	Min.	Average.
Deep wells . . . Kent	1·0	1·0	1·0
River Lea . . . { New River	3·3	0·9	1·9
{ East London	4·0	1·7	2·8
{ West Middlesex	6·7	1·8	3·3
{ Grand Junction	7·6	1·9	3·6
Thames . . . { Chelsea	7·0	1·9	3·9
{ Lambeth	6·2	1·7	4·0
{ Southwark	9·5	2·0	4·4

This Table shows that whilst all the river waters are, on the average, of a much lower quality than the deep well water of the Kent Company, the degree of their impurity varies between wide limits; thus the maximum proportion of organic impurity in the Southwark Company's water was nearly three times as great as that in the New River Company's supply.

Tables F and G ("Ammonia," and "Nitrogen as nitrates and nitrites," in 100,000 parts of water) need no comment.

Table H shows the total weight of combined nitrogen, which, after deducting a small correction for that present in average rain water, constitutes the total evidence both of past and present pollution by nitrogenous organic matter.

During the spring and summer months the combined nitrogen in river water is largely diminished by the abundant animal and vegetable life then existing in the streams, and consequently, as an indication of pollution, the combined nitrogen found during the autumn and winter months only should receive consideration. During the months of January, February, March, October, November, and December, 1875, the average proportion of total combined nitrogen in 100,000 parts of Thames water was '337 part; in the same period of 1876 it was '312 part. In the same quantity of water derived from the river Lea it was '314 part in 1875, and '294 part in 1876.

The deep well water supplied by the Kent Company is unaffected by animal or vegetable life, and the average may therefore be taken on the whole year. In 1875 it was '437 part, and in 1876 '423 part. Thus the total combined nitrogen has slightly decreased in all the three waters.

Table I gives the past as distinguished from the present or existing contamination of the water by sewage and animal substances, showing, in terms of average London sewage, the proportion of previous animal contamination as estimated from Tables F and G. This evidence is defective in river water during the spring and summer months, for the reasons which have been given as affecting the results expressed in Table H. Such action of animal and vegetable organisms may even obliterate altogether the evidence of previous sewage pollution; and it has actually done so during the past year, on one occasion, in the case of the East London Company's water. This water arrives at the company's intake exhibiting considerable evidence of previous contamination by animal organic matter, but it is stored for a period of from two to three weeks before being filtered, and during its continuance in the reservoirs the evidence of previous contamination becomes effaced. This evidence is of importance in the Thames and Lea water, owing to the likelihood of morbid matter derived from animal excreta being carried down the stream without undergoing decomposition. But it need not be regarded in the water of deep wells in the chalk, as the slow and therefore extremely efficient filtration which the water undergoes in passing through so great a thickness of chalk is an ample protection.

Table K exhibits the quantity of chlorine found in the various samples. The results obtained prove that the tidal waters of the Thames and Lea had, in no case during 1876, obtained entrance to the reservoirs or filters of the water companies.

Table L shows the hardness of the samples analyzed or the weight of carbonate of lime, or its equivalent of other soap-destroying substances, found in 100,000 parts of water. The average hardness of the Thames water was 20° or parts in 1875, and 19·8° or parts in 1876; of the Lea, 20·4° or parts in 1875, and 20·1° or parts in 1876; and of the Kent Company's water, 25·9° or parts in 1875, and 26·8° or parts in 1876.

Large quantities of soap or soda are required to soften these waters before they are used for washing. This softening could be accomplished for a small fraction of the expense before the distribution of the water by

the use of lime, as practised on similar waters at Aylesbury, Canterbury, Caterham, Tring, and Bushey.

Lastly, Table M shows the annual average of each determination, thus summarizing the average results of analysis of the water supplied by each company during the year.

The following table exhibits the results of my observations as to the degree of efficiency of filtration of Thames and Lea water distributed by the various companies in 1876:—

	No. of Occasions when Clear and Transparent.	No. of Occasions when slightly Turbid.	No. of Occasions when Turbid.	No. of Occasions when very Turbid.
<i>Thames.</i>				
Chelsea	7	4	1	0
West Middlesex	12	0	0	0
Southwark	5	6	1	0
Grand Junction	8	4	0	0
Lambeth	8	4	0	0
<i>Other Sources.</i>				
New River	12	0	0	0
East London	12	0	0	0
Kent	12	0	0	0

The natural filtration which the Kent Company's deep well water undergoes through an enormous thickness of chalk renders artificial filtration unnecessary, and is the cause of its uniform clearness and transparency.

This table shows that the West Middlesex, New River, and East London Companies only, out of the seven which supply river water to London, uniformly delivered the water in an efficiently filtered condition.

Since the year 1868, when I first instituted these observations, the filtration of the river water has undergone great and continuous improvement. Thus, during the year 1868, seven samples of water were *very* turbid when drawn from the mains; in 1869 six samples were very turbid; four in each of the years 1870 and 1871; in 1872 only one sample was very turbid; in 1873 none; in 1874 the Chelsea Company's water reached that degree of muddiness on two occasions, but since that date no sample has been drawn in a *very* turbid condition from any main in the Metropolis.

When examined by the microscope, the sediment deposited by turbid water on standing is almost always found to contain numbers of living and moving organisms. During the year 1876 such organisms were observed in the Chelsea and Lambeth Company's water four times each, in the Southwark Company's water seven times, and in the water of the Grand Junction Company three times. The annexed table exhibits the results of such microscopic examinations during the past eight years:—

	Number of Occasions when Moving Organisms were Found.							
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
Chelsea	3	2	2	3	2	5	4	4
West Middlesex	0	0	0	0	0	0	0	0
Southwark	8	1	4	1	2	5	5	7
Grand Junction	4	1	1	2	3	5	7	3
Lambeth	5	0	4	6	3	4	5	4
New River	0	0	0	0	1	1	0	0
East London	4	3	3	1	0	2	0	0
Kent	0	0	0	0	0	0	0	0

The following are the returns of the Society of Medical Officers of Health, on the composition and quality of the metropolitan waters in April, 1877:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.		Nitro- gen. As Ni- trates, &c.		Ammonia.		Hardness (Clarke's Scale).	
						Sal- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.
<i>Thames Water Companies.</i>	Grs.	Grs.	Grs.	Grs.	Grs.	Degrs.	Degrs.		
Grand Junction	20.80	0.064	0.129	0.000	0.009	14.3	3.7		
West Middlesex	19.80	0.057	0.120	0.001	0.009	13.2	3.3		
Southwark and Vauxhall	20.80	0.067	0.120	0.001	0.009	13.2	4.2		
Chelsea	20.80	0.071	0.150	0.000	0.008	13.7	3.7		
Lambeth	21.10	0.070	0.174	0.001	0.008	13.7	3.7		
<i>Other Companies.</i>									
Kent	27.90	0.006	0.350	0.000	0.003	18.8	5.6		
New River	18.80	0.042	0.105	0.000	0.006	13.2	3.7		
East London	19.60	0.060	0.129	0.001	0.008	12.6	3.5		

Note.—The amount of oxygen required to oxidize the organic matter, nitrates, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid, namely:—Lambeth, Southwark and Vauxhall.

C. MEYMOTT TIDY, M.B.

SINGAPORE GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held at the Cannon Street Hotel, London, on Tuesday, April 24—H. P. STEPHENSON, Esq., in the chair.

The SECRETARY (Mr. R. King) read the notice convening the meeting, and the following reports and statements of accounts were submitted:—

The directors have the satisfaction of reporting continued progress in the lighting of Singapore, for particulars of which they refer to the report annexed, from their engineer and manager, Mr. E. J. Wells, dated Feb. 23, 1877.

The directors going out of office by rotation are Messrs. Henry Palfrey Stephenson and Frederick Alexander Malcolm Nicol; and these gentlemen, being eligible for re-election, offer themselves for the support of the shareholders. The present auditors, Messrs. William Thomas Morrison and Alfred Williams, retire from office according to the articles, and, being eligible for re-election, offer themselves to the shareholders for that purpose.

The balance-sheet to Dec. 31, 1876, appended to this report, shows the financial position of the company. The directors have written off for depreciation of works and plant, and off the expenses of first establishment, as per balance-sheet, at the rate of 1 per cent. per annum for the present half year, and one-half per cent. per annum for the half years ending Dec. 31, 1874, and June 30, 1875, during which half years the profits would not admit of the usual amount being written off on this account. The profit for the half year, after writing off these sums, amounts to £2650 9s. 7d., which, together with £167 4s. 9d., the unappropriated profit of the preceding half year, makes the available balance £2817 14s. 4d.; out of this sum the directors recommend the declaration of a dividend at the rate of 7½ per cent. per annum, less income-tax, on the amounts paid up on the preference and original capital; the balance of £826 18s. 3d. to be carried forward to the profit of the succeeding half year, the dividend to be payable on May 21.

REPORT OF ENGINEER AND MANAGER.
Gas-Works, Singapore, Feb. 23, 1877.

Gentlemen,—At the close of another half year I have again the honour of laying before you my report. It affords me very great pleasure to be able to forward you statements of accounts showing a satisfactory working on the half year. The complete sets of balance-sheets, statements, &c., were sent from here by the mail of the 25th ult. I hope they reached you safely, and that they furnished the directors with all the information required in the preparation of the balance-sheet.

The working in the carbonizing department you will note has been very good as compared with the corresponding half year, there being a decrease in the first cost of coals, with an increased gas-rental of 2105.93 dols. The residual products also show an increase of 1054.05 dols. over the same period. It is not necessary for me to take up your

time further on the accounts, as most of the other items remain about the same, and everything is fully detailed in the statements sent.

The efficiency of the works, mains, plant, and buildings has been well maintained; repairs have been executed where necessary. All the ironwork in gasholders, &c., has been tarred; all the woodwork in houses and stores has been painted, so that everything is in good condition for produce and supply.

The No. 1 gasholder, after being at work 13 years, shows no sign of decay.

In the retort department the two new benches of retorts are working satisfactorily. Nos. 2 and 3 benches of retorts have been re-set on the same principle as the above; there are now four benches of retorts ready for use when required, which places the company in a very satisfactory position. I do not anticipate any further outlay in this department for some time to come, beyond the necessary expenditure upon wear and tear.

There are two or three important points connected with the works here, which I think will not be out of place to note. The first is burners. Previous to the last three years the ordinary burners have been used; these have been a continual source of expense and annoyance, as an ordinary iron burner becomes useless in a few months. I have tried several of the steatite tips, but they did not meet the difficulty. About three years ago I received some of Bray's burners, which answer the purpose, and give every satisfaction. I have now fully adopted them, and have entirely discarded iron burners.

Secondly, Normandy's patent joints. I had occasion to break the main to insert a tee-piece for the new benches of retorts, and previous to that for repairs to a valve; I found that the Normandy joints, after being laid 13 years and taken to pieces, the india-rubber was quite sound and pliable.

Thirdly, Donkin's valves. These valves are used throughout the works, and have worked quite satisfactorily ever since the works were opened; only in three or four instances the spindles have been renewed. There is one valve used daily for the ammoniacal liquor, and is now quite sound.

In the purifying department the working still continues satisfactory; the illuminating power has been maintained.

The unaccounted for gas for the half year has been 13 per cent.

The extension in the Havelock Road has not yet been carried out, but will be as soon as possible. With the change of the last monsoon a very wet season set in, and for upwards of three months there was a very heavy rainfall. The Havelock Road lying low, nothing could be done; also an unfortunate fatal accident occurred to the main-layer, and I have not yet been able to replace him. The fitters on the whole have been well employed, but the Chinese new year occurring during the present month, they are not now so busy.

The rates of exchange, I am happy to state, have been more favourable during the past half year, the loss of exchange on £5827 12s. 1d. remitted to England being £386 14s. 6d., as against £384 18s. 2d. on £3000 remitted in the previous half year.

The collection on the whole has been satisfactory; 39,571.05 dols. has been collected and paid to the bank. I should have liked to have had more collected; the collectors, however, have worked well, but trade has been dull, and money very scarce.

During the half year 36 new houses have been fitted up with burners, and 7 original houses have again been laid on.

The number of lights fitted up, including additional ones, was 400.

(Signed) E. J. WELLS, Manager.

Dr.	Balance-Sheet, Dec. 31, 1876.	Cr.
Capital—		Cash at bankers, London and Singapore
£5 paid on 2000 preference shares	£10,000 0 0	Ditto in hands of secretary
£5 paid on 9848 ordinary shares	49,240 0 0	Bills receivable
£4 paid on 175 ordinary shares	700 0 0	Office furniture
£3 paid on 499 ordinary shares	1,497 0 0	Cost of works & plant, as per last statement
£2 paid on 25 ordinary shares	50 0 0	Add, extensions during the half year
£1 paid on 50 ordinary shares	50 0 0	
12,597 shares	£61,537 0 0	Less depreciation at the rate of 1 per cent. per annum, for the present half year
Debtenture bonds	3,910 0 0	Ditto at the rate of ½ per cent. per ann. for the half year ending Dec. 31, 1874
Sundry creditors	337 17 7	Ditto, June 30, 1875
Insurance reserve-fund	71 5 4	
Profit and loss	2,817 14 4	
		343 4 5
		34,907 1 10
		Purchase of land
		Retort account
		Meter renewal account
		Stock on hand
		Amounts charge to capital for travelling expenses, rent, preliminary expenses, and interest on capital during construction
		Less amount previously written off
		£10,097 12 8
		Less amount written off this half year, at the rate of 1 per cent. per annum
		Ditto, half year ending Dec. 31, 1874, at the rate of ½ per cent. per annum
		Ditto, June 30, 1875
		108 0 0
		9,989 12 8
		Gas, meter-rental, fittings, and sundries under collection to Dec. 1
		Gas, meter-rental, &c., for the month of Dec., and gas for public lamps for the half year
		£68,673 17 3
<i>Profit and Loss Account, from July 1 to Dec. 31, 1876</i>		
Coal carbonized	£2,403 4 0	Balance at profit and loss, June 30, 1876
Lime and oxide	21 6 5	Less amount declared as dividend, after deducting income-tax on ordinary and preference shares
Trade & general charges	454 11 6	
Rent, rates, and taxes	101 7 9	
Directors and auditors	210 10 0	
Salaries and collectors commission	709 14 8	
Wages	409 6 7	Gas and meter rental
Interest on loans and debentures	194 13 11	Products, profit on fittings, and sundries
Interest on calls paid in advance	44 5 0	
Loss on exchange	386 14 6	
Bad debts and allowances	64 2 6	
Retort account	120 0 0	
Meter renewal account	75 0 0	
Depreciation on works and plant, & expenses of first establishment written off	451 4 5	
Office furniture	10 0 0	
Balance—profit for appropriation	2,817 14 4	
		£8,473 15 7
		£8,473 15 7

The CHAIRMAN, in moving the adoption of the report, said: Turning to the balance-sheet, and comparing it with the corresponding half year, Dec. 31, 1876, we find the following:—On the debit side the share capital has increased £6392, our debenture bonds have decreased £2210, the profit (including the balance brought forward) is £664 more. On the credit side the cash at bankers, bills receivable, &c., have increased £1482. Stock has increased £3000, there being a larger stock of coals. Turning to the profit and loss account, on the debit side the coal is £322 less, whilst on the credit side gas and meter rentals have increased £494, and products, &c., have increased £212, resulting, as before stated, in an increased profit (with the balance brought forward) of £664. We declare our usual dividend on both classes of shares, and we are enabled not only to deduct our usual amount of depreciation on works and plant, &c., but also to deduct back depreciation, which we could not do at the time, as the profit would not then admit of its being done.

Mr. R. S. FOREMAN seconded the motion, which was put and carried unanimously.

The CHAIRMAN moved, and Mr. F. W. COLLARD seconded, the following resolution, which was also unanimously accepted:—“That a dividend be declared to the preference and ordinary shareholders at the rate of 7½ per cent. per annum, less income-tax in both cases, on amounts paid up on their shares from the respective dates of payment to Dec. 31, 1876, such dividends to become payable on May 21 next.”

On the motion of Mr. R. RICE, seconded by Mr. H. W. SMITH, the retiring directors, Messrs. H. P. Stephenson and F. A. M. Nicol, and the retiring auditors, Messrs. W. T. Morrison and A. Williams, were severally re-elected, the remuneration of the auditors for the ensuing year being fixed at ten guineas each.

The CHAIRMAN moved, and Mr. D. HULETT seconded—“That the thanks of the shareholders be given to the local committee at Singapore for their attention to the business of the company.”

The motion having been carried unanimously, a similar compliment was paid to Mr. E. J. Wells, the company's engineer and manager at Singapore, for his energy and careful management of the company's affairs at Singapore.

It was proposed by Mr. D. HULETT, seconded by Mr. H. W. SMITH, and carried unanimously—“That the thanks of the shareholders be given to the directors for their superintendence of the business of the company.”

The CHAIRMAN, in reply, acknowledged the compliment paid, and expressed the appreciation, on the part of the board, of the confidence reposed in them. Referring to a suggestion made, as to looking forward to an increase of dividend, he said the directors were anxious to increase the amount, but then only when they felt that such increase would be of a permanent character. On this point he held a very strong opinion. Over-hasty increase of dividend enabled speculators on the Stock Exchange to trade upon companies, but was certainly not beneficial to the companies themselves.

It was proposed by Mr. R. RICE, seconded by Mr. T. A. GREEN—“That the thanks of the shareholders be given to Mr. R. King, the company's secretary and engineer, for his uniform courtesy and attention to the shareholders and the business of the company.”

Mr. KING having replied, the meeting separated.

WIGAN CORPORATION GAS-WORKS.

The following abstract of accounts for the past half year has just been published:—

Statement of Loan Capital on Dec. 31, 1876.

Description of Loan.	Rate per Cent. of Interest.	Total Amounts Borrowed at Dec. 31, 1876.	Remaining to be Borrowed.	Total Amounts Authorized.
Debenture stock.	4½ per cent. per annum.	£140,638 11 11	£9,361 8 1	Amount authorized by Wigan Improvement Act, 37 & 38 Vict., 1874. £140,000 Amount sanctioned by Local Government Board, Aug. 21, 1876 10,000 £150,000

Note.—The Wigan Improvement Act, 37 & 38 Vict., 1874, empowers the corporation, with the sanction of the Local Government Board, to borrow an additional amount not exceeding £40,000, for the extension and improvement of the gas-works.

Dr.—Capital Account.

	Expenditure to June 30, 1876.	Expended this Half Year.	Total to Dec. 31, 1876.
New buildings, manufacturing plant, machines, storage works, and other structures connected with manufacture	£144,255 0 7½	..	£144,255 0 7½
New mains and service-pipes (not being in place of old ones), including laying same, paving, and other works connected with distribution. . . . .	..	£3,037 17 9	..
New meters (not in place of old ones) . . . . .	..	2,050 5 11½ 359 11 1	..
Balance of capital account . . . . .	..	..	5447 14 9½ £149,702 15 5 1,866 11 7 £151,569 7 0

Cr.—Capital Account.

	Certified Receipts to June 30, 1876.	Received during Year.	Total Receipts to Dec. 31, 1876.
Debenture stock	£140,638 11 11	..	..
Amount representing reserve-fund, taken over from the old Wigan Gas Company	£7619 14 5	..	..
Less amount paid for interest to debenture stockholders, 1875	£2636 16 1	..	..
Balance in Bank, June 30, 1876.	2238 11 7	4875 7 8	..
Bankers	£3,055 1 1	£5,131 7 3	8,186 8 4
	2,744 6 9	..	£143,382 18 8
	..	..	£151,569 7 0

Dr.—Revenue Account.

To Manufacture of gas—		
Coals, including dues, carriage, unloading, and all expenses	£6,368 14 3	
Purifying materials, oil, water, &c.	58 14 9½	
Salaries of engineer, including chief engineer, &c.	150 0 0	
Wages and gratuities at works	1,446 0 10	
Repairs and maintenance of works and plant, &c.	608 13 9	£8,632 3 7½
Distribution of gas—		
Salaries of surveyors, chief inspector, inspectors, &c.	£35 3 8	
Repairs, maintenance, and renewal of mains, &c.	133 13 4	
Repairing, renewing, and refixing meters	32 0 0	200 17 0
Public lamps—		
Lighting and repairing, &c.	24 4 5	
Rents, rates, and taxes—		
Rates and taxes	536 7 7	
Management—		
Salaries of secretary, accountant, and clerks, office keepers, &c.	£120 16 4	
Collectors commission, &c.	60 0 0	
Stationery and printing, &c.	55 3 10	
Auditor	12 10 0	248 10 2
Sundries—		
Discounts and allowances	£1,229 3 6½	
Gas consumed on works	100 0 0	
Horse keep, &c.	42 4 5	1,871 7 11½
Total expenditure	£11,013 10 9	
Balance carried to profit and loss account	10,047 12 11½	£21,061 3 8½

Cr.—Revenue Account.

By Sale of gas—		
Sale of gas	£13,429 6 1½	
Rents of meters	463 14 3	
Public lighting, &c.	1,777 15 6½	£15,670 15 11
Residual products—		
Sale of coke	£2,503 12 7	
Do. tar	1,645 15 2	
Do. ammoniacal liquor	732 9 1	4,884 16 10
Sale of fittings, &c.	430 10 11½	
Rents, &c.	75 0 0	£21,061 3 8½

Dr.—Profit and Loss Account.

To Balance (being loss) brought forward from last account	£2,189 2 9½
Interest on debenture stock to Dec. 31, 1876	£2,995 16 8
Interest and commission on balances owing bankers to Dec. 31, 1876.	411 2 6
Amount set aside to meet bad debts	3,406 19 2
Balance of net profit to be carried to next account	300 0 0 4,151 11 0
	£10,047 12 11½

Cr.—Profit and Loss Account.

By Balance brought from revenue account, being profit for half year ending Dec. 31, 1876	£10,047 12 11½
	£10,047 12 11½

Dr.—Reserve-Fund Account.

To Amount of balance carried to next account	£2,289 7 0
	£2,289 7 0
Cr.—Reserve-Fund Account.	
By Balance brought from last account	£2,238 11 7
Interest on amount invested	50 15 5
	£2,289 7 0

Statement of Coals.

Description of Coal.	In Store, June 30, 1876.	Received during Half Year.	Carbonized or Used during Half Year.	In Store, Dec. 31, 1876.
	Tons.	Tons.	Tons.	Tons.
Common	1172	£907	9979	100
Cannel	2200	..	1480	720

Statement of Residual Products.

Description of Residual.	In Store, June 30, 1876 (estimated).	Made during Half Year (estimated).	Used in Manufacture during Half Year (estimated).	Sold during Half Year.	In Store, Dec. 31, 1876 (estimated).
Coke, chaldns. (18 cwt.)	244	10,822	2336	3480	5250
Breeze	384	721	..	354	751
Tar, tons . . . . .	..	1,327	..	82	1245
Ammoniacal liq., tons . . . . .	..	..	..	..	..

Dr.—General Balance-Sheet.

To Capital account, balance at credit thereof	£1,866 11 7
Profit and loss account, balance at credit thereof	4,151 11 0
Amount set aside to meet bad debts	300 0 0
Reserve-fund account, balance at credit thereof	2,289 7 0
Interest accrued and unpaid on debenture stock to Dec. 31, 1876	2,988 8 4
Sundry tradesmen and others, for amount due for coals, stores, &c., to Dec. 31, 1876.	3,455 5 6
Deposits, &c.	300 5 0
Bankers balance, amount owing on revenue account	6,761 1 2
	£22,112 9 7

Cr.—General Balance-Sheet.

By Coals, for stock on hand, Dec. 31, 1876	£806 1 0
Coke ditto	1,375 0 6
Tar ditto	1,428 8 0
Ammoniacal liquor ditto	687 0 0
Fittings and sundry stores ditto	557 15 9
Gas ditto	76 16 6
	£5,131 1 3
Gas and meter rental, balance of this account due to company on Dec. 31, 1876	£11,962 5 5
Coke, &c. ditto	793 5 5½
Tar, &c. ditto	438 14 10
Fittings, &c. ditto	1,453 19 6½
	14,648 5 3
Cash in hand	43 16 1
Ditto at bankers, renewal-fund account	2,289 7 0
	£22,112 9 7

LEICESTER GAS COMPANY.

An Extraordinary Meeting of Shareholders was held on the 23rd ult.—Mr. W. E. HUTCHINSON in the chair—"to consider and determine upon a proposed sale and transfer of the undertaking of the company to the mayor, aldermen, and burgesses of the borough of Leicester, upon the terms and conditions to be explained at such meeting; and if such sale be approved, then to affix the common seal of the company to an agreement with the said mayor, aldermen, and burgesses for carrying out the same."

The SECRETARY (Mr. Billson) having read the heads of the agreement,

The CHAIRMAN moved—"That the proposed sale and transfer of the undertaking of the company to the Corporation of the borough of Leicester, upon the terms set forth in the heads of agreement now read, be approved and confirmed; and that the directors be, and they are hereby authorized and empowered to settle the terms of an agreement to carry out such sale; and that the chairman be and he is hereby authorized to affix the seal of the company to such documents as may be necessary to give effect to this resolution." He said many of the shareholders, no doubt, would have been taken somewhat by surprise at the course which matters had taken between the company and the Town Council of the borough of Leicester. The change was rather a sudden one, and matters had proceeded at a somewhat rapid pace, and this was necessary if a very severe and costly contest in Parliament was to be avoided. He believed most of them would be acquainted with the discussion which took place in the Town Council on the subject of the Leicester Gas Bill, which had been duly reported in the newspapers, so that he could not add much information to that which they would have gleaned from those sources. It appeared to the directors that, in the course of that discussion, a strong desire was manifested, both by the council and the town, that some arrangement should be entered into which should preclude the necessity for a costly contest. That being the case, he thought if any communication was made that it should be brought before the directors, in order that it might be considered by them. In the course of time the thing ripened, so that negotiations were entered into for the transfer of the undertaking of the company into the hands of the Town Council. There were many reasons which weighed upon them in coming to the conclusion that it was desirable to entertain the project. They would be aware that the course of legislation of later times had been to vest these undertakings in the hands of corporations. And again, legislation in Parliament had taken rather a hostile course towards gas companies, especially in the matter of capital. The negotiations were conducted in a very amicable and conciliatory spirit, which was decidedly manifested by the representatives of the corporation, and adequately met by the directors. The terms were described at some length in the heads of agreement, but he would briefly recapitulate them. With regard to pecuniary compensation, he might say that the purchase-money was to be calculated by the addition of one-seventh to the maximum dividends now paid by the company, so that the A shares would receive 26s. 3d. and 3-7ths, instead of the present maximum dividend. The B shares would receive 17s. 1d. and 5-7ths, and the C shares 16s. per share, instead of the present dividend of 14s. Of course, there were two sides to every bargain. The directors might not have obtained all that some shareholders might have desired to have; but, looking at the thing dispassionately, they believed it was a fair and reasonable bargain for both parties—that it was a good sale of the works by the company, and a good purchase on the part of the corporation. They did not hand over to the corporation a poor concern, which they would have difficulty in making pay; but it was one which had progressed, during the last 55 years, from no dividend at all up to the maximum allowed by Parliament. They would hand over to the corporation works which were second to none in the kingdom in point of capability for the work for which they were designed; and he must express the obligation they all felt to their managers, the Messrs. Robinson, and their predecessors, for the zeal, energy, and ability which had enabled them to bring the works to their present state of efficiency. It was painful to some of them, who had been so long connected with the concern, to have the prospect of being severed from them in the work which they had had the pleasure of superintending for so great a number of years; but the question was not individual feelings, as they had to consider what was best for the shareholders under all circumstances, and they unanimously came to the conclusion to recommend to them the heads of agreement which they had heard read, and which had already received the sanction of the Town Council, and now awaited the sanction of that meeting. The directors considered that they had been met very fairly, and they had endeavoured to act fairly. He hoped the shareholders would see the matter in the same light as the directors had seen it, and, if they could, unanimously agree to the resolution which he now moved.

Mr. FOXTON seconded the resolution.

Mr. GRAY asked for an explanation with regard to the second clause, as to the notice to be given by the corporation. He wanted to know whether there was to be a mutual arrangement between the shareholders and the corporation on the point of notice, or whether it was to be all on one side. It might be that some shareholder's property would have to be sold, and the proceeds distributed, and he wished to know if a shareholder could give six months notice to the corporation to have his money, as well as the corporation giving the shareholder six months notice to pay his money in. If this could be done it would be more mutual. He did not think the corporation should have an advantage in this matter of arrangement. It appeared to him to be a point that might be very hard upon some of the shareholders, as it was well known that many of the shareholders were ladies, and circumstances were constantly occurring which would lead them to be obliged to have their money, and it might be at a time when it would not be convenient for the corporation to pay, and they would have to sell their shares at a time, perhaps, when money was dear. He thought the shareholders should have an opportunity of giving notice, and receiving the amount of their money in the same way as the corporation had of paying them off.

The CHAIRMAN said the clause referred to was that the option of giving six months notice would be entirely in the hands of the Town Council. The point was fully considered by the committee of directors in the first instance, and by the board at large. Of course, a great element in the negotiation was the facility with which the matter could be handed over to the corporation. They would not have obtained the terms they had done if there had been any compulsory power on the Town Council to pay them off at the option of shareholders. As to the difficulty which Mr. Gray had very properly alluded to, he thought it would not be serious. If any one wished to dispose of his shares, he would have the security of the profits of the corporation gas undertaking, and also the borough fund; and instead of having a dividend, which might be liable to fluctuation, he would have it guaranteed to him, which would materially benefit the shareholder. He had no doubt that, with such securities, the shares in the undertaking would be readily negotiated in the market.

The resolution was then put and carried unanimously.

Mr. R. TOLLER proposed a vote of thanks to the chairman for presiding, which was seconded by Mr. HOLYLAND, and carried.

The CHAIRMAN briefly replied, and the proceedings terminated.

PARIS GAS COMPANY.

The following Report of the Company's operations for the year 1876 was presented by the Board of Direction at the Annual General Meeting held in Paris on the 29th of March:—

Gentlemen,—In conformity with Article 23 of our statutes, we present to you our report on the company's operations for the year 1876, and acquaint you with the position of our undertaking on the 31st of December last.

During the year which has just passed away considerable progress was made in the consumption of gas. We should have been pleased to inform you that our profits had taken the same upward course; but different causes, the effects of which it has not depended upon us altogether to mitigate—notably the increase in the price of labour, the diminution in the value of silver, the exceptionally mild temperature which prevailed during the entire winter and suspended the sale of coke—have prevented us from attaining that result. We have, however, the satisfaction of announcing to you that we are in a position to pay you a higher dividend by 2 frs. than that for the year 1875.

GENERAL REVIEW OF THE COMPANY'S OPERATIONS.

Consumption of Gas.—During the past year, our works, ten in number, sent out for consumption a volume of gas equal to 189,209,789 cubic metres (rather over 6679 million cubic feet), being 13,271,545 cubic metres (nearly 468½ million cubic feet) more than in 1875.

This annual increase is lower than that for the year 1875, which reached 15,286,042 cubic metres (539,597,000 cubic feet), but it considerably exceeds the annual increase of preceding years, which has always varied between 6 and 8 million cubic metres (between 212 and 282 million cubic feet).

The day consumption, which takes place between the time for extinguishing and the time for relighting the public lamps, figures in the above total of 189,209,789 cubic metres to the extent of 39,801,042 cubic metres (1,387,326,000 cubic feet), and exceeds by 6,131,947 cubic metres (216,458,000 cubic feet) the corresponding amount for the year 1875.

Receipts for Gas.—The produce of the sale of gas amounts to 46,248,120 frs. (about £1,849,925), exceeding by 2,776,833 frs. (about £111,073), or 6·38 per cent., the analogous receipts for the year 1875. These receipts may be apportioned as follows between the three districts supplied by the company:—

	Francs.	Sterling.
In Paris	35,713,216	£1,428,528
In the environs	7,606,911	304,277
In the outskirts beyond the fortifications	2,963,993	118,559
Total	46,284,120	£1,851,364

Consumers.—The number of consumers on Dec. 31, 1876, was 117,790, exceeding by 6569, or 5·90 per cent., the number at the same date in 1875. Of these 6569 new consumers, 4325, or nearly two-thirds, are supplied from the house services.

This proportion is very nearly the same as that for the year 1875, which procured us 6542 new consumers, of whom 4230 were supplied from the house services.

Public Lighting.—The number of public lamps in use on the 31st of December last was as follows:—

In Paris	21,191
In the environs	13,032
In the outskirts	5,957
Total	40,180

exceeding by 773 the number in use on Dec. 31, 1875. These additional lights may be distributed as follows:—

In Paris	144
In the environs	443
In the outskirts	186
Total	773

*House Services.**—These have become one of the most important branches of the company's operations. In our previous reports we have explained the methods by which we seek to increase the number of house services, and to render them more productive. These means, however, are still but little known, and in spite of our efforts to place gas within the reach of consumers, many persons are even now ignorant as to how they may procure it. We think, therefore, that, without repeating details contained in previous reports, it might be useful to profit by the publicity that will be given to the present one, to recapitulate the conditions on which the company undertake the gratuitous laying on of these services.

The company will gratuitously lay on a house service, with the branch-pipes connected therewith, in every house, either new or inhabited, the landlord of which undertakes, at his own expense, to make the necessary preparations for at least three lights in three apartments; and in order to compensate him in some measure for the expense attending this work, the company award him, once for all, a premium of 100 frs. When the landlord has the gas laid on to more than three apartments, the company add to this a further premium of 30 frs. for each three lights beyond the three required by their regulations.

A premium of 30 frs. is also awarded to every person, whether landlord or lodger in a house provided with a gas service, who for the first time brings into use an unproductive branch-pipe, by making, at his own expense, provision for the introduction of three gas-lights into an apartment.

When the company lay on a service to a house already inhabited, for the purpose of supplying gas in an apartment the lighting of which they consider will be sufficiently remunerative, they award the landlord who has been at the expense of fitting up the three burners a premium of 30 frs. In this case, however, he has no right to the premium of 100 frs.

Lastly, the company award a premium of 40 frs. to any workman, approved by them, who, at his own expense, risk, and peril, and on the condition that he relinquishes them gratuitously to the landlord, shall provide fittings for two lights on a branch previously unproductive, belonging to certain determined groups of pipes.

Such is the system of premiums actually in use, and the application of which has had the effect of raising, in the course of ten years, the annual income from the sale of gas supplied to consumers by means of these house services from 829,715 frs. to 5,389,372 frs. (£33,188 to £215,575).

We will now, gentlemen, lay before you an account of the results obtained from these services in 1876. During that year the company laid on 1386 house services, 113 on the application of landlords, and 1273 on the application of lodgers. Consequently, the total number in use on Dec. 31 last had been increased to 9257. This represents very nearly double the number existing on Dec. 31, 1873, or four years previously. These 9257 services, exclusive of their branch-pipes, taps, and meters, which are subject to a special payment, in conformity with police arrange-

* These house services, called *conduites montantes*, are pipes carried from the bottom to the top of the building, for the supply of flats and separate apartments, as in Scotland.

ments and the consumers contracts, cost 5,394,967 frs. (£215,799), which corresponds to an average cost of 583 frs. (£23 6s. 6d.) per service, being about equal to the average of 585 frs. stated on Dec. 31, 1875.

The receipts arising from the sale of gas supplied by these services in 1876 amount, as stated above, to 5,389,372 frs., showing an increase of 869,647 frs. (£34,786), or 19·2 per cent., on the analogous receipts for the preceding year, which amounted to 4,519,725 frs. (£180,789).

With regard to the number of consumers supplied from the house services, which on Dec. 31, 1875, was 22,430, at the corresponding date last year it had attained the figure of 26,805, representing a little over one-fifth of the total number of consumers.

Principal Results of Working.—The following table gives the quantity of gas manufactured from Jan. 1, 1856 to Dec. 31, 1876. It shows that during a period of 21 years the total increase has been 148,435,389 cubic mètres (about 5240 million cubic feet), or 364 per cent., the average annual increase having been 7,068,351 cubic mètres (349 million cubic feet):—

Year.	Annual Consumption. Cubic Mètres. (1 c. m. = 35·317 c. ft.)	Annual Increase. Cubic Mètres. (1 c. m. = 35·317 c. ft.)	Annual Dividends. Francs.
1855 . . .	40,774,400	—	—
1856 . . .	47,335,475	6,561,075	40·00
1857 . . .	56,042,640	8,707,165	45·00
1858 . . .	62,159,300	6,116,660	50·00
1859 . . .	67,628,116	5,468,816	60·00
1860 . . .	75,518,922	7,890,806	70·00
1861 . . .	84,230,676	8,711,754	70·00
1862 . . .	93,076,220	8,845,544	85·00
1863 . . .	100,893,258	7,757,038	95·00
1864 . . .	109,610,003	8,776,745	105·00
1865 . . .	116,171,727	6,561,724	105·00
1866 . . .	122,334,605	6,162,878	110·00
1867 . . .	136,569,762	14,235,157	115·00
1868 . . .	138,797,811	2,228,049	120·00
1869 . . .	145,199,424	6,401,613	102·00*
1870 . . .	114,476,909	30,722,520 dec.	40·50†
1871 . . .	87,481,346	26,995,558	32·50
1872 . . .	147,668,331	60,186,985	51·00
1873 . . .	154,397,118	6,728,787	52·50
1874 . . .	160,652,202	6,255,084	55·00
1875 . . .	175,938,244	15,286,042	60·00
1876 . . .	189,209,789	13,271,545	62·00

Manufacturing Power.—The manufacturing plant upon the company's works at the end of last year represented a daily producing power of 935,000 cubic mètres (33 million cubic feet). Looking forward to an increase in consumption equal to that of the year 1876, we reckon on raising our producing power this year to 996,000 cubic mètres daily (rather over 35 million cubic feet), which corresponds very nearly to an annual make of 220 million cubic mètres (7766 million cubic feet). The available plant comprises, as usual, a reserve of 10 per cent., which is required in case of accident, and to meet any unforeseen increase in consumption.

Canalization.—During the past year important canalization works were carried out, for the purpose of extending or improving the distribution, and bringing more directly to the centre of Paris the gas made at the company's station at the Barrière d'Italie.

The total length of new mains laid was 28,774 mètres, apportioned as follows:—

	Mètres.	Yards.
In Paris . . .	7,851	8,583
In the environs . . .	11,809	12,911
In the outskirts . . .	9,114	9,965
Total . . .	28,774	31,459

The total length of mains laid under the public roadways on the 31st of December last had consequently been increased to 1,704,245 mètres, apportioned as follows:—

	Mètres.	Yards.
In Paris . . .	701,689	767,180
In the environs . . .	525,240	574,262
In the outskirts . . .	477,316	521,865
Total . . .	1,704,245	1,863,307

The greater portion of the main-laying work was undertaken, as usual, at the request of the municipal authorities, or in the execution of our contracts with the communes of the districts beyond the fortifications, as well as upon the requisition of private persons whose consumption ensured us a sufficient return for the outlay incurred.

We have recently negotiated with the commune of Montmagny a lighting contract, which is at present awaiting the approval of the *Administration Supérieure*. The conditions of this contract are exactly the same as those contained in contracts entered into with the other communes, and like them will expire with our concession on Dec. 31, 1905. When this contract comes into operation, the number of communes lighted by the company, in the departments of the Seine and Seine-et-Oise, will be fifty.

FIRST ESTABLISHMENT CHARGES.

Property Acquired.—When we consider the rapid increase that has taken place in the consumption of gas, especially during the past two years, we are naturally led to ask whether the company, whose works already occupy a superficial area of 66 hectares (163 acres), possess sufficient land to give to their undertaking all the extension it requires, and allow it perfect freedom for development.

The acquisitions of land which have taken place during the past year, on very advantageous conditions, afford us the means of providing in a great measure for the future requirements of our works.

Works and Plant.—You know, gentlemen, that every year we are obliged to augment our productive power, in order to keep it in a condition to meet the probable exigencies of the consumption in the last days of December.

In 1876 this obligation was forced upon our attention so much more strongly, seeing that we had not only to provide, as in 1875, for an increase in consumption double that of preceding years, but moreover to augment our reserve plant, which, at the end of that year, was no longer in proportion to the plant in operation.

Mains, Services, &c.—The balance-sheet placed in your hands will show the manner in which the other first establishment charges are spread over the canalization works, house services, fittings and meters on hire, working plant, and general establishment expenses.

* This was the first year in which a division of profits exceeding 12,400,000 frs. took place with the Municipality of Paris.
† As in this year the shares were divided, these figures must be multiplied by 2 to render them comparable with those of the preceding years.

ACCOUNT OF FIRST ESTABLISHMENT CHARGES FOR THE YEAR 1876.
Expended in the Purchase of Land, &c.

	Francs.	Sterling.
Land acquired for the construction of new works at Clichy-la-Garenne	544,811	£21,793
Ditto for the extension of the works at St. Mandé	190,000	7,600
Ditto for the development of the tar-works at La Villette	183,960	7,358
Property acquired for the extension of the coke-store at the Vaugirard station	80,426	3,217
Ditto in the Faubourg Poissonnière for the extension of the offices of the Central Administration	163,132	6,525
Ditto in the Rue Bebeval, Paris, for the extension of the coke and other store houses at the Belleville station	32,000	1,280
Land acquired for the extension of the works at Ivry	12,400	496
Legal and other expenses in connexion with the above	156,726	6,269
Total	1,363,455	£54,538

Expended on Works and Plant.

<i>La Villette.</i> —Erection of two settings of eight through retorts; five gasholder-tanks and two gasholders, each of 15,000 cubic mètres (530,000 cubic feet) capacity; enlargement of condensing apparatus, erection of 56 purifying vessels and a station-meter house	2,114,156	£84,566
<i>Les Ternes.</i> —Gasholder-tank and holder of 20,000 cubic mètres (706,000 cubic feet) capacity, new condensing-pipes, repair and completion of the interior canalization on the works	649,581	25,983
<i>Passy.</i> —Telescopic gasholder of 8500 cubic mètres (300,000 cubic feet) capacity, heightening existing condensing-pipes	121,021	4,841
<i>Vaugirard.</i> —New purifying-house containing 12 purifiers, enlargement of coke-store, laying a 28-inch main between gasholders and valve-house	145,702	5,828
<i>Ivry.</i> —Erection of four settings of eight through retorts, with Siemens's generators; pipe condenser, and purifying-house containing 24 purifiers; two gasholders, each of 20,000 cubic mètres (706,000 cubic feet) capacity; cisterns and reservoirs for tar; coke-store, and stable for 90 horses; consolidation of the subsoil and foundations; enclosing and paving of works	2,113,574	84,543
<i>Belleville.</i> —Completion of a half setting of three through retorts, heated on Siemens's system; hydraulic mains and condensers	62,637	2,506
<i>St. Mandé.</i> —A second coke-crusher; two sets of six purifiers, with revivifying-sheds and storehouse	379,159	15,166
<i>St. Denis.</i> —Tar reservoir	3,319	133
<i>Boulogne.</i> —Pipe condenser, earthwork in lower portions of works, and completion of boundary wall	25,661	1,026
<i>Maisons-Alfort.</i> —Completion of a half setting of three through retorts, raising level of yard, and paving work	70,293	2,812
<i>Tar-Works at La Villette.</i> —A setting of six new coppers for the distillation of tar, pipe-work for the oils and essences, two steam generators, and a press for the manufacture of anthracene	159,991	6,399
<i>Compressed Fuel Works.</i> —Completion of the second machine for the manufacture of compressed fuel from coke dust; reservoirs, cranes, and heating apparatus	33,639	1,346
<i>Works for the Treatment of Chemical Products.</i> —Completion of two settings of coppers for the distillation of ammoniacal liquor at the St. Mandé works; new apparatus at La Villette for a similar purpose; wells, pumps, and reservoirs	110,733	4,429
Sundry works at the other stations of the company	70,027	2,801
Total	6,059,493	£242,379

Expended on Mains, Services, Fittings, &c.

<i>Main-laying.</i> —New mains laid during the year, and replacing old mains by others of larger diameter	1,345,657	£53,826
<i>House Services.</i> —Expenses of laying on, including premiums	770,653	30,826
<i>Fittings.</i> —Construction of fittings let out on hire during the year 1876	340,652	13,626
<i>Meters.</i> —Acquisition of meters let out on hire	338,567	13,543
<i>Vehicles.</i> —Increase of the number of horses and vehicles for the conveyance of coal, coke, ammoniacal liquor, tar, &c.	96,724	3,869
<i>Plant and Tools.</i> —General increase in stock	97,334	3,894
<i>Establishment Charges.</i> —Miscellaneous payments	190,578	7,623
Total	3,180,165	£127,207
Total expenses of first establishment	10,603,113	£424,124
From this must be deducted— Value of works superseded, to be replaced by others, necessitating the opening of fresh credits 230,881 frs. Over-value realized on sale of the site of old La Tour, Trudaine, and Poissonnière works 1,309,134 frs.	1,590,015	63,600
Total	9,013,098	£360,524

The general position of the account of first establishment charges may be thus stated:—

	Francs.	Sterling.
Amount expended to Dec. 31, 1875	153,011,292	£6,120,451
Ditto during 1876	9,013,098	360,524
Total on Dec. 31, 1876	162,024,390	£6,480,975
To meet which there is a capital of—		
In shares	84,000,000 frs.	
In bonds	85,145,739 frs.	
	169,145,739*	6,765,829
Balance in company's favour	7,121,349	£284,854

Property to be Realized.—We informed you last year that the sale of our surplus land, resulting from the superseding of the Trudaine, La Tour, and Poissonnière works had been concluded, and that we should very probably this year be in a position to give you a definite account of this long and laborious operation.

These properties, which formed part of the estate of the original companies, figured primarily in our assets for the sum of 5,793,450 frs. (£231,738). In order to supply the place of this capital provisionally sunk, we have had to increase our loans by an equivalent sum, the interest upon which has necessarily been a burden upon the undertaking, and you decided on several occasions that this interest should be refunded to the shareholders out of the balance arising from the sale of the property.

This reimbursement has already been effected to the extent of 2,667,106 frs. (£106,684) for all the property sold previously to Dec. 31, 1863. The undivided balance arising from property sold since that date (valued at 525,020 frs., or £21,000) amounts to the sum of 222,694 frs. (£8908), which has been carried to the credit of the liquidation account for the year 1875.

The balance upon the entire operation, after deducting the interest reimbursed, amounts to 1,309,134 frs. (£52,365), and that sum has been placed to the credit of the general fund, in conformity with your resolutions of March 21, 1863, March 21, 1864, and March 17, 1866.

Loan.—The loan of 25,226,080 frs. (£1,009,044), which you authorized us to contract in 1875, in order to liquidate the expenses of first establishment incurred up to Dec. 31, 1874, and to raise the annual manufacturing power of our works from 185 to 225 million cubic metres (6530 to 8000 million cubic feet) has been affected, by works to be carried out during the year 1875 and following years, to the extent of 23,216,000 frs., apportioned as follows:—

	Francs.	Sterling.
Purchase of land and extension of works	12,716,000	£508,640
Main-laying	3,260,000	130,400
House services, fittings, and meters on hire, tools, &c.	7,240,000	289,600
Total	23,216,000	£928,640

The amount expended out of this sum during the years 1875 and 1876 reached a total of 16,638,456 frs., apportioned as follows:—

	Francs.	Sterling.
Purchase of land and extension of works	10,552,859	£422,114
Main-laying	2,437,098	97,484
House services, fittings, and meters on hire, tools, &c.	3,648,499	145,940
Total	16,638,456	£665,538

Consequently, on Dec. 31 last there remained to be expended:—

	Francs.	Sterling.
On land and works	2,163,140	£86,526
On mains	822,902	32,916
On house services, &c.	3,591,501	143,660
Total	6,577,543	£263,102

The difference existing between the last figure and that of the available resources is explained by the fact that the balance from the liquidation of the expenses of first establishment on Dec. 31, 1874, combined with the balance realized by the sale of the properties previously referred to, has remained below our anticipations, and has given rise to a bonus of 543,805 frs. (£21,752).

As far as concerns the works to be executed for raising by 40 million cubic metres (1412 million cubic feet) the productive power of our works, we hope to remain within the limits of our calculations, the expenses incurred up to Dec. 31 last being exactly in proportion to the increase in consumption of 28 million cubic metres (988½ million cubic feet) realized during the last two years.

Although the amount of the expenses of first establishment incurred up to Dec. 31, 1876, exceeds that of our resources realized at the same date, we do not think it will be necessary to modify the conditions of payment of the current loan. We shall confine ourselves, as last year, to authorizing those subscribers who request it, to relieve themselves, from the 6th of April next, of the last instalment not due, on condition that they add to the amount of this instalment a sum equivalent to the interest they will thus receive in advance by means of the half-yearly coupons attached to the fully-paid scrip. This sum, which last year was 15 frs., will this year be reduced to 5 frs.

WORKING ACCOUNT FOR THE YEAR 1876.

EXPENDITURE.		
	Francs.	Sterling.
Value of gas in store on Jan. 1, 1876	10,757	£430
<i>Materials used in Manufacture.</i>		
Coals carbonized	17,894,059	£715,762
Coke and tar for heating purposes	3,302,396	132,096
	21,196,455	£847,858
<i>Manufacturing Charges.</i>		
Salaries and wages	2,190,709	£87,628
Maintenance of works and plant	1,323,712	52,949
Incidental expenses of distillation	1,031,934	41,277
Purifying material	260,347	10,414
General expenses	79,299	3,172
	4,886,001	£195,440

* It follows from an examination of the balance-sheet that out of a capital of 169,145,739 frs. there had been paid off, on Dec. 31 last, in shares, 5,456,250 frs.; in bonds, 6,306,399 frs.; total, 11,822,649 frs.; leaving 157,323,090 frs. still to be redeemed.

Cost of Distribution.

	Francs.	Sterling.
Salaries of engineers and officers	917,216	£36,689
Repair and maintenance of mains and service-pipes	486,284	19,451
Allowances, premiums, &c.	5,934	237
Printing and advertising	131,219	5,249
Miscellaneous	48,464	1,938
	1,589,117	£63,564

General Management.

Board of direction	80,000	£3,200
Executive committee	70,000	2,800
Salaries	701,749	28,070
Office and other expenses	121,106	4,844
Service, accidents, relief, &c.	118,791	4,751
Law and other charges	24,340	973
Rents and insurances	68,145	2,726
Interest on loans	4,272,560	170,902
Loan redemption-fund	1,046,500	41,860
Share ditto	1,200,250	48,010
Cost of experiments, &c.	10,313	412
Pension-fund	85,500	3,420
Provident-fund	101,187	4,048
	7,900,441	£316,016

Municipal Charges.

Tax of '02 c. per cubic metre of gas	3,178,632	£127,145
Rating of subsoil	200,000	8,000
Lighting, extinguishing, and maintenance of public lamps	455,570	18,223
	3,834,202	£153,368

State Charges.

Taxes	395,867	£15,835
Subsidy to Control Department	8,000	320
Stamps	109,491	4,379
	513,358	£20,534

Total Expenditure 39,930,332 . . £1,697,213

REVENUE.

Produce of the sale of gas	46,284,121	£1,851,365
Value of gas in store on Jan. 1, 1876	26,642	1,066
Retort coke	14,999,028	599,961
Furnace coke	532,009	21,280
Tar	2,567,901	102,716
Ammoniacal liquor	306,008	12,240
Compressed fuel	11,475	459
Rent of meters on hire	932,406	37,296
Ditto of fittings, &c., ditto	919,396	36,776
Fire-bricks	251,177	10,047
Chemical products	930,008	37,200
Sundry works	100,617	4,025
Interests and discounts	627,132	25,085

Total Revenue 68,487,920 . . £2,739,516

Balance in favour of revenue, being profit made during 1876	28,557,588	£1,142,303
Add balance of profit from 1875	551,229	22,049
	29,108,817	£1,164,352

Deduct reserve to meet claims outstanding on Dec. 31, 1876	108,817	4,352
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Balance, being profit available for distribution	29,000,000	£1,160,000
Deduct for share dividend	12,400,000	496,000

Balance divisible equally between the Municipality of Paris and the Gas Company	16,600,000	£664,000
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The total amount available for distribution among the shareholders is, therefore, as follows:—

	Francs.	Sterling.
Dividend, as per above account	12,400,000	£496,000
Moiety of balance, ditto	8,300,000	332,000
Fourth payment by the city on account of loan	50,000	2,000
Balance of profit from 1875	380,604	15,224

Total 21,130,604 . . £845,224

Deduct 1 fr. per share for special reserve-fund, authorized at the general meeting on March 23, 1875	336,000	13,440
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Balance	20,794,604	£831,784
Deduct first dividend of 12 frs. 50 c. paid in October last	3,987,200	159,488
	16,807,404	£672,296

Deduct final dividend of 49 frs. 50 c., making a total dividend for the year of 62 frs. per share (250 frs.)	16,632,000	665,280
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Net balance to carry forward 175,404 . . £7,016

PROVIDENT AND OTHER FUNDS.

Provident-Fund.—During the year 1876 the medical staff visited at their homes 1675 of the company's servants who were absent on account of sickness, and attended 22,375 consultations. The medical fees, medicine baths and instruments, half salaries, and funeral expenses, caused an expenditure of 236,279 frs. (£9451). The account of this fund is as follows:—

EXPENDITURE.

	Francs.	Sterling.
Medical fees, medicine, &c., as above	236,279	£9,451

RECEIPTS.

One per cent. deducted from salaries, &c.	101,187	£4,047
Equal amount given by the company	101,187	4,047
Interest and sundry receipts	8,776	352

Total 211,150 . . £8,446

Excess of expenditure 25,129 . . £1,005

This increase in expenditure results principally from the payment of half salaries to the workmen and other servants of the company who are unable to discharge their duties on account of sickness, the number of whom increased, as in the year 1875, in a very large proportion.

On the 31st of December last this fund possessed 157 of the company's fully-paid bonds; the company were, however, at the same time, indebted to the fund in a sum of 51,138 frs. (£2045), which reduced the balance to its credit to 28,670 frs. (£1147). At the corresponding date in 1875 this credit balance stood at 53,799 frs. (£2152).

Pension-Fund.—The amount placed to the credit of this fund since its formation, including interest and balance realized upon the last drawing of bonds, reached on Dec. 31 last a total of 1,336,431 frs., represented by—

	Francs.	Sterling.
Bonds partly paid up (3028)	1,213,315	£48,532
Balance in hand	123,116	4,925
Total	1,336,431	£53,457

The disposable balance, augmented by the grant made to the fund for the first half of the year 1877, will be employed in paying off the fourth instalment on 1190 bonds not fully paid up, and in the purchase of fresh securities. Supposing that these can be purchased at about par, it will be seen that the annual revenue of the pension-fund will, on the 1st of July next, amount to about 70,000 frs. (£2800), after deducting tax.

The deduction of 4500 frs. made each year from the amount placed to the credit of this fund, in conformity with the rule, for the purpose of assisting those of the company's servants who have become incapable of performing their duties, but who have no claim upon the fund, has not been sufficient. We have, therefore, subsidized it to the extent of 56,502 frs. (£2260), forming a total of 61,002 frs. (£2440), of which 15,800 frs. (£632) are for pensions, and 45,202 frs. (£1808) are for assistance, renewable every year. Last year this subsidy amounted to 49,654 frs. (£1986).

Special Reserve-Fund.—This fund, the formation of which was authorized by you in conformity with Article 40 of the statutes, was founded with the object of securing to the completed shares, at the end of the concession, a capital of equal value to the share which the City of Paris will then take of the company's assets. It is augmented every year by means of a levy to the extent of one franc per share upon the shareholders profits, and to this is added the interest on former levies. You further decided that the annuity of 210,296 frs. (£8412) due to the company by the City of Paris, in execution of Article 4 of the treaty of April 27, 1872, should be added to it. This annuity, the repayment of which is to be deferred till 1888, represented on Dec. 31 last a credit, in capital and interest, of 906,833 frs. (£36,273).

The position of this fund on Dec. 31 last may, therefore, be stated as follows:—

	Francs.	Sterling.
Amount paid into fund	1,008,000	£40,320
Interest	62,789	2,511
Deferred annuities of the City of Paris, capital and interest	906,833	36,273
Total	1,977,622	£79,104

The first two amounts are represented by 2715 of the company's bonds, paid up to the extent of 800 frs., and costing 691,857 frs. (£27,674), and by a balance in hand of 378,941 frs. (£15,157), which will be applied in paying off the fourth instalment upon these 2715 bonds, and in the acquisition of fresh securities.

In July next the special reserve-fund will be in possession of 2980 fully-paid bonds of 400 frs., producing, after deducting the tax of 3 per cent., an annual interest of 57,800 frs. (£2312).

LABOUR, MATERIALS, RESIDUALS, ETC.

Labour.—In 1876 the price of labour in Paris underwent a further advance, and, in order to retain our workpeople, we were obliged to raise the salaries of a certain number of them. But you are aware, gentlemen, that we do not confine ourselves to considering these augmentations of salaries as a necessity commanded by circumstances, but that we make it our duty to endeavour, at the same time, to give them a tendency to a useful and moral end. Thus we have successively added to the fixed salaries of our special workmen a variable sum proportionate to the amount of work performed, and a premium, called a "premium for punctuality," because it is awarded exclusively to those men who have not absented themselves without leave during the month.

Savings-Fund.—While ameliorating the material condition of our workmen, we proposed also to inspire in them habits of thriftiness, and to afford them facilities for putting away, without expense or loss of time, whatever money they might be able to save each month out of their earnings. We have thus been led to establish a savings-fund, the object of which is to render productive the smallest sums deposited in it. This fund has been in existence since the 1st of July last, and has worked with the greatest simplicity on the following conditions:—

The deposits are entered in a small book in the name of the depositor, and bear interest at the rate of 5 per cent. per annum. The interest is made up in periods of six months, no fractional parts of such periods being considered, and added to the capital previously deposited.

The sums deposited, whether at one time or successively, must not exceed 500 frs. When they reach that amount the company undertake to purchase, with the consent of the depositors, and without any expense to them, some of the following stock, the vouchers for which are at once transmitted to them:—French Three per Cents.; 3 per cent. Bonds of the Eastern, Northern, Western, Lyons, and Orleans Railways; or 5 per cent. Bonds of the Paris Gas Company.

All the company's servants, permanent or temporary, are admitted to a participation of the benefits of this institution, the operations of which may be summarized as follows:—

	Francs.	Sterling.
In the second half of 1876, 2392 accounts were opened, and there was received on deposit a total sum of	152,993	£6,119
Out of this sum there was repaid—		
In cash to 141 depositors leaving the company's service	7,679 frs.	
In vouchers to 41 depositors whose deposits exceeded 500 frs.	15,745 frs.	
	23,424	937
Balance in hand on Dec. 31, 1876	129,569	£5,182

This sum belongs to 2251 depositors, and represents an average deposit in the six months of 57frs. 56c. (£2 5s. 8d.), corresponding to about 6 per cent. on the salaries received.

The total amount of interest placed to the credit of the depositors accounts on Dec. 31 last reached the sum of 1780 frs. (£71), which was deducted from the sum realized by the investment of the deposited funds.

Coal.—Although the price of coal has lowered considerably since this time last year, our net price for 1876 was rather higher than that for 1875. The extent of our consumption does not allow us to purchase our

coals as we require them; we are obliged to secure our supplies a long time in advance. If this obligation prevents us profiting afterwards by any lowering that may take place in price, it, at the same time, guarantees us against the vexatious results of a rise.

It is, in a great measure, to this circumstance that we are indebted for the progressive increase that has taken place during the past few years in our profits, even when the price of coal, which constitutes nearly half of our working expenses, had very nearly trebled.

For the rest, you will learn with satisfaction that we have lately renewed, on advantageous terms, several of our contracts, which would have expired either this year or in the course of the next.

Retort Coke.—The employment of retort coke for domestic purposes continues to become more general, in spite of the extent to which heating by gas is carried on.

At the commencement of the winter the sale considerably exceeded the production, and we should have been able easily to dispose of our summer stock of coke, if the mildness of the temperature had not caused a diminution in the demand.

Notwithstanding the unfavourable circumstances in which we were placed, our sales of retort coke produced 14,089,688 frs. (£563,587), differing by only 8746 frs. (£350) from the amount realized in 1875, which reached 14,098,434 frs. (£563,937).

With regard to the sale of metallurgic coke, it has only produced 585,624 frs. (£23,425), which is less by 93,188 frs. (£3727) than the total amount of the corresponding sales in the preceding year. Under the head of coke, therefore, the receipts have decreased by 101,934 frs. (£4077).

Heating Apparatus.—In the course of the year 1876 we sold 2301 apparatus for heating by coke, being 332 less than in 1875; this brings the number of apparatus sent out from our works up to 43,032, the whole of which are now, so to speak, in operation in Paris.

These apparatus, which are constructed with special care, are offered to the public at cost price, and have largely contributed to extend the use of coke for domestic purposes.

Tar and Chemical Products.—All the products resulting from the treatment of our tar and ammoniacal liquor are disposed of with great facility, and on advantageous terms. The net result of this manufacture in 1876 was as follows:—

	Francs.	Sterling.
Treatment of tar	2,567,901	£102,716
Treatment of ammoniacal liquor	930,008	37,200
Total	3,497,909	£139,916

Exceeding by 151,289 frs. (£6051) the corresponding amount in the preceding year.

Gas-Engines.—The use of these engines is extending slowly. Last year, however, we sold 14 horizontal engines on Lenoir's system, and 48 of Otto and Langen's vertical engines, representing altogether a motive power of 82 horses. These latter engines, which, unlike those on Lenoir's system, do not require the employment of electricity, and also occupy less space, seem destined to render real service in minor manufacturing operations. The number of gas-engines in use in Paris on Dec. 31 last was 234, and the quantity of gas consumed by them may be approximately estimated at 800,000 cubic metres (28½ million cubic feet) annually.

Compressed Fuel.—During the year 1876 we manufactured 31,703 tons of compressed fuel, for the production of which 495,000 hectolitres (1,361,250 bushels) of coke dust were used. The employment of this combustible in our works enabled us to profitably offer for sale a nearly equal quantity of retort coke, instead of consuming it ourselves.

GAS AFFAIRS AT LIMERICK.

The First Report of the Commission appointed to inquire into the local government and taxation of towns in Ireland has just been presented to Parliament. The commission was appointed in August last on the recommendation of a select committee of the House of Commons, to inquire into the operation in Ireland of certain statutes relating to these subjects, applicable to that part of the kingdom, and to advise whether any and what alterations should be made in the law. The commissioners state that their inquiry in the four important municipal boroughs of Limerick, Cork, Waterford, and Belfast, which occupied much of their time, involved so many matters of interest as bearing on the administration of the trusts of the corporations, that they deemed it right to present a special report on each.

The question of the corporate management of the gas-works at Limerick, which works have been carried on in competition with the rival undertaking of the United General Gas Company, engaged much attention, and the commissioners, in their special report, make the following observations thereon.*

In the year 1856 the premises, machinery, plant, and stock-in-trade of the Limerick Gas Consumers Company were purchased by the corporation for the sum of £10,000, in the exercise of the powers conferred by the 62nd section of the Improvement Act of 1853. For this purpose debenture mortgages charged upon the improvement fund were, to the amount of £10,000, issued to the scrip holders of the Limerick Gas Company, in consideration of which the gas-works, machinery, and plant, were assigned to the corporation at the time of the purchase.

These works were, it was unanimously admitted, in a very defective state at that time, and they were graphically described by Mr. William Spaight as a "rickety, worn-out, and insolvent concern."

The working of this concern has hitherto proved unprofitable, and from time to time, between the years 1856 and 1863, advances were made by the corporation in aid of the works out of the funds produced by the improvement rate, amounting in the whole to £7331.

Besides these advances from the improvement fund, the corporation, acting as the Gas Committee, mortgaged the gas-works, premises, plant, and gas-rental, and also the improvement rate, to the National Bank for £5000, by two mortgages for £3000 and £2000, to secure their overdraft of that amount on the current account.

That overdraft has since been very considerably exceeded, and on the 31st day of December, 1875, (vide report of Mr. Spillane, dated March 2, 1876, Appendix No. 51), the overdraft of the corporation upon the National Bank on the gas-works account stood at £14,769 16s. 1d.

It appears, too, on the books of the corporation that on the 11th day of July, 1876, a resolution was passed in the council by a majority of eleven to four, there being only fifteen members present, to advance a further sum of £2130 out of the improvement fund to the gas-works.

At the close of our inquiry in Limerick, this resolution had, however, not been acted upon, and the overdraft at the National Bank had been reduced to £14,000. We have since been informed that on Oct. 17, 1876, £400 was, in pursuance of the resolution, paid out of the improvement rate into the account of the gas-works.

It is alleged by Mr. Spillane, the manager, and those members of the corporation who have supported the policy of thus subsidizing these works,

* A summary report of the evidence taken by the commissioners on the gas question appeared in the JOURNAL for Oct. 3, 1876, pp. 492-5.

that their value has been thereby so increased as to justify the outlay from a financial point of view, but the result is that the actual position of the Limerick Corporation Gas-Works is as follows:—The balance still due to the scrip holders of the original purchase-money is reduced to £7712; £2288 of that £10,000 having been paid off out of the improvement rate by the operation of the sinking-fund. The amount of advances made by the corporation out of the improvement fund is £7331 1s. 9d., and the amount due to the National Bank is £14,000, so that the total capital debt on account of the gas-works now stands at £29,043 1s. 9d., instead of at £7712 as at first represented to us.

The statement of the capital account upon the printed report of March 7, 1876, is misleading, as no reduction is there made from the original mortgage for £10,000 in respect of the payment of a bond for £2288, which reduced that charge on the improvement-fund to £7712.

The corporation, since the purchase of these gas-works, has manufactured gas for the public lighting of the borough, and for supplying private consumers. For the conduct of this business, there was up to June, 1875, a Gas Committee of the council, under whose directions the gas-works were carried on.

From 1868 to June, 1875, Mr. William Spillane was chairman of this Gas Committee, and at the latter date he was appointed manager of the gas-works, at a salary of £300 per year. Reports of the working of the gas business were from time to time submitted by the committee to the corporation, but these accounts appear to have been very superficially examined; and the reports of the committee were invariably adopted by the council *en bloc*, although there seems to have existed always some difference of opinion as to the prudence of the corporation retaining the ownership and management of the works.

Besides the interest accruing on these large advances to the gas-works already adverted to, the ratepayers are each year charged with the annual expense of lighting the public lamps, for which, by a resolution of the council dated Dec. 5, 1872, they have been charged from Jan. 1, 1873, to the present time £5 per lamp, £1 per lamp having been added to the original charge of £4 in 1873 on account of the increased price of coals, which, notwithstanding the subsequent reduction in price, has not yet been taken off.

From June, 1874, to June, 1875, the charge to the improvement fund for lighting the town was £1748 1s. 10d. From the time of the purchase of the gas-works by the corporation in 1856 to the end of June, 1875, the total charge for lighting the town has been £33,578 11s. 10d. This has been always paid out of the improvement rate, and in no single year has anything been placed to the credit of the fund in respect of the receipts from the supply of gas to general consumers.

From time to time efforts have been made by some members of the corporation to have the accounts of the gas management more closely investigated, but without effect; and similar efforts to defer the votes for advances in aid of the gas capital account out of the improvement fund until the opinion of the citizens could be taken thereon, were likewise overruled or frustrated.

Other attempts by members of the council to have the system of management changed also failed. On June 5, 1875, Mr. John Somerville, a gas engineer, submitted a tender for undertaking the management of the gas-works, and supplying lights to the borough (see Appendix No. 50). Mr. Somerville, it will be thereby seen, offered to become sole manager and engineer of the Limerick Corporation Gas-Works, his remuneration to be one-half of the net profits of the concern after deducting all expenses of maintaining the works, and the profits not to be calculated till this had been done, with a provision for ascertaining the same by arbitration. He also bound himself to light the public lamps at £4 each, and to submit the accounts annually to the Government auditor.

The acceptance of this offer, assuming that it would be fairly carried out, would apparently have resulted in the saving of about £400 per year in the cost of public lighting alone, as there are about 400 public lamps; but notwithstanding this, Mr. Somerville's offer was practically, though not in terms, rejected on June 24, 1875, by a resolution of the council "that we are determined to retain our gas-works, and that Mr. William Spillane be requested by the council to accept the office of sole director of the works, and in the event of his doing so, that he be paid a salary of £300 per annum."

At this meeting only 16 members out of the 40 constituting the town council were present.

Mr. Spillane resigned his seat as a member of the council, and paid the nominal fine of 6d., in order that he might be able to accept the office of manager at the salary named in the resolution, which position he has since held.

No notice of the motion, nor of any resolution to appoint a salaried manager, was given to the members of the council. The matter, therefore, did not receive full or fair consideration or discussion, and the result is that in addition to the former liabilities and responsibilities in respect of the gas-works, the corporation have to pay a salary of £300 per year to a paid manager.

Mr. Spillane is a man of ability and energy, but he is not a gas engineer, and his only experience in the manufacture of gas has been in connexion with these works.

Mr. Spillane laid before us a statement of the gas accounts for the half year, ending June 30, 1876 (Appendix No. 54), in which, after charging the corporation with £986 7s. 6d., for public lighting for the half year, he shows a profit on the half year's working of £507 11s. 10d.; but this charge for public lighting is above the rate charged for gas to private consumers, and the effect of this is to increase the apparent profits of the gas-works at the expense of the improvement fund.

The accounts of the gas business, although a portion of the public property, have never been submitted to audit, for which a special provision will be found in Mr. Somerville's tender.

APPENDIX No. 50.

Offices, 20, Westland Row, Dublin, June 5, 1875.

To the Right Worshipful the Mayor, Burgesses, and Corporation of the City of Limerick.

I propose to become the engineer and general manager of the Limerick Corporation Gas-Works on the following terms, and subject to the conditions hereinafter contained:—

1. The remuneration for my services to be one-half of the net profits of the working of the concern, after payment, out of such profits, of interest on such portions of the existing liabilities of the undertaking (upon which interest is at present payable by the Gas Committee) as shall from time to time be due.

2. Deductions for depreciations and rates and taxes, as stated in the accounts of the Gas Committee, to be also made before computing net profits.

3. Premises to be insured for not less than £3000, the premium to be also deducted from the profits.

4. The works, mains, &c., to be maintained out of profits in a state of thorough efficiency.

5. I am to have the whole management and control of the works, workmen, &c., and subject to the inspection of a person to be from time to time

appointed by the corporation, and who should have access to the works at any time without previous notice.

6. The accounts to be submitted for audit to the Government auditor, should the corporation so require.

7. The gas to be supplied to be of the quality that 5 cubic feet per hour shall be equal to 14 standard candles, to be tested in the town-hall, and the price to be charged to be according to the scale proposed by the Gas Committee.

8. The contract for the lighting of the public lamps to be given to the concern. The lamps to be supplied with 5 cubic feet per hour during the prescribed hours for lighting, and to be paid for by the corporation at the rate of £4 per lamp per annum; the payment to be made by the corporation quarterly as at present, after deducting quarterly proportions of interest due on the debts. The lighting to be subject to the conditions at present existing.

9. The price per lamp to be increased according to the scale for private consumers, or at the rate of 1s. 4d. per lamp for each 1s. per ton that the price of coal shall exceed 30s. The standard price of coal to be taken at the average price of first-class gas coals in Newcastle district, with all charges and freights added.

10. This agreement to be continued upon the aforesaid terms as long as a reasonable profit shall be made for the corporation, the reasonableness of such profit to be ascertained by arbitration in the manner prescribed by the Companies Clauses Consolidation Act, 1845, or the Gas-Works Clauses Act, all the circumstances of the case being taken into consideration. The expense of such arbitration to be paid out of profits.

11. The agreement is to terminate if arbitrators find that reasonable profit is not being made.

12. If the corporation extend their works, or erect, or carry out new works, or become sole manufacturers of gas in Limerick, this agreement to extend to such extension of capital and premises, together with the working thereof, as long as the corporation are manufacturers of gas in Limerick.

13. The proportion of net profits payable yearly to the corporation is upon payment to be applied towards paying off the debts of the gas concern, or in the promotion of a sinking-fund for that purpose.

14. This agreement to be determined on my side by giving six months notice previous to a gas gale day.

15. All moneys required for extension or permanent improvements (as approved of by the corporation officers) to be provided by the corporation, who are to be the owners of such extension or improvements; interest on such outlay and the usual depreciation being deducted out of profits.

16. All moneys required for floating or working capital to be provided between myself and the corporation equally.

17. This agreement to commence from the 1st of July next.

(Signed) JOHN SOMERVILLE.

APPENDIX No. 51.

LIMERICK CORPORATION GAS-WORKS—HALF-YEARLY REPORT.

Corporation Gas Office, 34, William Street, March 2, 1876.

To the Mayor, Aldermen, and Burgesses of the City of Limerick.

Gentlemen,—While I submit for your information my first half-yearly balance-sheet, I venture to direct your attention to the circumstances which led to the purchase and maintenance, by the corporation, of the gas-works at Watergate. Previous to 1841 the United General or English Company was the sole manufacturer of gas in Limerick. Many amongst you remember how you feared in those days, but those who do not will best understand *now* the condition of things under that régime, from the following resolution passed unanimously at a public meeting called at the request of, and attended by, the leading citizens of Limerick. The meeting was held in the City Court House in the year 1837, and the Mayor, Edmond Morony, was chairman; resolved—"That the gas supplied for lighting this city is impure and bad, and the price charged most extravagant and unreasonable; it, therefore, appears very desirable that a local company should be formed for supplying the citizens with cheap and good light, thereby keeping the profits at home amongst themselves." The following committee was appointed to carry the foregoing resolution, amongst others, into effect:—Francis Spaight, John Westropp, Michael Quinn, James Morris, John Rochford, John Stevenson, J. N. Russell, J. Alton, C. O'Brien, J. M. Osborne, James Morgan, Samuel Dickson, J. Boyse, W. H. Hall, and R. M'Mahon. The following was the scale of charges enforced with the utmost rigour by the English company:—For each burner to nine p.m., £3 8s. per annum; to ten p.m., £4 1s.; to eleven p.m., £4 15s.; to twelve p.m., £5 8s. 6d.; or, if they consented to give a meter, 15s. per 1000 cubic feet. Intolerance and extortion had gone too far—public spirit was aroused, and the Citizens Company was established in Watergate in 1841. This local institution, formed at the urgent request of the people of the city, in order to relieve them from what they had been suffering for many years at the hands of the English company, was but poorly supported, and in 1856, having struggled against fearful odds for 15 years, it got into pecuniary difficulties, and was obliged to give way, consoled by the reflection that it had very materially improved the quality of the gas, and had brought down the price from 15s. per 1000 to 5s. 6d. The English company now seeing the crisis, and anxious, no doubt, to recoup itself for what it had been despoiled of since 1841, made every effort to again get sole possession of our city, but the corporation having a very lively recollection of what that meant, and judging the future by the past, interposed in the interests of the people, and made an offer of £10,000 for the works. The shareholders, being themselves Limerick men, understanding and dreading the danger in the future, refused a much larger offer from the United General Company, and handed over the works to the corporation. Thus it was that the council, with the full approbation of their constituents, was forced into the undertaking, not so much with the hope of making profit as to save the people from what they had all suffered up to 1841. No sane man can assert that, in purchasing the gas-works under those circumstances, the corporation outstepped its legitimate province, and if, as yet, the investment has not proved as profitable as it might, perhaps the people themselves are not altogether free from blame. Let those citizens who have, up to the present hour, refused to support it, ask themselves have they done their duty by their own. Now, looking at the purchase from a purely financial point of view, what have been the results after 20 years? One is tired of hearing from persons who either have never considered, or who, if they have, do not properly understand the question, what a heavy drag-chain the gas-works have been on the necks of the people! Let us examine calmly what grounds exist for this complaint. The purchase-money, which has not been paid, was fixed at £10,000. The corporation only undertook to pay interest on the sum at 5 per cent., or £500 a year. This interest has been for 20 years punctually paid by the Gas Committee, and not one single penny on this head has been paid, up to 1875, by the citizens. Since 1856 (the year of purchase), the various grants made by the council for the extension of the concern amount to £7331 1s. 9d. In addition to this sum levied from the rates, the council has paid for the redemption of some of the original bonds (part of the £10,000) £2280, thus making a total of £9619 paid by the people in aid of the works. Out of this sum £1800 was refunded by the Gas Committee,

thus leaving the net amount expended by the corporation £7819 in 20 years, or £391 per annum. So far we have been contemplating our losses by the purchase. Let us now see what have been our gains. If we take the gas-rental of the whole city at £10,000 per annum—a sum considerably under the actual amount—when gas is sold at 5s., this sum would be £20,000 a year if the price charged were 10s., which the English company admit was their price, and it would amount to £30,000 were the price charged 15s. per 1000 feet, which latter price was the minimum charged by them, as documents in my possession will prove. It does not require much arithmetical calculation to ascertain what £20,000, or as the English will have it, £10,000 a year saved, would produce in 20 years. This product, £200,000 at the very lowest estimate, has been saved the gas consumers of this city by the so-called “drag-chain,” and if all do not appreciate the boon thus conferred, surely it is not too much to ask the charity of their silence. The supporters of the alien establishment here have, as far as I know, but one argument in vindication of their policy, if it can be called such. They say, and the officials of that company having first prompted them, lustily join the chorus, if we do not keep the two companies working we will be subjected to the same treatment we experienced at the hands of the English prior to your opposition. ‘Tis well the English admit their intolerance; their motive now is too transparent to need comment. If the two were joint-stock companies, we could all see the force of the argument; but when one of the two is the property of every ratepayer in this city, the argument advanced is a delusion. Every one competent to form an opinion on this subject knows that Limerick cannot support two rival gas companies without loss to either or both. One of the two must inevitably give way. Which do the people wish to maintain, the English or their own? This is the simple question every man in this city has to ask and answer himself. We all know, some by bitter experience, others by tradition, what the aliens were when monopolists. Would the corporation be equally intolerant in their treatment of the people, and exorbitant in their prices? Further, would they advance the prices at all? The forty members would be all consumers of gas; hence, they would supply it as cheaply as possible. The price for the council would be the price for the city, then cheap gas would be the order of the day. Again, unlike a joint-stock company, the corporation could not divide the dividends out of their profits among themselves; hence there could be no motive for the price being high. It is absurd to suppose that, in order to reduce taxation by large profits for this could be the only motive, the council would advance the price, thereby causing the citizens to use oil or candles instead of gas, and thus destroy their income, and all to what end? Simply to take a large sum of money out of one pocket and put a small portion of it into the other. And, lastly, though by no means the least, public opinion would be too strong to permit such a disastrous line of conduct being adopted; the property would be the citizens’; and they would insist on its being properly managed, due regard being had to their interests. The Irish have ever been able to hold their own even against the English, and let us hope that in Limerick they will not permit themselves to be driven from their own house, after a bitter struggle which has lasted for 20 years. I have now truthfully, and I hope plainly and intelligibly, stated my case on behalf of the Citizens Gas-Works. Let the people themselves now say, through their representatives, what side they will take in the future struggle, for struggle it must continue to be, until one succumbs. Will they flock to the English standard, or will they rally around their own? I feel an apology is necessary for the length of this report—let the importance of the subject matter under your consideration be my excuse. A glance at the balance-sheet, appended hereto, will show what have been the results of the concerns for the half year ending Dec. 31. The net profit which, were you a joint-stock company, would be available for dividend is £912 5s. 9d. This sum would be much larger were it not for several heavy payments under the headings renewals and charges. A new crown for one of the gasholders cost £100. Auditors fees for examining books and accounts to July 1, 1875, were £25. A completely new set of books, recommended by auditor, £14. A new fireproof safe, for books, papers, and cash, £20. These are all exceptional charges, and will not occur again for many years. The works are now, for the first time, insured for their value in six respectable offices, and this has entailed an outlay of £39. Since the 1st of July last, 79 new accounts have been opened in our ledger, and 19 good ones were refused, merely through inability to supply any more gas, owing altogether to deficiency of storeage, mains, and governors. During the past three months the machinery and plant have been taxed to the utmost limits of their power, and frequently beyond what was safe; and an increase of business, or even a satisfactory or sufficient supply of gas to those customers we have, with the present extent of our plant, cannot and must not be hoped for. Having learned, by experience, the defects of the concern, I invited the head engineer of the Dublin Gas Company to visit and report on your works. He has done so, and I now submit his elaborate report for your information.

(Signed) WILLIAM SPILLANE, Manager.

APPENDIX No. 54.

Dr.	Revenue Account, for the Half Year ending June 30, 1876.	Cr.
Coals carried forward	£2,241 11 9	
Wages	613 7 2	
Lime	14 5 3	
Salaries	295 3 9	
Renewals and repairs	149 12 1	
Charges account	168 7 4½	
Public lamps, lighting, and re- pairing	158 13 9	
Rent and taxes	47 19 5	
Discounts and allowances	88 0 6	
Bad debts	25 0 0	
Plant depreciation	194 2 2	
Meter ditto	156 13 10	
Profit and loss	507 11 10½	
	£4,660 8 11	£4,660 8 11
Profit and Loss Account.		
National Bank for interest	£339 13 6	
Balance	167 18 4½	
	£507 11 10½	
Balance Account.		
Plant expenditure	£21,723 1 1	
Meters ditto	3,202 0 5	
Gas-rents	1,930 9 6	
Coke accounts due	172 7 2	
Fittings ditto	312 11 11	
Ditto in stock	146 4 6	
Coals ditto	734 5 10	
Retorts, bricks, and clay	250 0 0	
Cash on hand	31 18 1½	
Profit and loss	4,311 18 6½	
	£32,814 7 1	£32,814 7 1
		Revenue account, half year's profit £507 11 10½
		Capital account. £17,331 1 9
		National Bank 14,000 3 11
		Liabilities 1,475 16 5
		Deposits by consumers 7 5 0

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The declaration of war by Russia has not, so far, had much effect on the iron and steel trades, which were previously so greatly depressed that it would have been almost impossible for them to have become materially worse. On the other hand, however, the crisis has not brought the promise of any special amendment, although it has hitherto almost invariably happened that Sheffield has been the first and often the only town to feel the benefit of a great European war. In the armour-plate departments, for instance, the amount of work in hand is not very large, nor is it likely to become so in the face of the adoption of Creusot steel armour by the Italian Government for their two new vessels, *Il Dandolo* and *Il Duilio*. The slackness of the forges here has the natural tendency of keeping forge pig quiet, whilst those foundries which are at present doing any appreciable amount of work produce their own pig. Despite this fact, many of the blast furnaces near the town and throughout both counties are out of blast, and likely to remain so unless trade should take a turn, which is at present altogether unexpected and improbable. In the coal trade the situation is just now rather peculiar, so far as the export branch is concerned, and in some respects appears likely to be benefited. The Baltic is open as far as Perm, and will doubtless be free throughout in the course of a week or so, hence that class of shipments may begin in the ordinary way. This branch of business may improve for a time, whilst stores at depôts are being replenished, but it is extremely doubtful whether any permanent good will result. The Mediterranean trade, of course, also furnishes extra orders, but the bulk of these will doubtless go, as they have mostly done aforesaid under similar circumstances, to South Wales. House coal is moderately good for the season, owing to the cold weather. Best house qualities are 15s. to 17s.; good, 13s. to 14s.; reliable, 11s. to 13s.; seconds, 11s. to 12s.; various classes down to slack, 10s. to 4s. per ton. Locomotive coal is 7s. to 9s. 6d.; ordinary steam, 9s. to 10s.; and gas, 8s. to 10s. per ton at the pits.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

In some quarters there is a little giving way in the value of round coal, but no general reduction in prices has as yet been announced, and the demand for this class of fuel remains much the same as last reported, some of the pits being still fairly busy. For some classes of common coal there is more demand from brickmakers, but generally this class of fuel continues a drug, and for sales in bulk very low prices are being taken. Good burgy meets with a fair demand, but the common sorts are plentiful. Slack generally continues scarce, with a stiffness in prices. The average pit quotations remain at 9s. 6d. to 10s. 6d. per ton for good Arley; 8s. 6d. to 9s. for Pemberton four-feet; 6s. 6d. to 7s. 6d. for common coal; 5s. to 5s. 6d. for burgy, and 3s. 9d. to 4s. 9d. per ton for slack.

In the West Lancashire districts a reduction of 10 per cent. in miners wages, to come into force on the 17th of May, has been decided upon. The men, who have resolved to carry the eight hours system of work into effect on the 1st of May, are, however, likely to meet the proposed reduction with opposition, and a meeting, to be held in Manchester, has been called for next week to consider the matter.

In the iron trade everything continues in a very stagnant condition, and very few orders, either for raw or manufactured iron, are at present being given out. The local makers of pig iron are doing little or nothing, and although more than half the furnaces are out of blast, stocks are going down. Prices remain without change, as makers will not come any lower; and for delivery into the Manchester district they are still asking 56s. to 57s. per ton for No. 3 foundry, and 54s. to 55s. per ton for No. 4 forge, less 2½ per cent. Middlesbrough iron delivered here is quoted at 50s. 9d. for No. 3 foundry, and 49s. 9d. for No. 4 forge, net cash. For the few finished iron orders that are being given out there is so much competition that prices are kept very low, and it is difficult to obtain more than £6 15s. per ton for bars delivered into the Manchester district.

Some of the late partners in the Darwen Iron Company are making an effort to start the works again; but whether they will succeed in the present depressed state of trade is doubtful.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The excitement with regard to the war between Russia and Turkey was as great as ever upon Newcastle Quayside, and in the North of England generally, last week. Steam shipping freights to the Mediterranean advanced about £4 per keel. There was a further rise to the Baltic. Coasting freights were also stiffer. But notwithstanding the fact that there is likely to be very considerable movements of the fleets of the belligerents, and of England and the European Powers generally, there was no improvement to note in the price of steam coal. This is not a little remarkable. It was fully anticipated that as steam coal may be calculated amongst war material, and as everything of that kind was running up very fast in the market, it would partake of the same upward tendency. But all that can be noted about it is that it is firmer—that the official rate of 12s. 6d. per ton, less 2½ per cent. discount, is more readily obtainable for best qualities. The change is very little, however. Second-class steam is in moderate demand. The shipments of Durham gas coal are seasonable. With May, the Baltic may be considered fully open to trade. This has caused an inquiry for gas coals. The prices are, off and on, what they have been during the spring. A very fair trade is doing from the Tyne Dock. The shipments at that place average 31,000 chaldrons per week, which may be considered tolerably heavy. More than one-half of the shipments are gas coals. Second-class gas coals find a market, but prices are low. House coals, on account of the weather having been cold so long, maintain their price.

During last week very heavy fleets of coal-laden vessels sailed from the Tyne. They were the largest we have had this spring, and the vessels were bound to all parts of the world. A number of coalsters have proceeded to sea. Coasting freights are a little better, but shippers have no reason for anxiety lest the war should force them up very much. The tonnage at the disposal of this trade is ample, and at the very highest there could not be more than a difference of from 3d. to 6d. per ton upon freights.

The general business of the North of England continues to be materially affected by the war. There is little inquiry for any kind of manufacturing goods. Iron is low in the market, and the chemical trade has not been so depressed for a long time. The shipments of fire-bricks and fire-clay goods are for immediate use and for repairs. There is nothing beyond that.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The Fifth Anniversary Meeting of the West of Scotland Association of Gas Managers, which was held in Linlithgow on Thursday last, under the presidency of Mr. Levi Monk, of Lanark, was a very great success, alike as to the attendance of members and the interest of the proceedings. In due course, readers of the JOURNAL will have an opportunity of perusing the official report of the proceedings, and, therefore, it is not necessary that I

should say much on this occasion. Eleven new ordinary members were elected, including Mr. Alexander Bell, of Gibraltar, who was present at the meeting; and four honorary members were elected, one of whom was Mr. Henry Aitken, joint patentee with Mr. William Young of the process of enriching gas by means of the hydrocarbons which, practically, are suspended permanently in it. The leading features of the meeting were the presentation and discussion, and the sub-committee's report upon that process; and Mr. Peebles experimentally illustrated paper upon "The application of Electricity to Peebles's System of controlling the Action of Gas-Governors, and its adaptation for giving Flash Signals for Lighthouses, for Railway Signals," &c. With reference to the first-named subject, I may mention that the report contained a very elaborate summary of the results obtained by the sub-committee at the Hamilton Gas-Works, where the process has now been in actual operation for upwards of sixteen months. Representatives of the sub-committee were present at Hamilton on at least three occasions, superintending the experiments over a considerable length of time. The paper and experiments by Mr. Peebles excited a great amount of interest. In a discussion which afterwards took place on "20-candle Gas as a National Standard," some pertinent remarks were made by Mr. Samuel Stewart, Greenock; and eventually the president stated that, in the light of the results obtained in the experiments at Hamilton, his opinions on the subject had undergone a complete change, and he unhesitatingly withdrew all that he had said upon it at the half-yearly meeting held in Glasgow last October. In succession to Mr. Monk, as president, Mr. James M'Gilchrist, Dumbarton, was elected to that office; and Mr. Carlow, Port Glasgow, was elected secretary, in succession to Mr. M'Gilchrist. Before separating, it was resolved that the next half-yearly meeting of the Association should be held at Helensburgh. Most of the members visited the magnificent ruins of Linlithgow Palace, and subsequently there was a dinner held in the "Star and Garter" Hotel, the chairman being the new president, the vice-chairs being worthily occupied by Mr. Monk and Mr. Blaikie, of Messrs. Milne and Sons, Edinburgh. Some members stayed at Linlithgow over the night, and had a pic-nic in the grounds of Hopetown House on the following day.

I understand that Dr. Wallace, Gas Examiner for the City of Glasgow, has, during the last few weeks, visited Hamilton Gas-Works some eight or ten times, for the purpose of instituting a very complete examination of the Aitken and Young process of gas manufacture, and that he has employed a variety of cannel coals and bituminous shales, so as to enable him to say with confidence what sort of results the process shows under the varying circumstances in which it may be employed in actual practice. His official report is not yet in shape, but it is satisfactory to know that he does not hesitate to pronounce the process to be a very decided step in advance in the science and art of gas-making.

The Perth Water Bill having obtained the sanction of the House of Commons Select Committee last Tuesday, many of the inhabitants received the news with great rejoicing.

On Wednesday last, the Forfar local authority lodged their proposed water scheme with the Court of Session, in compliance with the order pronounced by the First Division of the Court. The Bill will be promoted in Parliament next session.

The Water Commissioners of Dundee have requested their engineer to draw up a report on the proposed supply of Linlithgow water to Newport on two views—first, for the delivery of the water at the north end of the Tay Bridge; and second, to deliver it to the inhabitants of Newport on the principle of a domestic water-rate.

There has been some fluctuation in the price of pig iron during the past week; but generally the market has been firm. The market closed on Friday with sellers at 55s., and buyers offering 54s. 11d. cash.

The coal trade continues quiet. Prices are steady, but there is rather a dull look-out as to business during the next few months.

MAP OF THE METROPOLITAN GAS DISTRICTS.—A coloured map of London, showing the boundaries of the Metropolitan Gas Companies since the amalgamations of last year, has been prepared by Mr. Preston Davies, of No. 6, Victoria Street, Westminster. Mr. Davies has had much experience in works of this description, and, possessing unusual opportunities for securing accuracy of detail in reference to the limits of the several London companies, he has supplied a map which may be implicitly relied upon, and which is drawn upon a scale which renders it very suitable for office purposes.

SWINDON WATER-WORKS COMPANY.—The directors and shareholders of this company have just presented to Mr. P. H. Mason, their chairman, handsome testimonials of their esteem and appreciation of the valuable services rendered by him to them during the 12 years of the company's existence. The present from the directors consisted of a drawing-room timepiece, and that from the shareholders of a massive silver salver, and a gold chronometer with chain, seal, &c. The presentations were made at a complimentary dinner to Mr. Mason, when appropriate speeches were delivered.

THEFT OF GAS AT PETERHEAD.—At the Peterhead Police Court last Tuesday week, Bailies Will and Macintosh on the bench, John Milne, shoemaker, was charged with fraudulently consuming gas, quantity unknown, between the 1st and 8th of April last, in the premises occupied by him in Longate. He pleaded not guilty, and was defended by Mr. Fletcher. From the evidence, it appeared that Milne, being in arrears with his account, had his meter removed on the 2nd of April, but on one of the servants of the gas company going to his premises on the evening of the Sunday succeeding, it was found that a connexion had been formed by Milne, and that the gas was burning as brightly as when he had a meter. The Bailies found the charged proved and imposed a fine of 40s., or 20 days in gaol. The fine was paid.

SMASHING A STREET-LAMP.—At the Chesterfield Borough Police Court, on the 19th ult., Patrick O'Brien, a tramp, was brought up in custody, charged with smashing a street-lamp and doing damage to the amount of 5s. It appeared that because the prisoner was refused a ticket for the union, in consequence of his violent conduct, he took up a stone and threw it through the glass of one of the street-lamps near the police-station. Mr. Jones, the manager of the gas company, stated that they had had no less than 51 lamps broken in about four months. The Bench sentenced the prisoner to one month's hard labour in default of paying a fine of 10s., in addition to the damage and costs.

SALES OF GAS AND WATER SHARES.—At the Auction Mart, London, on Thursday last, Messrs. Ventum, Bull, and Cooper sold £500 ordinary A stock in The Gaslight and Coke Company, in five lots, the price realized being £215 per £100. A further lot of £90 stock in the same company realized £192 10s., and a third lot, of £80, realized £172 5s., these prices being all in advance of the market quotation of the previous day. At the same time and place twenty £10 shares, fully paid up, in the Colne Valley Water Company were sold at par, and £1566 ordinary stock in the Chelsea Water-Works Company realized prices ranging from £147 to £153 per £100. On the 10th ult., forty £10 shares in the York New Water-Works Company were sold by auction. They were offered in lots of five, with the option of taking 5, 10, or 15. Ten shares were sold for £20 5s. each, and the remainder at £20 2s. 6d. a share.

ODESSA WATER-WORKS COMPANY, LIMITED.—The half-yearly report of this company states that the receipts amounted to £44,763, and the expenditure to £25,953, leaving a balance of £18,810. The interest charges for the year, amounting to £8873, reduce the above balance to £9936, out of which it is proposed to carry the sum of £855 in liquidation of the 1874 revenue suspense account, leaving a sum of £9081 available for distribution. In recommending a dividend at the rate of 1½ per cent. on the A shares, the directors declare the present inability of the company to provide cash to pay off the deferred dividend warrants issued last year, or those which have now again to be distributed, and they state that "the board have been earnestly trying to obtain from the Russian authorities some fulfilment of the hopes and promises referred to at the last November meeting; but the directors are obliged to report that, while excellent water continues to be abundantly supplied to the Imperial troops, as well as to the inhabitants of Odessa and its suburbs, the company to whom they are indebted for this blessing have obtained no recognition whatever of their claims. It remains a standing reproach to the people it benefits, who continue their efforts to increase its liabilities and difficulties. The directors must repeat that the city of Odessa does not use half the quantity of water required for the purposes of health and ordinary cleanliness. It neither flushes its drains nor has an outlet for its solid sewage, which should employ an amount of water that formed a main feature in the estimate of revenue relied upon for the legitimate success of the enterprise. Half the water which is brought into Odessa, under the requirements of the concession, is not, in consequence, paid for at all, while the price of what the inhabitants do take is extremely difficult to collect."

PROPOSED TESTIMONIAL TO MR. W. F. COTTON.—The *Freeman's Journal* says: "We learn that a movement is on foot amongst the shareholders of the Alliance Gas Company to present a testimonial to Mr. W. F. Cotton, the secretary and manager of the company. Never was a presentation of the kind better deserved, and we trust it will be one worthy the occasion. It is no exaggeration to say that the company owes its present unprecedented prosperity to Mr. Cotton. When he first interested himself in it, the company was in a wretched condition. He it was who worked up the facts on which the corporation based its case for the purchase of the concern. Had his advice been followed, the citizens would have now been in possession of a splendid property, yielding in relief of taxation a revenue of £25,000 or £30,000 per year. This project, however, fell through, and the gas company were then wise and fortunate enough to secure his services. He reorganized the concern, he effected enormous savings in the manufacture and general management, he converted a semi-bankrupt company into one of the most prosperous in the kingdom—paying the maximum dividend of 10 per cent., and with a moral certainty of continuing to pay it. The shares, which were worth £9 or £10, are now worth £18 or £19, and will be worth £20 or £21. All this is due to Mr. Cotton. The directors, no doubt, are able, painstaking men, but they would be, and have been, the first to recognize the debt they owe their manager and secretary, and would be the first to acknowledge that he is the real animating spirit of the concern. The shareholders, no doubt, will gladly avail themselves of the opportunity of evincing their recognition of his services, the more especially as they cannot but feel assured that a graceful compliment of this kind is certain to stimulate Mr. Cotton to, if possible, greater exertions in the future."

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1542.—HISLOP, G. R., Renfrew, N.B., "A new or improved mode of and means and chambers for calcining or revivifying spent lime." April 20, 1877.
- 1547.—JANIG, H., Sherwood, Nottingham, "Improvements in machinery for cooling liquids, vapours, and gases, and for condensing steam and vapours." April 20, 1877.
- 1549.—ATKINS, F. H., Fleet Street, London, "Improvements in filters." April 20, 1877.
- 1564.—BRADSHAW, A., Accrington, Lancs, "Improvements in the construction of pressure-gauges." April 21, 1877.
- 1587.—KIDD, J. and J., Wandsworth, London, "Improvements in carburetted gas and air." April 24, 1877.
- 1592.—NEWTON, J., Longport, Stafford, "Improvements in apparatus for regulating the supply of gas to gas-burners for street lamps and other purposes." April 24, 1877.
- 1608.—SALLIEN, L., Brussels, "An improved apparatus for filtering liquids, applicable also to other similar purposes." April 25, 1877.
- 1611.—DALZIEL, S., Kilmarnock, N.B., "Improvements in gas-meters." April 25, 1877.
- 1619.—SYNGE, M. H., Pall Mall, London, "Improved apparatus for filtering and purifying sewage." April 25, 1877.
- 1626.—PEEBLES, D. B., Edinburgh, "Improvements in apparatus for governing or otherwise acting on the flow or pressure of illuminating and other gases or vapours, and in part relating to the testing of gas and gas apparatus." April 26, 1877.
- 1632.—WEATHERHOGG, G. W., Camberwell, London, "Improvements in apparatus for carburetted atmospheric air." April 26, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 3763.—BLUNDELL, G. T. and J. W., Limehouse, and HOLMES, F., Victoria Park, London, "Improvements in pumps." Sept. 27, 1876.
- 3989.—BARNES, J., Accrington, Lancs, "Improvements in water or other fluid meters or motors." Oct. 12, 1876.
- 4109.—WALKER, J., Glasgow, "An improved fluid meter." Oct. 24, 1876.
- 4203.—WATSON, J., Seaham, Durham, "Improvements in the treatment and utilization of sewage." Oct. 30, 1876.
- 4207.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in glass-gauges." A communication. Oct. 31, 1876.
- 4293.—GENT, J. S., Salford, Lancs, "Improvements in apparatus employed in the manufacture of gas-burners." Nov. 6, 1876.
- 4379.—OTHON, L. P., Westminster, "Improvements in pumps." Nov. 11, 1876.
- 4392.—WATSON, J., Greenwich, "Improvements in pumps." Nov. 13, 1876.
- 130.—BREEDEN, J., Birmingham, "Improvements in valves and taps or stop-cocks, and in hose unions." Jan. 10, 1877.
- 657.—GREEN, C. H., Old Broad Street, London, "Improvements in the arrangement and construction of gas-stoves and utensils to be used therewith, and for other purposes." A communication. Feb. 17, 1877.
- 706.—JACKSON, W. M., Rhode Island, U.S.A., "Improvements in gas-stoves." Feb. 21, 1877.

NOTICE OF APPLICATION FOR LEAVE TO FILE A DISCLAIMER AND MEMORANDUM OF ALTERATION.

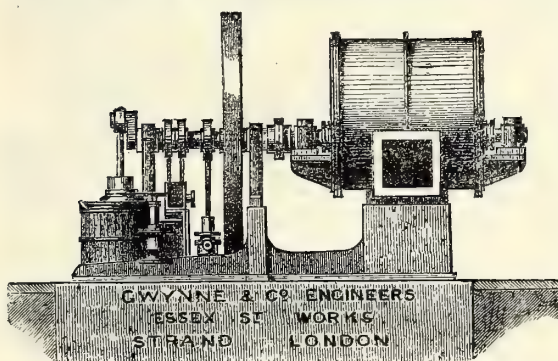
- 831.—SUGG, W. T., Westminster, "Improvements in gas-burners and in the method of constructing and manufacturing the same." March 18, 1869.

Share List of Metropolitan Gas and Water Companies.

(Corrected by Mr. F. N. GOLDING, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

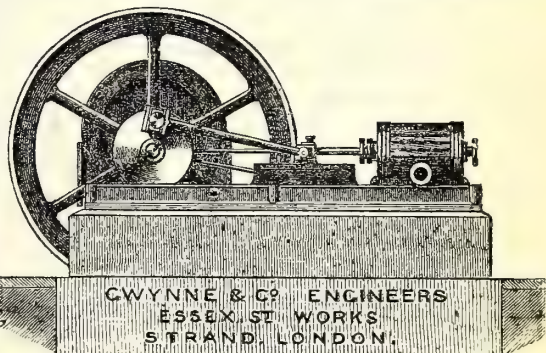
Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Div. p. Cent.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Div. p. Cent.	Latest Quotations.	Number of Shares issued.	Amount per Share.	NAME.	Amount paid up per Share.	Last Div. p. Cent.	Latest Quotations.
10000	20	£ GAS COMPANIES.	£ s. d.	£ s. d.	£	5000	10	£ GAS COMPANIES.	£ s. d.	£ s. d.	£	9000	4	£ GAS COMPANIES.	£ s. d.	£ s. d.	£
5000	20	Anglo-Romano . .	20 0 0	9 0 0	20-22	56000	50	Hong Kong (Lim.)	10 0 0	10 0 0	18½-19½	1500	10	United General . .	4 0 0	2 10 0	3-2½
1000	20	Bahia (Limited) . .	20 0 0	2 0 0	14-16	2500000.	Sk.	Imprl. Continental	43 15 0	9 10 0	85-88	1500	10	Wandsw. & Putney .	10 0 0	10 0 0	19-20
1500	20	Do., do., redeem.	20 0 0	2 0 0	25-27	1500000.	Sk.	London	100 0 0	10 0 0	213-217*	1500	10	Do.	10 0 0	7 10 0	11-12
40000	5	Do., 2nd pref. . . .	20 0 0	7 10 0	21-22	14450	Sk.	Do., 1st pref. . . .	100 0 0	6 0 0	138-143*	2957	10	Do.	10 0 0	7 0 0	6
10000	5	Bombay (Limited). .	5 0 0	7 10 0	7-7½	4350	Sk.	Do., 2nd pref. . . .	100 0 0	6 0 0	115-120	993	10	Do.	3 0 0	7 0 0	0
10000	5	Do., fourth issue.	4 0 0	7 0 0	5-5½	7622	Sk.	Do., 3rd pref. . . .	100 0 0	6 0 0	115-120	16000	5	West Ham	5 0 0	10 0 0	8-8½
10000	20	British (Limited). .	20 0 0	10 0 0	41-43	26805½.	All	Do., A shares . . .	12 10 0	6 0 0	34-36	10000	5	Do., new shares . .	2 10 0	10 0 0	3-4
7500	20	Cagliari (Limited). .	20 0 0	5 0 0	16-17	15000	5	Do., Deben. stk. . .	100 0 0	5½ & 6½	—						
5500000.	Sk.	Commercial	100 0 0	10 0 0	212-217	6000	5	Malta and Mediter-	5 0 0	2 0 0	2-3						
70000	100	Do., 7 per cent. . .	100 0 0	7 0 0	150-155	20000	5	anean (Limited). .	5 0 0	7 10 0	5-5½						
20000	20	Continental Union. .	20 0 0	6 0 0	20-22	20000	5	Do., preference . .	2 0 0	—	½-1						
10000	20	Do., new	12 10 0	6 0 0	par-1	25000	10	Mauritius (Limited)	20 0 0	8 0 0	18½-19½						
10000	20	Do., preference . .	20 0 0	7 0 0	26-28	8000	20	Monte Video (Lim.)	20 0 0	—	—						
75000	Sk.	Crystal Palace Dis-	100 0 0	10 0 0	212-217	30000	5	Nietheroy, Brazil	10 0 0	3 10 0	—						
125000	Sk.	trict	100 0 0	7 0 0	150-155	30000	5	(Limited)	5 0 0	9 10 0	8-8½	12000	100	Chelsea	100 0 0	6 0 0	149-152
50000	Sk.	Do., 7 per cent. . .	100 0 0	7 0 0	135-140	10000	5	Oriental (Calcutta).	3 0 0	9 10 0	2½-2¾pm	1800000	100	East London	100 0 0	5 0 0	158-161
23406	10	Do., preference . .	10 0 0	6 0 0	18-19	17500	5	Do., new shares . .	5 0 0	3 0 0	2-3	8000	50	Grand Junction . . .	50 0 0	5 0 0	77-78
12000	10	European (Limited).	10 0 0	10 0 0	06-7pm.	27000	10	Ottoman (Limited).	20 0 0	7 0 0	5-6	5840	25	Do., 4 shares	25 0 0	5 0 0	38½-39
35406	10	Do., new shares . .	7 10 0	10 0 0	04½-5½pm	3600000.	Sk.	Pará (Limited) . . .	60 0 0	7 10 0	101-106	2160	25	Do., new ditto; . .	25 0 0	5 0 0	32-34
3797770½.	Sk.	Gaslight & Coke A. .	100 0 0	10 0 0	210-213	100	100	Phenix	100 0 0	5 0 0	105-110	547960	100	max. div., 7½ p.c.	25 0 0	5 0 0	194-198
1000000.	Sk.	Do. B.	100 0 0	4 0 0	85-90	36000	20	Do., capitalizd . .	20 0 0	10 0 0	17-18pm	970	100	Lambeth	100 0 0	6 0 0	150-155
30000	10	Do. 5 per ct. pref.	all	5 0 0	20½-21	7359	5	Do., new, 1876. . .	5 0 0	7 10 0	5½-6½	1161	100	Do., max., 7½ p.c.	100 0 0	6 0 0	152-155
50000	10	conv., 3rd issue. . .	6 0 0	5 0 0	94-9½pm	2000	5	Rio de Janeiro (L.)	20 0 0	10 0 0	31-33	442	100	New River	100 0 0	7 0 0	270-300
50000	10	Do. do., 4th do. . .	2 0 0	5 0 0	9-9½ pm.	1500	32½	Singapore (Limited)	5 0 0	7 10 0	5½-6½	4475	100	Do.	60 0 0	7 0 0	—
2000000.	Sk.	Do. do., 5th do. . .	100 0 0	10 0 0	0230-235	4000	5	Do., preference . .	5 0 0	7 10 0	5½-6½	400000	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	101-103
1650000.	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	0230-235	4000	12½	Shanghai	32 10 0	12 0 0	30-32	3036	100	Southwark & Vauxh.	100 0 0	4 0 0	114-117
3000000.	Sk.	Do. D do. do. . . .	100 0 0	10 0 0	0230-235	20000	12½	South Metropolitan	50 0 0	10 0 0	109-112	1296	100	Do., pref. stock . .	100 0 0	5 0 0	113-116
1650000.	Sk.	Do. E do. do. . . .	100 0 0	10 0 0	0230-235	15000	10	Do.	12 10 0	10 0 0	27-29	100	100	Do., D shares	100 0 0	4 0 0	112-115
300000.	Sk.	Do. F 5 do. do. . .	100 0 0	5 0 0	0114-116	10000	10	Do., new shares . .	10 10 0	10 0 0	12½-13½	100	100	Do., 4½ preference .	100 0 0	4 0 0	106-108
600000.	Sk.	Do. G 7½ do. do. .	100 0 0	7 10 0	0165-170	10000	10	Surrey Consumers.	10 0 0	10 0 0	20-22	1600	100	Do., new ordinary . .	40 0 0	4 0 0	106-108
13000000.	Sk.	Do. H	100 0 0	7 0 0	0150-153	10000	10	Do., new	8 0 0	10 0 0	9-10pm	12172	61	Do., neword.No.1 . .	40 0 0	4 10 0	106-108
6200	5	Georgetown, Guiana	5 0 0	5 0 0	—									West Middlesex . .	61 0 0	6½ p.sh.	145-147

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS. **GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.**



The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO.,** Hydraulic and Gas Engineers, **ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.**

G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines with many others of all sizes.

D. BRUCE PEEBLES & CO.,
ENGINEERS,
FOUNTAINBRIDGE WORKS, EDINBURGH,
MANUFACTURERS OF WET AND DRY GAS-METERS;
Patentees and Sole Manufacturers of "PEEBLES' GAS-GOVERNORS,"
FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS,
OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.
"These Lamp-Governors are so superior that they are likely to supplant all others."—Dr. Wm. Wallace, F.R.S.E., F.C.S.

Now ready, price One Shilling, No. 6 (to be continued Monthly) of
A TREATISE ON THE SCIENCE & PRACTICE
OF THE
Manufacture and Distribution
OF
COAL GAS.

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For the convenience of persons resident in remote districts, arrangements have been made by the Publisher to forward the "Treatise" by Post, securely packed on a roller, at the cost of the number and postage only—viz., 1s. 2d. Monthly, or 7s. for the Half Year.

JOHN ROMANS, C.E., F.G.S.E.,
CONSULTING GAS ENGINEER
AND
CANNEL COAL FACTOR,
30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.
GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

WANTED, a small Gas-Washer complete, inlet and outlet from 3 to 5 inch.
Address G. DAVIS, Wilmington, HULL.

WANTED, a good practical Retort-SETTER and BRICKLAYER. State age, present and last employment.
Apply, with copies of testimonials, to W. J. WARNER, Engineer, Gas-Works, SOUTH SHIELDS.

WANTED, by a Lancashire Manufacturing Chemist, large or small quantities of strong Gas AMMONIACAL LIQUOR, above 8° Twaddell.
Address No. 353, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a permanent Situation in a Gas-Work, by a young Man, who thoroughly understands all fitting and repairing on and off the works. Eight years at a gas engineer's. Good reference.
Address J. P., 2, Taylor's Buildings, Rochester Row, WESTMINSTER, S.W.

WANTED, an experienced Manager to take charge of the Gas-Works of the Borough of Macclesfield. Annual make about 90 millions. Salary £200 per year. He will be required to devote the whole of his time to the duties, to superintend the main-laying, services, public lamps, and the entire distribution of gas, as well as the manufacturing department.
Applications, in candidate's own hand writing, with recent testimonials, stating age and experience, to be sent in not later than Saturday, the 12th of May, 1877, addressed to the CHAIRMAN of the Gas Committee, MACCLESFIELD, and endorsed, "Application for Gas Manager."

TO GAS APPARATUS MANUFACTURERS.
A Gentleman of good address, who understands the Trade throughout in detail, and has a large and valuable connexion with Gas Companies, Engineers, Managers, &c., is desirous of entering into an arrangement with any respectable Firm wishing to extend their Trade.
Address No. 361, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS COMPANIES.
WE beg to call attention to our special STEATITE BURNERS for Street Lamps. Sample gross 8s. Quotations for quantities.
Messrs. TINDALL AND TELLING, Gas Apparatus Works, 74, Wynford Road, Penton Street, LONDON, N.

TO BE SOLD CHEAP, a 100-Light Gas APPARATUS, by Porter and Co., Lincoln, in excellent condition.
May be seen on application to ROBINSON BROS., Gas-Works, COVENTRY.

GAS-METERS.
FOR SALE, about 100 Gas-Meters (little used).
John Morton, Manager, Gas-Works, Muirkirk, will show the Meters, and offers will be received by JAMES GIBSON, Banker, Muirkirk, on or before May 1, 1877.

TO BE SOLD, Four Cast-Iron Purifiers, 6 ft. square, with hydraulic centre-valve; also Ten 18-in. round, and Sixty-two 15-in. round Retort Mouthpieces, and Forty-seven 6-in. H-Pipes.
Apply to W. WINSTANLEY, Manager, Gas-Works, NEWCASTLE-UNDER-LYME.

READING GAS COMPANY.
FOR SALE, as they now stand, and at any reasonable price, as the ground upon which they stand is wanted, four 12-ft. square Cast-Iron PURIFIERS, with centre-valve and connexions, grids, tee bars, &c., complete.
Apply to Mr. E. BAKER, Engineer, Gas-Works, READING.

WALTON-ON-THAMES AND WEYBRIDGE GAS COMPANY.
FOR SALE, Three Engines and Exhausters (Two by Gwynne, and one by Waller) for 15,000 feet per hour. Being about to be replaced by larger ones.
Can be seen at the Works, Walton-on-Thames, or particulars can be had of Mr. GEORGE ANDERSON, 35A, Great George Street, WESTMINSTER.

TO GAS COMPANIES AND OTHERS.
THE Dewsbury Corporation, having recently discontinued the use of their Batley Carr Gas-Works, offer FOR SALE the following GASHOLDERS—viz.:
One Telescopic Gasholder, 74 feet diameter, in two lifts of 18 feet deep each, with columns, guides, girders, with balance-weights, &c., all in good condition.
One Telescopic Gasholder, 58 feet diameter, in two lifts of 16 feet deep each, with columns, guides, girders, &c., in first-class condition.
The above Gasholders are suitable for putting in again, and will be sold at most reasonable prices.
Particulars may be had on application to the undersigned,
CHAS. A. CRAVEN, Engineer and Manager.

THE Swansea Gaslight Company have for immediate SALE, the following Plant:—
A 6-h.p. Patent Trunk Engine. (Beale.)
Exhauster to pass 15,000 feet per hour. (Beale.)
An 8-h.p. Grasshopper Engine. (Easton and Amos.)
Exhauster, 20,000 ft. per hour. (Beale.)
Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.
Wrought-iron Condenser, six vertical Legs, 39 ft. high, 34 in. by 6 in., with tar-boxes, dips, and syphons.
A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.
May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.
Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

GASHOLDERS.
FOR SALE, Two Telescopic Gasholders.
One 50 ft. by 16 ft., the other 70 ft. by 20 ft., each complete, with cast-iron tanks, columns, girders, and inlet and outlet pipes, valves, &c., both of modern construction, in good condition, and made by Messrs. Piggott and Co., of Birmingham. To be seen at work at the Gas-Works, Birkenhead. Cause of removal to make room for extensions.
To be sold a bargain, taken down and re-erected ready for work.
For particulars apply to ASHMORE AND WHILE, STOCKTON-ON-TREES; or to view, apply to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

FOR SALE.
A Set of 8-in. Vertical Condensers, with tar-box and all connexions complete, containing about 180 ft. of pipes.
Also a SCRUBBER, 12 ft. high, 5 ft. diameter, with reversing valve.
The above are nearly new (only been in work six years), and are now removed to make room for larger.
May be seen and price obtained on application to H. and F. BAILEY, Engineers, EAST RETFORD.

THE Newport (Mon.) Gas Company have FOR SALE the following PLANT at their Works, Newport, Mon.:—
Two Cylindrical Boilers, 13 ft. by 4 ft., with fittings complete, and steam-pipes to engines.
Two Horizontal Engines, each cylinder 9½ in. diameter, and stroke of each 1 ft. 6 in.
Two Beale's Exhausters, made to pass 20,000 cubic feet per hour each, with regulators and bye-pass.
The above are in good order, have been working during the past winter, and are now offered for sale because larger ones have been fixed.
They can be seen at the Works, Mill Street, Newport, Mon.
THOMAS CANNING, Engineer.

THE Chepstow Gas Company desire to receive TENDERS for the purchase of their TAR and AMMONIACAL LIQUOR, together or separately.
For particulars and forms of tender, address Mr. WILLIAM DORE, Secretary for the Company.

TO TAR DISTILLERS, DYE MANUFACTURERS, AND OTHERS.
THE Directors of the Swansea Gaslight Company are prepared to receive TENDERS for the purchase of the TAR produced at the Gas-Works, Swansea.
For information as to terms and conditions, apply to the undersigned,
THORNTON ANDREWS, Secretary and Manager.
Swansea, April 24, 1877.

TO TAR DISTILLERS AND OTHERS.
THE Directors of the St. Helen's Gas Company are prepared to receive TENDERS for the TAR produced at their Works (into which there is a siding from the London and North-Western Railway), for a term of One or Two years, commencing on the 1st of July next.
Sealed tenders, properly endorsed, to be sent in not later than Wednesday, May 16, addressed to the Secretary, Mr. E. DYSON, Gas Office, St. Helen's, LANCASHIRE.
The Directors do not bind themselves to accept the highest or any tender.

ELLAND-CUM-GREETLAND GAS COMPANY.
THE Directors of this Company are pre-pared to receive TENDERS for the purchase of their surplus TAR and AMMONIACAL LIQUOR, for One or Three years, from the 21st day of November next.
The Directors do not bind themselves to accept the highest or any tender.
Sealed tenders to be sent to the undersigned, from whom all particulars may be obtained, not later than Thursday, the 24th of May.
W. A. WALKER, Secretary, &c., to the Company.
Gas Company's Offices, April 28, 1877.

TO BUILDERS AND CONTRACTORS.
THE Eastbourne Gas Company invite TENDERS for the construction of a GASHOLDER-TANK on their premises at Willington, Sussex, 102 ft. diameter and 24 ft. 3 in. deep, in accordance with drawing and specification to be seen at the Office of Alfred Williams, 64, Bankside, S.E., Engineer to the Company.
Tenders to be sent in not later than the 7th of May, to J. H. CAMPION COLES, Esq., EASTBOURNE, endorsed "Tender for Gasholder-Tank."
April 26, 1877.

TO GASHOLDER MAKERS.
THE Eastbourne Gas Company invite TENDERS for the erection of a Single-Lift GASHOLDER, 100 ft. diameter and 24 ft. deep, on their premises at Willington, Sussex, in accordance with drawing and specification, to be seen at the Office of Alfred Williams, 64, Bankside, S.E., Engineer to the Company.
Tenders to be sent, endorsed "Tender for Gasholder," not later than the 7th of May next, to J. H. CAMPION COLES, Esq., EASTBOURNE.
April 26, 1877.

TO COAL MERCHANTS, SHIPOWNERS, AND OTHERS.

THE Directors of the Torquay Gas Com-pany are prepared to receive TENDERS for the supply of about 5000 Tons (or such other quantity as may be agreed on) of Pelaw Main, Waldrige, Pelton, New Pelton, Peareth, or other approved GAS COAL. About 600 tons per month to be delivered during June, July, August, September, and October, and the remainder at the rate of about 400 tons per month during the succeeding five months.
Tenders to state the price of Coals and freight to Dartmouth, separately and together, and also for delivery into the Company's Works, free of all charges.
Payment by cash for freight on delivery, and by three months bills for the Coals.
Further particulars to be obtained from Mr. Greenfield, the Manager of the Company, Hollacombe, Paignton, and tenders to be sent to the undersigned on or before the 14th day of May next.
By order,
J. KIRSON, Secretary.
Torquay, April 23, 1877.

TENDERS FOR GAS COAL.
THE Bangor Water and Gas Company, Carnarvonshire, invite TENDERS for 1400 tons of the best GAS COAL, to be delivered in such quantities, and at such periods as may be required during the Twelve months ending June 30, 1878.
Parties tendering must give full particulars of the Coal offered, and the colliery from which they propose the supply, to be delivered carriage paid at the London and North-Western Railway Station, Bangor.
Sealed tenders, addressed to the undersigned, will be received until the 15th of May next.
DAVID WHITE, Secretary and Manager.
April 21, 1877.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.
THE Bangor Water and Gas Company, Carnarvonshire, are prepared to receive TENDERS for their surplus TAR and AMMONIACAL LIQUOR, for One, Two, or Three years, from the 1st of June next.
The Company will deliver the Tar and Liquor at the Bangor Railway Station, in iron tanks to be provided by the contractor.
The Company do not bind themselves to accept the highest or any tender.
Particulars may be obtained of the undersigned, and the tenders must be sent to me not later than the 22nd of May next.
DAVID WHITE, Secretary and Manager.

ROCHDALE CORPORATION.
GAS DEPARTMENT.—TENDERS FOR COAL.
THE Gas Committee of the Corporation invite TENDERS for the supply of COAL for One or Three years, to be delivered free in waggons at the Milkstone siding, Rochdale, or at the Gas-Works, in such proportion as the Gas Manager may direct.
Tenders, endorsed "Tender for Coal," must be sent to me on or before the 8th of May next.
All particulars can be obtained from Mr. Patterson, the Manager, Gas-Works, Rochdale.
By order,
ZACH. MELLOR, Town-Clerk.
Town-Hall, Rochdale, April 26, 1877.

ROCHDALE CORPORATION.
THE Gas Committee of the Rochdale Corporation invite TENDERS for certain alterations and renewals of PLANT in their Retort-House.
Plans and specification may be seen at the Gas-Works, and any other information required will be furnished by Mr. Paterson, the Engineer.
Sealed tenders to be sent in to me not later than the 7th of May next.
By order,
ZACH. MELLOR, Town-Clerk.
Town-Hall, Rochdale, April 19, 1877.

TO CHEMICAL MANUFACTURERS, TAR DISTILLERS, AND OTHERS.
THE Chorley Commissioners are pre-pared to receive TENDERS for the purchase of their surplus TAR and AMMONIACAL LIQUOR for One or Three years from the 16th of October next.
The Commissioners will deliver the goods at the Chorley Railway Station into waggons to be provided by the Contractor.
Particulars may be obtained on application to Mr. Thomas Hamer, Gas Manager, Chorley, Lancashire.
The Commissioners do not bind themselves to accept the lowest or any tender.
Sealed tenders to be sent to the undersigned not later than the 15th of May next.
By Order,
RICHARD JACKSON, Solicitor,
Clerk to the Chorley Commissioners.
Dated the 6th of April, 1877.

RIPON CITY GAS-WORKS.
TO GASHOLDER MAKERS.
THE Corporation of Ripon are prepared to receive Plans, Specifications, and Tenders for a Single-lift GASHOLDER, 60 ft. in diameter and 16 ft. deep, with 10-in. valves, syphons, &c.
The plans, specifications, and tenders to be delivered at the Corporation Office, Stammergate, on or before the 16th of May next.
No allowance for plans, &c., and the lowest or any tender will not necessarily be accepted.
Further particulars may be obtained on application to the undersigned.
By order,
ROBERT DARNEY, Manager.
Gas-Works, Ripon, April 21, 1877.

BOROUGH OF HALIFAX.
TO COLLIERY PROPRIETORS.
THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of 22,000 tons of GAS COALS and 3000 tons of CANNEL, to be delivered upon the railway siding at their Gas-Works. The whole to be supplied before April 30, 1878.
Specifications and forms of tender may be obtained on application to Mr. Wm. Carr, Engineer, Gas-Works, Halifax, and tenders, properly endorsed, must be sent to me on or before Wednesday, May 16, 1877.
By order,
A. C. FOSTER, Town-Clerk.
Town-Hall, Halifax, April 21, 1877.

BOROUGH OF BURNLEY.
THE Gas Committee of the Corporation are prepared to receive TENDERS for a supply of the best screened GAS COAL and CANNEL for One, Two, or Three years.
The quantities required for the first year will be 14,000 tons of Coal and 3000 tons of Cannel, to be delivered at the Gas-Works Wharf, on the Leeds and Liverpool Canal. For the second and third years the Corporation will expect to be supplied with any additional quantity they may require at the contract price.
Further particulars may be obtained on application to Samuel Petty Leather, Gas Engineer, Burnley, to whom all tenders, endorsed "Tender for supply of Coal and Cannel," must be sent on or before Wednesday, May 9, 1877.
By order,
A. B. CREEKE, Town-Clerk.
Burnley, April 17, 1877.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 8, 1877.

Circular to Gas Companies.

THE Crystal Palace District Gas Company have been unsuccessful with the Bill they promoted to get rid of the obligation to keep the amount of sulphur impurity in their gas below twenty grains per hundred cubic feet. We gave in our last "Circular" a conjectural outline of the case which would be presented by the promoters and answered by the opponents of the measure; and, in future numbers, we shall give in detail the evidence adduced on both sides. Briefly speaking, it embraced the points we mentioned, the object of the Company being to show that no practical means exist of purifying gas from the known "sulphur impurities, other than sulphuretted hydrogen," which could be employed without producing offence, while some identified sulphur compounds can be demonstrated to be present in gas, which utterly defy removal by any process yet discovered. It was further sought to show that the damage alleged to be caused to health and property by sulphur in gas, if real, might be attributed to other causes. On the other hand, the opposing Local Authorities sought to prove that practical means of purification were known, and that the damage done to property was real, and was undoubtedly occasioned by the production of sulphuric acid during the combustion of gas containing sulphur compounds.

At this moment it would be inopportune to make any comments on the evidence brought forward. Under present arrangements, the consideration of the Bill promoted by The Gaslight and Coke Company, with an object similar to that above mentioned, stands adjourned until to-morrow. Although, as we have said, the objects of the two Bills are identical, the circumstances of the two Companies are very dissimilar. If, then, the Chartered Company decide to proceed with their Bill, it is understood that while the evidence given in the previous case will be accepted by both parties, much additional testimony will be

adduced, with a view to strengthen the case of both promoters and opponents.

We ought to have said that at the onset it was proposed that the decision of the Committee should be reserved until the evidence on the two Bills had been heard. The Committee, however, determined that each should stand on its own merits. It cannot be disguised, that the decision of the Committee in the case of the Crystal Palace District Company causes apprehension as to the possible success of the Chartered Company's Bill; yet, as we have said, the circumstances of the two Companies are in many respects so different, that the last named may very properly urge their claims for a special consideration of their case. It is, no doubt, an anxious time for the Directors and their counsellors, who have to decide on the advisability or not of proceeding with their Bill, and we must leave them to their own deliberations.

Somewhat contrary to our expectation, the Local Authorities who have promoted Bills in the present session, to confiscate gas undertakings, are not meeting with much success. We were told last year—and, to say the truth, we, to some extent, believed it—that the days for Gas Companies had vanished, and that gas undertakings were about to pass into the hands of Corporations and Local Boards. Parliament, however, hesitates to sanction the transfers by compulsion, and Companies opposing purchase clauses in the Bills of Authorities have been in every case successful. The instance of the Blackburn Bill may be quoted against us; but it must be remembered that in this case, although the clauses empowering the Corporation to purchase are retained in the Bill, the Gas Company are virtually left to set their own value on the undertaking. The terms, we understand, have been arranged. The Corporation, under the advice of Mr. G. W. Stevenson, have agreed to pay annuities equal to maximum dividends on the subscribed capital, with a bonus on all classes of shares, the full particulars of which we shall give next week. The Ashton-under-Lyne Improvement Bill, as we mentioned last week, has passed, but with the purchase clauses struck out. The Gas Company, by the success of their Bill, obtained all they desired, and more, we might say, for they have, of course, auction clauses and the sliding scale inflicted upon them. The confiscating Gas Bill of the Hanley Corporation was, last week, promptly rejected by a Committee of the House of Commons, and the British Company are left to continue their prosperous career at Hanley without fear of molestation, at all events for many years to come. Perhaps, however, the greatest success achieved this session has been that of the Londonderry Gas Company, in the House of Lords. In this case the Corporation of Londonderry endeavoured to obtain power to make a compulsory purchase, but it was disallowed by the Lords Committee. In the accounts presented by the Company in support of their Bill, it was shown that, during the forty-five years of their existence, they had expended on works, out of profits, £12,000; and the whole of this sum was allowed as original capital entitled to 10 per cent., making the total original capital of the Company £36,000. They have also obtained power to raise additional capital to the amount of £24,000, with borrowing power to the extent of one-fourth of the total capital, the Company having at present no mortgage debt. Auction clauses and the sliding scale have, of course, been inflicted, although we are credibly informed that Earl Redesdale entertains precisely the objections we do to these provisions. The sliding scale, however, is not likely to operate to the prejudice of the shareholders, for the standard price of 5s. 9d. has been granted. At the present moment the Company are supplying gas for 5s. per 1000 feet, so there can be no immediate fear of a disastrous operation of the sliding scale.

Gas and water affairs at Ramsgate may now be considered as settled—that is, in Parliament. We mentioned last week that an agreement had been come to between the Companies and the Local Board, for the sale and purchase of the undertakings, on the terms we stated. The revived Bill of the Ramsgate Board, embodying the terms, and asking powers to borrow, has been reported by the Committee of the Commons, and the seal of the Local Board has—not, however, without opposition—been affixed to the agreement. The Bill of the Thanet Gas Company has also been reported, with amendments necessary to fit it to its altered limits. It now relates to only the Margate portion of the undertaking; for the Corporation of Margate lost their chance of effecting a purchase when the Ramsgate Board made terms with the Company. It will be remembered that the Company, in respect of the two undertakings, asked for power to convert £48,000 of expended profits into improvement stock; of this the Committee have allowed £16,000 to be charged to the Margate undertaking, and have limited the dividend on it to five per cent. The new capital is, of course, to be disposed of by auction, and the sliding scale of dividend is imposed. The

standard price has been fixed at 4s. 2d. per 1000 feet, and it is, in our opinion, too low. The Company should have stood out for, at least, 4s. 6d. It cannot be said that Margate is more favourably situated for gas-making than other towns which have been granted a higher price. The Company should strive to get the price amended in the House of Lords.

The day so anxiously expected by those who, not having a penny invested in a gas undertaking, regard with envy every farthing of profit made by a Gas Company, and that feared by those who object to the acquisition of gas undertakings on the ground that gas is likely to be superseded by some other means of illumination, is reported to be dawning. Electricity, it has constantly been said, is the force which will generate the light of the future, and now a Northern Light has appeared, which many believe will fulfil the prophecy. A Russian electrician, M. Jablochkoff, of St. Petersburg, has invented what is called an "electric candle," of which vague information reached us long ago. The invention has been exhibited in Paris, and will presently, we are told, be shown in London; and now we have details, incomplete enough, as to the nature of the invention. It would appear that M. Jablochkoff has succeeded in subdividing an electric current; that is to say, from what we may call an electric trunk main, he can carry off "services" to generate light at various points. The interest and value of this invention or discovery we are not at all disposed to underrate; but, at the same time, we must caution gas proprietors against attaching the importance to it which patent-mongers desire. It is now many years since Liebig demonstrated that electricity, generated by acid and metal batteries, could never compete, in point of economy, with the ordinary illuminants—American petroleum being then undiscovered. That opinion undoubtedly holds good to-day. But, since the publication of the "Familiar Letters," vast strides have been made in electric science. We have now the powerful magneto-electric machines of Wilde, of Holmes, and of another more recent inventor, whose name has, for the moment, escaped us. Either one of these ponderous machines, rotated by the force of a four or six-horse power steam-engine, will develop sufficient electricity to furnish such a light as may be seen, if we remember rightly, at the lighthouse at the North Foreland, and two or three other lighthouses round our coasts. What we wish now to learn is, how many "electric candles" one of these machines will supply. We read in the daily papers of the electricity furnished by an "ordinary machine;" but at present we are left in ignorance of what this expression means. It can only mean one of those we have mentioned, or one similar, invented by M. Jablochkoff.

With the information before us, we are disposed to concede that the invention may be applied to the lighting of large halls and theatres; but at what cost we cannot at present say. To the strongholds of Gas Companies, however—shops and dwelling-houses—we regard the invention as utterly impracticable. When it is mentioned that every "electric candle" must be furnished with two perfectly insulated "service" wires, which will have to be carried all about a building, the difficulty of the installation (without having regard to the expense) will, we believe, be enormous. Then comes the cost of the "ordinary machine," and the power to work it. Altogether, we cannot regard this invention, which, as it is put before us, is undoubtedly the most advanced step in electric illumination, as at all inimical to the interests of Gas Companies. We shall look forward with much interest to the experiment which it is reported is about to be made at the East India Docks, and shall endeavour to acquire all the information respecting the invention. In the meantime, we hope that no gas proprietor will be beguiled into selling his shares. Gas has still, we believe, a "long day." It will last our time.

We have now in the Metropolis a deputation from the Municipal Council of Paris, who, among other novelties, were invited to see, at the Baker Street Station, the manufacture of gas from shale oil, for illuminating railway carriages. It is the invention of Messrs. Pintsch and Co., of Berlin, and would have been mentioned to our readers earlier, but that we waited for details, which have not yet been supplied. The process may, however, be described in a very few words. Shale oil—Young's paraffin, we believe, was used when we saw the apparatus—is made to trickle slowly over the inclined floor of an iron retort, heated to moderate redness, on to the floor of another, heated more strongly. In this way about one third of the oil is converted partly into permanent gas, and partly into vapour, which are carried away to a gasholder. From this it is pumped into a large iron cylinder, in which it is subjected to a pressure of about six atmospheres. Every carriage to be lighted carries underneath it a similar cylinder of smaller dimensions, which is filled from the large stationary cylinder at, of course, nearly an equal pressure. From this the

burners in the roof of the carriage are supplied by means of suitable apparatus. The gas made has, at the ordinary test rate of consumption (five feet per hour), the illuminating power of more than forty candles, and costs, we believe, about 16s. per 1000 feet. When this is burnt at the rate of half a foot per hour, it is necessarily cheaper than common coal gas burnt at the rate of three feet per hour, and costing 3s. 6d. per 1000 feet. As regards the relative luminiferous value of the two lights, we must leave our readers to form their own opinion. They may travel on the Metropolitan line, lighted with coal gas, and, changing at Baker Street, get into a carriage on the St. John's Wood line, lighted with the oil gas, consumed at the rate we have mentioned, and may judge for themselves. The special recommendation claimed is the fact that a carriage, with a cylinder filled with the compressed gas in London, may travel hence to Aberdeen and return, without any necessity for replenishing the cylinder. We have a description and drawings of the apparatus of this or of a very similar invention in use on an American railway, which we may shortly lay before our readers.

The Corporation of Birmingham have justifiably, and even wisely, taken to dealing in gas-fittings. They do not manufacture, but buy in the open market, and retail to their gas customers. It is natural that their articles, stamped with a sort of Corporation guarantee of excellence, should command a sale. It is also natural that the proceedings of the Gas Committee should excite the ire of manufacturers from whom they do not buy. Unhappily, political feeling runs high in the Birmingham Town Council, and thus it happened that at a recent public meeting a Councillor and J.P. took the opportunity of making a disgraceful attack on the Gas Committee, whom he accused of jobbery and corruption in connexion with their trade in gas-fittings. The attack was altogether undeserved, and we think the Committee could have afforded to treat the slander with contempt. They have, however, taken it seriously to heart, and, failing to obtain an apology from the rancorous J.P., they have resolved on calling the attention of the Lord Chancellor to his conduct. With this little interlude, the gas business of the Corporation is progressing most satisfactorily. During the quarter ending the 31st of March last, 867 new services were supplied, being an excess of 337 over the number supplied in the corresponding quarter of 1876. The average illuminating power of the gas supplied, according to official testings, during the quarter, was 17·30 candles.

It is not without amusement that we learn that the advice we have several times given to our North British friends, to reduce the quality of their gas, is interpreted as part of a deep design to procure a reduction in the price of Scottish cannel, for the advantage of English Gas Companies. It is hardly necessary to say that no idea of the sort ever entered into our head. Our Scottish friends are welcome to their twenty-eight candle gas as long as the material which will furnish it lasts. That may not be very long, and soon a descent, we imagine, will be made to twenty-three or twenty-five candles, at which the standard may remain for many years. The process of Messrs. Aitken and Young, a report on which we shall publish next week, will perhaps prolong the days of rich gas; but as the gas is enriched at the expense of the tar, which thereby loses something of its commercial value, we fancy the cost of the gas must be somewhat increased.

Water and Sanitary Notes.

ANOTHER Conference on the Health and Sewage of Towns has been held under the auspices of the Society of Arts, and it has been well attended. If no great good is to be expected from these meetings, which give various gentlemen the opportunity of dilating on their crotchets, and, in some cases, of puffing their inventions, at all events no harm is done. Most people who attend these meetings go there possessed of fixed ideas, and nothing they hear at all affects their opinions. The hour and the man have yet to arrive, at which and by whom the "sewage difficulty" will be solved, and perfected sanitary arrangements make the lifetime of an average Englishman equal that of Old Parr. Meanwhile, we shall have to listen to such "distracting utterances" as are evoked by the praiseworthy efforts of the Society of Arts to encourage invention, and disseminate information. Our special thanks are due to the Society for liberally furnishing printed copies of the papers to be read at the Conference. A glance over these papers shows them to be of very unequal value, some being of much interest, some of very little, and one, at least, being distinctly foolish. Nevertheless, we recommend all our readers interested in the sewage question to become possessed of this book, for it opens with a summary of returns furnished to the Society by various

towns, showing the mode in which sewage is dealt with in the several localities, the cost and other particulars, to which the population and death-rate have been added. One other item of information should have been given—namely, the density of the population; for, in our opinion, other things being equal, the death-rate of a community varies with the space into which the individuals composing it are compressed. All such returns are, of course, more or less misleading; but this, to our minds, bears evidence of being compiled with more than usual care. In connexion with the Conference, there was a small Exhibition of Sanitary Appliances, and some inventions displayed therein we would notice, but for the fact that our limited space is just now so much occupied with parliamentary proceedings.

We have already mentioned that the undertaking of the Ramsgate Water Company has been disposed of to the Local Board for £70,000. Only a small profit is expected by the Board for a few years; but there can be no doubt that, in the course of time, the concern may, if the Board are disposed, be made very profitable. It is, however, a question whether a Local Authority should work a water undertaking so as to make a profit. We have always urged that a gas undertaking, in the hands of an authority, should only be made self-supporting, and much more might be said in support of our argument in connexion with a water undertaking.

The water accounts of the Corporation of Salford show that, at the commencement of the year ending June 30, 1876, the revenue account was credited with a balance to the bad of £3308. In the past year, however, a net profit of £1447 has been made, thus reducing the deficit to £1860. Last year seems to have been exceptional, for in the previous one a profit of £3690 was realized, which was handed over to the Salford Improvement Fund.

The Lambeth Water Company, exercising their undoubted legal rights, have lately excited a commotion among their tenants by demanding their rates in advance. The rates have hitherto been collected at the expiration of each half year, but the Company have given notice that they will collect the rent due on Lady-day, and with it that which would, under the old system, have become due at Midsummer. What has created the most dissatisfaction is, perhaps, the manner in which the change has been made. When alterations of this kind are contemplated, the tenants are fairly entitled to a long notice.

WIMBORNE MINSTER GAS SUPPLY.—A correspondent writes: "Gas matters here have been amicably arranged. The works, which are now situate in the town, are to be removed to a new and suitable site adjoining the railway, where entirely new works are to be erected, the plans for which have been entrusted to Mr. George Thorneloe, of London, the company's engineer."

QUALITY OF THE BIRMINGHAM GAS.—The reports of Mr. Thomas Jackson, the gas examiner, show that during the month of April, at the four gas-making stations of the corporation, 16 examinations of the illuminating power of the gas supplied to the borough were made. The maximum light in sperm candles was 17·61; minimum, 16·47; average, 17·14. The parliamentary standard is 15 candles, with Sugg's No. 1 "London" burner.

CANTERBURY GAS AND WATER COMPANY.—On the 28th ult. a special meeting of shareholders was held for the purpose of taking into consideration the question of the repayment of loans amounting to £7500. Two courses were proposed for adoption—namely, either to borrow again on mortgage, or to create 750 new £10 shares, and after some conversation it was unanimously decided to carry out the latter suggestion. A resolution was agreed to, that the shares should be distributed, as the Act of Parliament directs, *pro rata* among the present shareholders.

THE RECENT EXPLOSION OF GAS AT BRIGHTON.—At the meeting of the Brighton Town Council, on Wednesday last, the Works Committee reported that they had received a letter from the insurance companies with whom the property in Market Street and King's Road, damaged by the late explosion of gas, was insured, asking whether the corporation were prepared to admit their liability to make good the loss. The committee instructed the town-clerk (Mr. James A. Freeman) to reply that the Town Council were not prepared to admit any liability; on the contrary, they denied that the corporation were liable for the accident or its consequences. The course adopted by the committee was approved.

WASTE OF WATER AT BIRKENHEAD.—At the Police Court, on the 19th ult., a man named Butler was summoned for wasting the township water. The case was proved by water-inspector Jones, who said he found the valve of the defendant's closet tied up with wire, and the water running away for about a month, and Mr. Jones estimated that there had been a waste of 250,000 gallons. For the defence it was said that the cistern was out of order, and the landlord of the house had not attended to it. There were two other cases against the defendant, who was fined 20s. and costs in one, and 5s. and costs in the others. The Magistrate remarked that if every householder were to let the same waste go on, there would be no water for the use of the inhabitants.

ODESSA WATER-WORKS COMPANY, LIMITED.—At the meeting of this company in London, on the 30th ult., the report, an abstract of which we gave in our last, was adopted, and it was resolved "that a dividend at the rate of 1½ per cent. be and is now declared upon the A shares of the company for the year 1876, to be payable only when funds are available, and notice to that effect be given by the board; and that this meeting approves the creation of a debenture stock, bearing interest at 5 per cent. per annum, to rank after the mortgage debentures of the company now issued or hereafter to be issued, and that all or any warrants for dividends upon the A shares, for the years 1875 or 1876, be taken in payment for such stock in unbroken pounds, if tendered during the current year, and that all such stock be issued in such manner, upon such terms, and subject to such regulations as the board may from time to time prescribe."

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

DR. FRANKLAND AND THE LATE DR. LETHEBY.

SIR,—In the course of his cross-examination by Mr. Philbrick, on Wednesday last, before the Select Committee of the House of Commons on the Crystal Palace District Gas Bill, the following question was put to Dr. Frankland:—

"Now let me ask you this . . . Do you not know that Dr. Letheby himself, conducting his own experiments in his own way . . . actually prohibited the use of these large cylinders, because they led to results that could not be trusted?" Answer: "If he did abandon them, it would be because they gave too much sulphur."

Now, these words convey a grave imputation, and I must ask space for a reply.

For the last twenty years I have been more or less engaged with the late Dr. Letheby, and more especially in connexion with gas questions. Dr. Letheby was always well aware that his sulphur apparatus did not secure all the sulphur in gas, and was desirous to improve its efficiency. With this object, about 1861 (I being at the time engaged with him) we were making parallel experiments with one of the larger cylinders, and with two of a smaller size connected together, when the unexpected fact was discovered that 99·100ths of the sulphur caught was detained in the first of the smaller cylinders, and that the quantity there found was always greater than that found in the larger cylinder. As soon as this result had been confirmed by repeated experiments, the use of the larger cylinder was discontinued, and Dr. Letheby directed Mr. Sugg in the future to furnish the smaller whenever the sulphur apparatus was ordered.

These are facts within my own knowledge, and I relate them in justice to the memory and reputation of my deceased friend.

13A, Great George Street, S.W., May 5, 1877.

W. T. FEWTELL.

THE GAS REFEREES AND THE BOARD OF TRADE.

SIR,—Having been abroad when the letter from the Referees to the Board of Trade, inserted at p. 666 of your last number, was written, I wish to add my individual disclaimer of any intention to cast imputation on my professional brethren, the engineers connected with The Gas-light and Coke Company. I have a high opinion of some of these gentlemen, with whom I am personally acquainted, and I know nothing—and would certainly insinuate nothing—to the disparagement of any.

I regret that such an impression should have existed, and it can only have arisen from a misunderstanding as to the sense of our communication.

Westminster, May 5, 1877.

WILLIAM POLE.

SUGGESTED EXHIBITION OF GAS APPARATUS AT BRISTOL.

SIR,—One word upon this—don't! There are, to me, several reasons for saying this. The principal one is, that as it is probable the movement will be general, from the interest which has been taken in it by the public, the next Exhibition should be promoted by a representative body, such as the British Association of Gas Managers, with the view of producing a model one, which provincial gas companies could follow and promote in their own particular localities. For this to be done, and as great a success as possible ensured, the affair should be well thought out and thoroughly organized. It is manifest there is no time for this for the Bristol meeting; London is the place for the Association to hold such an Exhibition, and if they do, there is no reason why the scope of it should not be enlarged—general apparatus, gas-fittings, products of gas-works, plants grown in gas-works, and raw materials, with pipes, &c., exhibited. Such an Exhibition would be worthy of us as an Association, and worthy of the profession, the manufacture, and the business. Such, I do not doubt, would be a commercial success; but the companies and manufacturers should subscribe to a guarantee-fund. Let a committee, with power to add to their number, be appointed at our next meeting to carry this out. South Shields will then see how well its labours have been appreciated, and other towns will then have a Metropolitan model to follow.

South Shields, May 5, 1877.

W. J. WARNER.

SHOREHAM WATER COMPANY.—The half-yearly meeting was held at Brighton, on the 28th ult.—Mr. W. Hall in the chair. The report stated that there had been a steady increase in the business of the company, 58 additional services having been laid on during the past six months. There was an available balance of £296 15s. 11d., out of which a dividend of 3 per cent. (making 5 per cent. for the year) was recommended, which would absorb £225. The report was unanimously adopted, and the retiring directors and auditor having been re-appointed, the meeting terminated with a vote of thanks to the chairman.

MACCLESFIELD CORPORATION GAS SUPPLY.—General inconvenience was caused on Friday, the 27th ult., by a failure in the gas supply. The town was left almost in darkness for two or three hours, and shopkeepers and others had to resort to lamps and candles for lighting up their establishments. The pipes for several hours appeared to be charged with air instead of gas, and it was not until general business hours were almost over that the supply was of adequate illuminating character. This failure of the gas supply was very properly the subject of consideration at the ordinary meeting of the Gas Committee on Monday morning—Alderman Stancliffe, the chairman of the committee, presiding. The mayor also was present, and there was a full attendance. The following are the recorded minutes of the meeting:—"The gas manager (Mr. Lyon) having been called upon for his reasons why unilluminating gas was supplied for several hours on Friday evening last, whereby the town was left almost in darkness for a length of time, and he having stated that two pipes were left open admitting atmospheric air to mix with the gas, that he left the works in that state about 4.30 p.m., and did not return thereto till 7.30, when the darkness was being suffered, which explanation was not satisfactory, and having been duly considered, it was resolved that notice be given to the manager that his term of service cease in two months from this date. This notice was accordingly given by the chairman to the manager, then present. Also resolved that a gas manager be advertised for at a salary of £200 a year." (This is an increase of £50 on the present gas manager's salary.)—*Macclesfield Courier*.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXXIII.

SERVICE-PIPES (*continued*).

The ordinary appliances for drilling mains for connecting service-pipes are the ratchet-brace and diamond-pointed drill, fig. 17. In using these, there is necessarily an escape of gas until the hole is completed and tapped, and the service-pipe inserted. Various instruments, however, have been invented for performing the work without loss of gas, thus obviating not only the escape, but the risk of accident attendant thereon.

The apparatus invented by Mr. Upward, shown in fig. 18, answers the purpose admirably. The drill-post is secured to the main by a clamp chain, which serves for a variety of pipes of different diameters. The cutter, which is of the construction shown in the engraving, works in an air-tight cylinder. When the ratchet-brace is turned by the handle in the usual way, the cutter, on being fed by the screw, makes a circular channel in the iron, which is gradually deepened until a small button is cut out. This button is held in a hollow at the bottom of the drill, and is withdrawn with it. The feeding-screw is telescopic in construction, in order to admit of the apparatus being worked in a space where the room is limited. As soon as the hole is formed, the tapping begins, and is completed when the tap comes home to the shoulder. The piston-tap and drill are then removed by working the ratchet backwards, and the valve at the side is closed. A cap, fitting the cylinder gas-tight, and having a vulcanized india-rubber top, is now put on, the service-pipe is inserted through a door in the cap, and on the valve being opened is screwed up and completed.

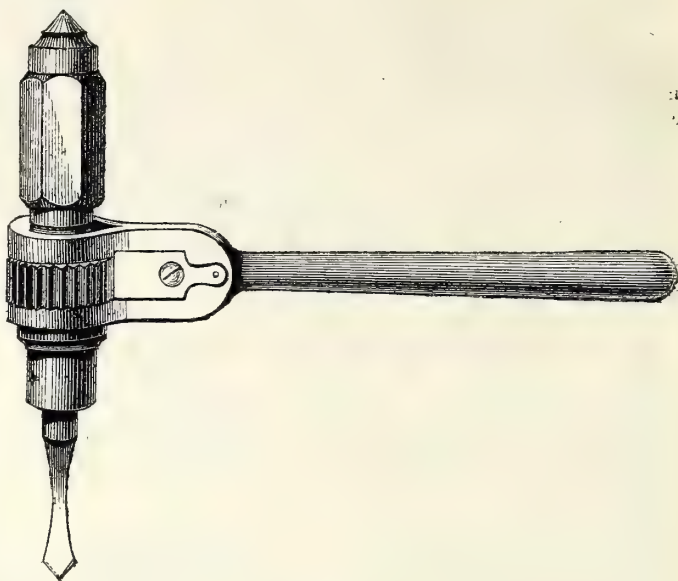


FIG. 17.

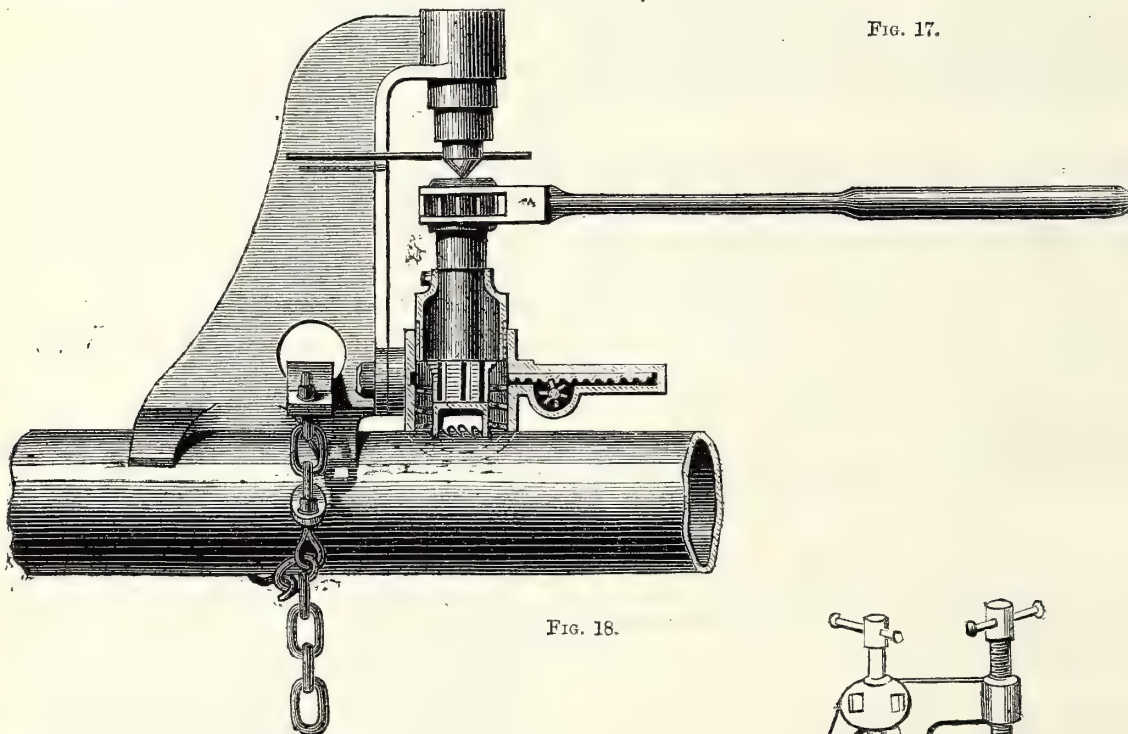


FIG. 18.

With this apparatus, all the operations of drilling, tapping, and inserting the service-pipe are accomplished in a quarter of an hour or twenty minutes, without the slightest escape of gas, and hammers, chisels, gouges, and rymers are entirely dispensed with. In confined situations, and in deep cuttings, in the vicinity of cellars, into which there is a liability of any escaping gas entering, and in subways, the use of this apparatus is invaluable.

Mr. Rafferty also devised an apparatus of the kind, which will be readily understood from figs. 19 and 20 and explanation. The apparatus consists of a small bag made of india-rubber, in the form of a frustum of a cone, fastened to the gas-main by straps and buckles. In the interior are fixed self-acting closing and opening doors, made of overlapping flaps of india-rubber, to allow the drill, rymmer, and tap to be introduced or withdrawn, as required. These latter are worked in the ordinary way by a ratchet-brace, which is supported by a light stand firmly chained to the gas-main.

The accompanying engraving is a view in perspective of the apparatus when in operation; *a* represents the gas-main to which it is required to connect a service-pipe, a cock, or a plug; *b* is a bag made of india-rubber, within which are the valves or doors, *c*, shown in section in fig. 20. The upper one is formed by cutting a slit in a disc of india-rubber, and the lower one consists of two overlapping flaps; these doors yield to allow the tool to pass, and when this is withdrawn they close again by their own elasticity, and prevent the escape of the gas. A ledge is made all round the base, forming a recess, to receive the borings in drilling the hole, and in screwing. The stand, *d*, is secured to the main by the chain, *e*, which passes under the main, and is hooked to the bridge,

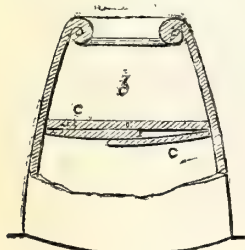


FIG. 20.

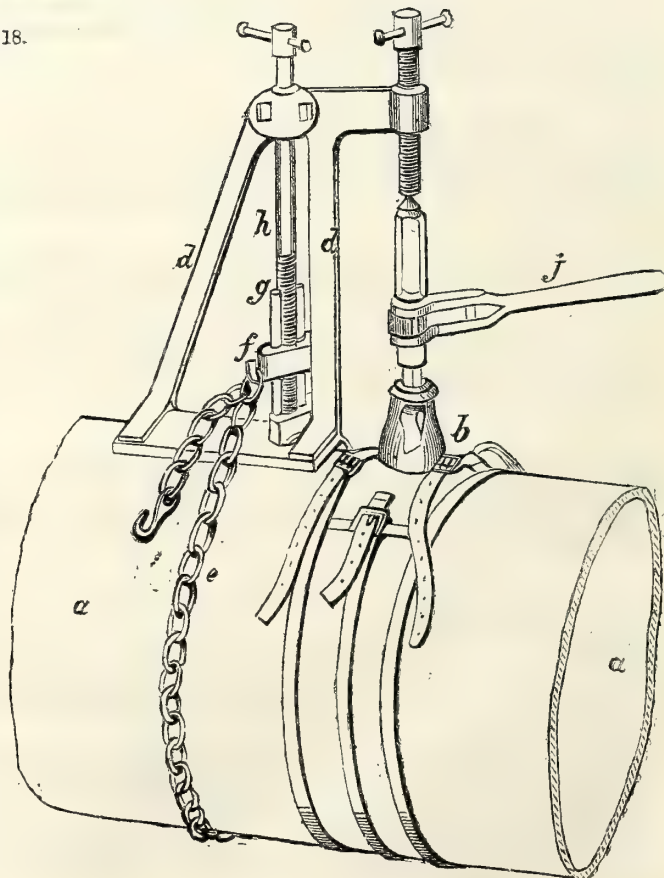


FIG. 19.

f, guided by the studs, *g*, and raised by the screw, *h*, to tighten the chain. The stand, *d*, also supports the screw, *i*, the end of which bears upon the end of the ratchet-brace, *j*.

The mode of operation is as follows:—When the stand, *d*, has been secured to the main, the requisite hole is bored through about three-fourths of the thickness. The gas-bag, *b*, is then placed in position, care being taken that its centre corresponds with the centre of the hole that has been partly bored. The drill is then passed through the gas-bag, and the hole is completely bored through, rymered out, and tapped by the usual tools. The drills, rymers, and taps are made with a shoulder resting on the top of the gas-bag, and this, as the tool penetrates the main, serves as a joint to prevent the escape of gas. When the hole is screwed it is ready for the service-pipe, cock, or plug; but, before removing the gas-bag, it is closed by reinserting the drill, which has a recess near its shoulder to receive an india-rubber ring, and this ring prevents the escape of the gas while the apparatus is removed, and the service-pipe, cock, or plug is got ready.

(To be continued.)

Parliamentary Intelligence.

HOUSE OF LORDS.

TUESDAY, MAY 1, 1877.

The CHAIRMAN of COMMITTEES informed the House that the opposition to the Sittingbourne Gas Bill was withdrawn.

The Longton Corporation Bill was read a second time and committed.

THURSDAY, MAY 3.

The Tudhoe and Sunderland Bridge Gas Bill, brought from the Commons, was read the first time, and referred to the Examiners.

GAS AND WATER ORDERS CONFIRMATION (BROTTON, &C.) BILL.—This Bill, for confirming certain Provisional Orders made by the Board of Trade under the Gas and Water Works Facilities Act, 1870, relating to Broton Gas, Guisbrough Gas, Bridport Water, Burgess Hill Water, Ruthin Water, and Pickering Gas and Water, was read the first time, and referred to the Examiners.

FRIDAY, MAY 4.

The Examiners reported that the further Standing Orders applicable to the Maryport District and Harbour (Gas) Bill have been complied with; and that no further Standing Orders are applicable to the Kent Water and the Stamford Water Bills.

The Carnforth District Water and the Leeds Improvement Bills, brought from the Commons, were read the first time, and referred to the Examiners.

A petition against the Kent Water Bill was presented from the Bromley Local Board.

HOUSE OF COMMONS.

MONDAY, APRIL 30, 1877.

The Carnforth District Water Bill, as amended, was considered.

The Leeds Improvement Bill, as amended, was considered. Three clauses were added, and amendments made.

A petition in favour of the Bishop Auckland District Gas Bill was presented from Inhabitants and consumers of gas in South Church.

TUESDAY, MAY 1.

The Tudhoe and Sunderland Bridge Gas Bill was read the third time and passed.

The Louth Gas Bill, as amended, was considered.

The Epsom and Ewell Gas and the Dukinfield and Denton Local Boards of Health Bills were reported.

The Hanley Corporation Gas Bill was reported, "Preamble not proved."

WEDNESDAY, MAY 2.

The Alliance and Dublin Consumers Gas (Bray Supply) Bill, as amended, was considered, and an amendment made.

The Ramsgate Water Bill was reported, "Parties do not proceed."

The Ramsgate Local Board (recommitted) and the Thanet Gas Bills were reported.

LOCAL GOVERNMENT PROVISIONAL ORDERS (GAS) CONFIRMATION (PENRITH, &C.) BILL.—This Bill, to confirm certain Provisional Orders of the Local Government Board relating to the Local Government districts of Penrith, Silsden, and Ynyscyhaiarn, was read the first time, and referred to the Examiners.

The United General Gas Company (Limerick) and the Waterford Gas Bills were referred to a Select Committee, consisting of Mr. Norwood (chairman), Mr. Richard Bright, Viscount Folkestone, and Mr. Ernest Noel; to meet on Wednesday, May 9.

THURSDAY, MAY 3.

The Carnforth District Water and the Leeds Improvement Bills were read the third time and passed.

The Wakefield Gas Bill was reported.

The Reservoirs Bill was considered in committee, and reported, with amendments.

FRIDAY, MAY 4.

The Bolton Improvement, the Leicester Gas, and the Sunningdale District Water Bills were reported.

The Crystal Palace District Gas Bill was reported, "Preamble not proved."

The Newport (Monmouthshire) Gas Bill, as amended, was considered.

The North Cheshire Water Bill, as amended, was considered, and an amendment made.

The Louth Gas Bill was read the third time and passed.

A petition against the new Standing Order, "Gas Companies Additional Capital," was presented from the Flint Gas and Water Company.

A petition against the Blackburn Borough Gas, Water, and Extension Bill (Lords) was presented from Matthew Brown.

The constitution of the Select Committee on the United General Gas Company (Limerick) and the Waterford Gas Bills was altered by the appointment of Mr. Arthur Vivian in place of Mr. Norwood. Mr. Richard Bright to be chairman.

HOUSE OF COMMONS COMMITTEES.

TUESDAY, MAY 1.

(Before Mr. ASHETON, Chairman; Messrs. SMITH, BELL, and DUNDAS; Mr. BONHAM-CARTER, Referee.)

RAMSGATE LOCAL BOARD (RECOMMITTED) BILL.

(Continued from page 666.)

Mr. GRANVILLE SOMERSET complained of what he described as a breach of faith. He said that during the contest between the Isle of Thanet Gas Company and the Ramsgate Local Board his clients (the Corporation of Margate), who were the urban sanitary authority in that town, appeared on petition, in which it was stated that by clause 60 of the local board Bill certain means were provided by which the petitioners were to acquire a transfer of the Margate portion of the undertaking. Previously to the presentation of the petition, an agreement to that effect had been come to between the authorities of the two towns. It was on the faith of that agreement that the clause was introduced into the Bill, the preamble of which stated that "whereas it is expedient that provision be made for enabling the Mayor, Aldermen, and Burgesses of Margate to acquire . . . so much of the undertaking of the gas company . . . which now supplies the borough of Margate and the neighbourhood thereof, and that the provision hereinafter contained for the transfer of so much of the said gas undertaking to the said Mayor, Aldermen, and Burgesses be made accordingly." But that provision was now struck out.

Mr. O'HARA submitted that as the Margate petition related only to the 60th clause, which was struck out of the re-committed Bill, his learned friend could not now be heard against the preamble.

Mr. SOMERSET said he intended to call a witness to prove what was the agreement between the parties.

The CHAIRMAN said he thought Mr. Somerset had better proceed.

Mr. SOMERSET proceeded to read the clauses of the original Bill relating to the transfer of the Margate portion of the works to the corporation in the event of the Bill passing. Those clauses, without the knowledge of his clients, had, by arrangement with the Thanet Company, been eliminated from the Bill, and his clients were left out in the cold. He was not going to argue the question whether it was advisable for corporations and local boards generally to have the control of gas-works, but he would say that, if in this particular district it was considered advisable for the Ramsgate Local Board to have such control, it was now much more so in the case of Margate, which would otherwise be left in the hands of a company who had no interest in the town, except to make money out of it. The public would be thus placed at a great disadvantage. He did not say that the arrangement which had been come to between the company and the Ramsgate Local Board was fraudulent, but he maintained that it was a very gross breach of faith, and he asked the committee to remedy the mischief occasioned to his clients by reinserting the clauses in the Bill so as to leave them in the same position they were in before.

Mr. CHANDOS LEIGH said he objected to the *locus standi* of his learned friend as against the Isle of Thanet Gas Bill, inasmuch as there was no petition from Margate against it.

Mr. SOMERSET admitted that technically he had no right, but if he was objected to here he would have the right to appear on petition in the other House.

Mr. POPE said it was not a question of *locus standi*, but a question as to what the committee could hear his learned friend upon, inasmuch as his clients had not petitioned against the Thanet Gas Bill.

Mr. O'HARA said the Margate petition was directed to a certain section in the local board Bill, and that section was struck out. There was no agreement in the matter, and his learned friend was stating that which was not the fact.

The committee-room was then cleared, and, on the counsel and parties being again called in.

The CHAIRMAN said: The committee are of opinion that the Bill which is now placed before them is in a different position from what it was when it was previously before the committee, and that under these circumstances the petitioners—we mean the Corporation of Margate—have a right to amend their petition, and to be heard against the preamble of the local board Bill.

Mr. G. F. Kelcey, examined by Mr. GRANVILLE SOMERSET.

I am town-clerk of Margate, and instructed counsel originally to appear on the petition against the Bill of the Local Board of Ramsgate. The matter was considered by the Corporation of Margate on Dec. 12 last, and this resolution was passed—"That this council approve of the project of the Ramsgate Local Board to obtain parliamentary powers in the ensuing session to purchase the whole of the undertaking of the Isle of Thanet Gaslight and Coke Company, provided that clauses be approved by the council and inserted in the Bill, making provision for the transfer to the corporation, on equitable terms, of that portion of the undertaking within the parish of St. John the Baptist." That resolution was sent to the clerk of the Local Board of Ramsgate; and I presume, in consequence of that, clauses 60 and 61 were inserted in the Bill. There was a meeting of the ratepayers of Ramsgate, and a poll was demanded, which took place in the early part of February; and on the 5th of that month the clerk to the local board wrote to me, notifying that the poll had resulted in favour of the promotion of the Bill, and he said—"The committee hear that some doubt has been expressed at Margate as to the incidence of the costs incurred by the local board in the parliamentary contest last session. I am desired to state that it never was, and is not intended, that Margate should be asked to pay one farthing for such expenses, and the committee will insert in their Bill any clauses approved of by your council to make this point clear." Upon that we took steps under the Borough Funds Act to consider the propriety of opposing the Bill promoted by the local board, and a meeting of the Town Council on the 23rd of February resolved to do so, it being understood that the opposition should only extend to protect the interests of Margate so far as the transfer of the Margate portion of the works was concerned. We were, therefore, substantially part promoters of the Bill, retiring from the opposition if we had proper power to purchase. The chairman of the Ramsgate Local Board was present at the meeting, and knew all that was going on, and we relied from beginning to end upon the agreement contained in the preamble and clauses of their Bill which are now struck out. We ask to be kept in the same position still. I only heard of the arrangement come to between them and the company by accident last Tuesday morning. If a transfer of the Ramsgate portion of the works to the local board does take place, we think we ought also to acquire the Margate portion, or we shall be placed in a very inconvenient position.

Cross-examined by Mr. O'HARA: There was no definite agreement come to between the corporation and the local board. A print of the Bill having been sent to us with the clauses inserted, making provision for transferring the Margate portion of the works to us, we were prepared, with a slight amendment of those clauses, to accept the Bill as it stood. We did not present a petition against the Thanet Gas Bill. The corporation intended to appear against it when it got into the House of Lords.

Re-examined by Mr. SMITH: If the preamble of the local board Bill had passed with these clauses in it, there would have been no necessity to oppose the Thanet Gas Bill.

At the suggestion of the REFEREE,

Rev. E. G. Banks was recalled, and examined by Mr. O'HARA.

I am now chairman of the Local Board of Ramsgate. I have read the preamble of this Bill. It is true in substance and in fact. We have made an agreement with the Isle of Thanet Gas Company with respect to their Ramsgate works. We could have come to an agreement before if we had chosen to be dishonourable to Margate; but we considered that we ought to stick to them until our preamble was declared not proved. We made the best bargain we could for Ramsgate, leaving the Margate works in the hands of the company, subject to whatever provisions the committee may make. I gave evidence before in favour of the whole of the original preamble, which stated that it was expedient that provision should be made to enable the Margate Corporation to acquire so much of the company's undertaking as now supplies the borough of Margate.

Mr. O'HARA: Was it your opinion that it was expedient, as stated in the old preamble.

Witness: I can answer that question if the chairman thinks it right.

Mr. SMITH: Have you changed your opinion, and do you now think that part of the preamble should be struck out?

Witness: I think it is better for Margate, and for all corporations, that they should have the works; but when Margate wants to get them, and we are to pay, I think these are different circumstances altogether. We only began our communications with the gas company at the last moment before the meeting of the committee. We did not make any communication to Margate on the subject; we did not think there was any reason for doing so. We have not been acting together in a friendly way up to the time of the breaking up of the committee before the recess. It was partly an understanding with us that they should oppose the Thanet Gas Bill, but they refused to sign the petition, and, therefore, we were not bound to them at all. There was no agreement that they should pay a part of the expenses we were put to in respect of that Bill, only for the promotion of our own Bill; and if we get our Bill, I am afraid we shall have to fight for it.

Re-examined by Mr. O'HARA: When we promoted a Bill last year we tried to get Margate to come to terms, the contention of the company being that we ought not to take one portion of their undertaking without the other. But we were met with the opposition of the mayor, he being the chairman of the water company, and also trustee for a great number of gas shareholders. He told me distinctly that he was opposed to us, and that he could not get the corporation to help us. At the same time, he thought the town wanted the works, so that he was in an awkward position. In consequence of his vacillation we found ourselves in a fix, whether to include Margate or not, and on the day previously to that for depositing petitions, I went to him and tried to persuade him to do it, but he said it was too late to do anything. The corporation then refused to petition against the gas company's Bill, but they did petition against our Bill on the 60th clause. The mayor himself refused to come and give evidence for us before the committee, and we said that we could do nothing, and must drop the Margate part of the Bill. The town-clerk also told me he thought it was the proper course for them to take to support us, but he could not get the corporation to see the matter in that light. They thought that by our doing it and spending the money they might possibly get an advantage, and we have to pay. More than that, I believe, in the Margate Improvement Bill, they first of all had clauses to purchase the gas-works, and those were struck out.

Mr. SMITH denied the correctness of this statement.

Mr. O'HARA having addressed the committee on behalf of the local board,

The room was cleared, and after a time counsel and parties were called in.

The CHAIRMAN: The committee have determined that the preamble of the Bill, as proposed on re-committal, is proved. We take it with the clauses relating to the Margate portion of the undertaking of the Thanet Gas Company struck out.

The clauses were then proceeded with.

On clause 62, relating to the capital to be authorized for the gas and water undertakings,

Mr. G. W. Stevenson was recalled, and examined by Mr. COOPER.

I have not prepared a detailed estimate for the £90,000 referred to in the preamble of this Bill with reference to the water-works, or the £80,000 with reference to the gas-works. It is impossible to ascertain how this money will be expended over a series of years—say, over the next 10 or 20 years. We know that the water-works do require some considerable extension, which will involve an immediate outlay of money, and that pipes are required to be laid to points to which they are not yet laid. There is no doubt that the difference between the sum which the local authority are paying for the gas and water undertakings and the sum they are seeking power to borrow will be required for capital purposes within the next 10 or 15 years. I can specify some things; but a detailed estimate would be misleading, and would be of very little value.

Mr. COOPER: Of the £90,000, does part consist of £70,000 to be paid to the water company? and in the case of the £80,000, does part of that consist of £65,000 to be paid for the gas undertaking?

Witness: Yes. A new gasholder is required at once for the gas-works—they are very short of storage room—and that will absorb quite £6000.

The clause was agreed to.

Mr. POPE stated that no provision was made in the Bill with reference to the presence of sulphur compounds in the gas, the question of the purification of gas from these compounds being at the present time under the consideration of a committee on another Bill.

The remaining clauses in the Bill, with amendments and additions, and also the schedules and M.S. clauses, were discussed and agreed to.

The chairman was ordered to report the Bill, as amended, to the House.

RAMSGATE WATER BILL.

WEDNESDAY, MAY 2.

Mr. MICHAEL said the course he had to adopt was to withdraw this Bill, as there was no object to be gained in proceeding with it. He therefore considered himself relieved from the pledge he gave the committee to proceed with it.

The CHAIRMAN: You withdraw the Bill?

Mr. MICHAEL: We withdraw the Bill, for I see no object in proceeding with it.

Mr. BIDDER: I quite assent.

The CHAIRMAN: We absolve you from your pledge with regard to that.

Mr. MICHAEL: That is why I mentioned it to you, in order that you might relieve me from the promise I made.

The Bill was then withdrawn.

THANET GAS BILL.

WEDNESDAY, MAY 2.

Mr. MICHAEL said the promoters, although their undertaking was cut in half, were obliged to proceed with this Bill, so as to regulate that portion of their undertaking still remaining, which related to Margate.

Mr. BIDDER, who represented the Ramsgate Local Board, objected to the Bill in the form now presented to the committee, alleging that if the Ramsgate Local Board Bill should from any contingency fall through, this

Bill would be binding on his clients. His learned friend's Bill, as framed, did not leave out the Ramsgate portion, but dealt with the capital and improvement stock of the company as a whole, inserting a clause, however, to the effect that from and after the vesting of the Ramsgate portion in the local board these figures should be reduced to half. The consequence would be that if the Local Board Bill failed to receive the Royal Assent his clients would be committed to a valuation of the capital of the company which would bind them in future.

Mr. MICHAEL maintained that what his learned friend desired was exactly what he had done. He had dealt with the matter as though for twelve months, or the period for which the undertaking was to be carried on as a whole, it was all subject to the terms of the contract entered into, and now forming part of the local board Bill. As the referee had taken some objection, as not being within the powers of the promoters, he (Mr. Michael) was ready to strike that out; but the underlying principle was this, and he must draw attention to the terms of the contract entered into with the local board. The vesting period was different from the time of purchase. The vesting period could only occur when the money was paid, but the time of purchase referred back, and occurred at a period anterior to that at which the Bill would pass—i.e., from Jan. 1, 1877, the company carrying on the undertaking subsequently, and until the vesting period, as trustees for, and at the risk of the local board, and they were to be paid a certain sum of money. Therefore, in the contingency mentioned, they must provide for carrying on the undertaking under any circumstances; and whatever was their capital, it did not affect his learned friend's clients in any way. They were to pay a certain sum— $4\frac{1}{2}$ per cent.—upon the amount of the purchase-money, and, therefore, whatever the company's capital was, it could not in any contingency matter to them. With regard to Margate, the plan was this: As soon as the vesting period came, the undertaking of the company would be cut in half, capital and everything else, and it was provided that from that time they should not supply any gas within Ramsgate and St. Lawrence.

The REFEREE said if he understood Mr. Bidder's contention aright, it was that, supposing his Bill did not pass, he might hereafter be in such a condition with regard to the additional capital as to be obliged to purchase the property of the company, taking that into consideration.

Mr. MICHAEL said it was impossible it could be so, because the price to be paid by Ramsgate was fixed. It was not as if they had to go before an arbitrator at the vesting period to fix the sum to be paid.

Mr. BIDDER said his point was this—it had been agreed between the company and the local board to carry out the purchase, and they had reason to believe the Bill to enable them to do so would become law, but they could not shut their eyes to the fact that some extraneous opposition might yet arise in the other House. Supposing it did, and the local board Bill fell through, his clients would be under the *régime* of this new Thanet Gas Bill for the future. This was the second session in which the local board had come to Parliament at an enormous cost to the ratepayers, and it was questionable whether the ratepayers would be willing to spend money on a third gas fight. He was, therefore, bound to look to this contingency, that if the present Bill passed in the form in which his learned friend chose to put it, his clients might in future be bound by it. He, therefore, asked that this Bill should be confined to Margate, and that under it the promoters should acquire no new rights which would fetter him in the future. There was, for instance, the standard price for gas named in the Bill; he should contend that it was an improper price if it affected his clients. Then again the amount of the improvement stock; he maintained that it was excessive and unreasonable, and there were various other matters that he should have to bring forward if there was any possibility of the company still having the control of the Ramsgate supply. He should also require to have provisions inserted with regard to the public lighting, the breaking up of streets, &c. He now proposed to insert this clause: "The powers and provisions of this Act with reference to standard price, and all other matters relating to the supply of gas, shall relate only to the Margate portion of the undertaking." If this clause were inserted, it would relieve him from the necessity for discussing with the promoters whether the powers asked for by them in their Bill were right and proper.

Mr. MICHAEL could not agree. His learned friend's argument proceeded upon a fallacy—viz., that, in order to carry out the agreement, it was necessary to have an Act of Parliament. This agreement was quite as binding upon the company as upon the local board, and was enforceable under the Public Health Act of 1875. It was not stated in the contract that, if the local board failed to carry their Bill, the agreement should be void, and of no effect.

Mr. BIDDER asked that an article should be put into it to the effect that the bargain might be confirmed, if necessary, in a subsequent session.

Mr. MICHAEL said he would do so with pleasure if that would relieve his friend from the difficulty.

The CHAIRMAN: What is the suggestion?

Mr. MICHAEL: The suggestion is that they may have the power—and we will help them to it by every means at our command—to pass a Bill in any subsequent session of Parliament. They are already relieved, for they have only $4\frac{1}{2}$ per cent. to pay on the purchase-money, even if the matter be deferred for five years, while they realize the whole of the profits, the company being only trustees for them to do exactly what they desire, and at their risk. It is just the same as though the purchase-money were already deposited in a bank, and the company were getting $4\frac{1}{2}$ per cent. upon it, but were not able to draw it out.

After some further discussion the room was cleared, and the committee deliberated. On the parties being called in,

The CHAIRMAN said: We think that the provisions of the Thanet Gas Bill should deal with the Margate portion of the undertaking only, and need contain nothing with reference to the contemplated failure of the agreement.

On clause 5, relating to the creation of improvement stock, being read, the room was again cleared. On the re-admission of the parties,

The CHAIRMAN said: The committee have decided that the amount of the improvement stock shall be £16,000, and that the interest upon it shall be 5 per cent.

Mr. MICHAEL: Would you now, sir, be kind enough to take evidence upon the initial price, and then you will be able to set us free.

The CHAIRMAN: We have considered the question of price, and have agreed to take the price you put in—viz., 4s. 2d.—and to insert the sliding scale and auction clauses.

The committee proceeded with the further consideration of clauses, which were agreed to, with amendments and additions, and

The chairman was ordered to report the Bill to the House.

THURSDAY, APRIL 19.

(Before Mr. SANDFORD, Chairman; Mr. LAMBERT, Mr. HANBURY, and Sir HUGH CHOLMELEY; Mr. BONHAM-CARTER, Referee.)

ASHTON-UNDER-LYNE GAS BILL.

ASHTON-UNDER-LYNE IMPROVEMENT BILL.

In this case the Ashton-under-Lyne Gas Company were seeking powers to raise an additional capital of £50,000, and to purchase land for the enlargement of their works. The Bill was opposed by the Ashton Corporation,

who, moreover, had introduced a Bill of their own, applying, among other things, for compulsory powers for the purchase of the works of the gas company. So far as the gas question was concerned, it was arranged to treat the two Bills as competing Bills.

Mr. CRIPPS, Q.C., Mr. POPE, Q.C., and Mr. GOULDTHORP appeared for the Gas Company; Sir E. BECKETT, Q.C., Mr. MICHAEL, and Mr. BALFOUR BROWNE for the Corporation of Ashton-under-Lyne, and also for Owners and occupiers of property in the district; and Mr. YATES on behalf of the Earl of Stamford and Warrington, petitioners against the gas Bill.

Mr. CRIPPS, in opening the case on behalf of the gas Bill, said the Ashton-under-Lyne Gas Company were established in 1825, with a capital of £30,000, and the only restraint imposed upon them in their original Act was that they should supply a light at least as good as oil would have given if the gas had not been supplied. In addition to the capital of £30,000, the company had also expended a sum of £6000 out of the profits, which they might otherwise have divided, which made their actual capital embarked in the business before the year 1847 about £36,000. In that year, however, they applied for an additional capital of £24,000, and also took power to raise that capital by what were now familiarly known as the auction clauses, and in that way they had raised the money required up to the present time. The company had been very successful in their business, the quality of their gas had been exceptionally good, and they had been enabled to supply it at very moderate prices. With regard to the new capital, the company originally proposed to raise it at 7 per cent., as had been the case for some years past with regard to other companies. Should, however, the new Standing Order proposed by the Chairman of the Committee of Ways and Means be adopted, the auction clauses would have to be taken in connexion with what was known as the sliding scale of prices. [The learned counsel then commented at some length on the proceedings before Mr. Forster's committee, when the sliding scale and the auction clauses were imposed on certain of the metropolitan gas companies.] As regarded the land sought to be purchased, a petition had been presented by a few parties within the 300 yards area, but he (Mr. Cripps) did not think the committee would be disposed to pay much attention to that, and he would proceed to certain points in which the case of the company differed from others. The Corporation of Ashton seemed to have desired to become the managers of the gas-works, and they had made several bids for them to the directors and shareholders of the company. In several cases unquestionably certain corporations had made arrangements with the gas companies, and those arrangements had been confirmed by Parliament; but it would be an entirely new thing for Parliament to give compulsory powers to buy up the interests of a gas company against the consent of such company. Under any circumstances a case must be made out, and, inasmuch as the company were not willing to sell, but the corporation sought for compulsory powers to purchase, it must be because the company had failed in their duty to the public. If the company, as alleged in the petition of the corporation, grossly exceeded their rights, and had charged the public very high, or had supplied them with bad gas, or had committed any misdeeds of that kind, there would be some ground in favour of compulsory purchase; but they could not prove anything of the sort. So far as individual members of the corporation were concerned, they might like to have more business to do, or they might like the superior authority of having a number of things to manage, and so sought to get the gas supply into their power. They might also like to get a profitable thing into their possession, so as to assist the rates. That was very intelligible; but they must go a great way further than that before they could lay a foundation for a case of that kind; they must show the desire of the consumers in the matter, and they must also show that the corporation could give a better supply. If there were any special matters in the case, they would tell extremely against the proposals of the corporation, because the area of supply was very much beyond the area of the borough. It happened that the area of supply was about four times what it would be in the borough only; and, consequently, if the works passed to the corporation, they would be nothing more than another company as regarded three-fourths of the area. The corporation would very likely say that the company did not apply to Parliament for new powers until they found out that the purchase was contemplated, and that was true, but they would have had to apply next year. When the Bill of the corporation came on, the company would show in detail a variety of reasons why they did not think there was the slightest pretence for their application. If the committee decided to impose upon the company the auction clauses and the sliding scale, a very important question would arise as to the commencing price from which to slide either way.

The CHAIRMAN said that point had better be reserved.

Mr. CRIPPS said he would produce evidence to show that the business of the company had been conducted properly and economically. He would also show that no change was desired by the consumers and customers of the company—no change, at any rate, in desiring the supply to be in the hands of the corporation.

The following evidence was then called:—

Mr. A. Buckley, examined by Mr. GOULDTHORP.

I am secretary and solicitor to the Ashton Gas Company, and have had more or less to do with the affairs of the company for at least 15 years. The original Act of the company was obtained in 1825, and the capital authorized was £30,000. The company were also empowered to carry out a water-works scheme, but that has never been done. The original capital was raised in 1200 shares of £25 each, and in addition to that capital the company spent £6000 out of profits, which amount was capitalized by Parliament in 1847. In that year the company were also authorized to issue some new shares, of £30 each, under what are called the auction clauses. The shares were to be put up in lots, and such lots were not to contain more than 40 shares. The new capital, which amounted to £24,000, was to bear 10 per cent. interest on the nominal amount of the shares, and any premiums obtained were to go to the credit of the company, but not to have any interest paid on them. The effect is that at the present time the real capital of the company is £59,800 odd, while the dividend-paying capital is only £47,700. We did not obtain any borrowing powers under the Act of 1847. By the same Act this district [pointing out same] was taken from us, and all parts of the parish of Ashton-under-Lyne which were in the borough of Stalybridge, but in other respects the *status* of the company was the same as under the old Act of 1825. On Oct. 18, 1850, the first lot of 40 shares, of £30 each, was sold by auction for £2104 9s. 4d. On Sept. 30, 1851, 80 shares were sold for £4532 1s. 5d. On Aug. 31, 1855, 60 shares were sold for £3577 7s. 9d. On Nov. 8, 1855, 50 shares were sold for £3116 17s. On Nov. 13, 1874, 80 shares were sold for £5190 19s.; and on Oct. 20, 1875, 80 shares were sold for £5363 6s. The company have recently expended considerable sums in extensions, alterations, and improvements beyond what has been spent out of capital. The dividends paid since 1847 have been as follows:—For the year ending June 30, 1847, 5½ per cent.; 1848, 8½ per cent.; and since, with the exception of 1850, 10 per cent. In the year 1850 they not only paid 10 per cent., but also the deficiency of 4½ per cent. and 1½ per cent., so as to make up the two earlier dividends to 10 per cent. In 1854 an agreement was entered into with the Dukinfield Gas Company, by which the Ashton Gas Company relinquished a certain right to supply gas in Dukinfield. At that time the Dukinfield Gas Company were applying to Parliament for additional powers, some of

which the Ashton Gas Company thought detrimental to their interest. The result was that on condition of the Dukinfield Gas Company giving up those clauses the Ashton Gas Company agreed to sell the right of supplying Dukinfield, and they received £1500 for the mains which were laid in that district, that amount being subsequently applied to capital purposes. In 1870 and 1871 the price charged by the Ashton Gas Company was 4s. per 1000; in 1872, 3s. 9d.; in 1873, 4s.; in 1874, 1875, and a portion of 1876, it was 4s. 6d. In October, 1876, it was reduced to 4s. 2d., at which price it still remains. All consumers are entitled to a discount of 6d. per 1000 feet if the accounts are settled within a month or six weeks. Consumers of between 300,000 and 500,000 feet get a discount of 1d. extra, making 7d.; between 500,000 and 600,000, 2d. extra, or 8d.; from 600,000 to 800,000 the discount is 9d.; from 800,000 to one million, 10d.; from one million to 2 millions, 11d.; and above 2 millions, 1s. The price charged is the same to all consumers, both inside and outside the borough, with the exception of a small district called Haslehurst, where an extra 6d. is charged, because there are so few consumers there. In September, 1876, I received a communication from the town-clerk of Ashton in reference to the sale of the works. It was to the effect that the corporation offered to secure to the shareholders 10 per cent. on the amount of their paid-up capital, clear of income-tax, to be paid to the shareholders by the bonds or debentures of the corporation. If the purchase-money was desired by the company to be paid in cash, then the corporation offered £60 per share. If the company desired to be secured by stock of the corporation, then coupons would be granted to the shareholders at £75 for each share, bearing interest at 4 per cent., clear of income-tax. The reserve-fund was to be dealt with at the discretion of the gas company alone. The reply of the company was that the terms were inadequate, and such as the directors could not recommend their shareholders to accept. On Jan. 22, 1877, a second proposal was made by the corporation, but the directors again refused to entertain the offer. On the 22nd of February a deputation from the corporation waited upon the company, and verbally offered to purchase the undertaking for £125,000 in cash, or to give coupons in stock to the extent of £78 12s. 4d. in respect of each £30 share. A meeting of the directors was held on the 24th of February, and a resolution was passed by them declining to accede to the purchase, which decision I communicated to the town-clerk.

Cross-examined by Mr. BROWNE: I am a small shareholder in the company, and paid between £60 and £70 for my shares. The last shares that were sold in the market realized £75 each, I believe.

By the CHAIRMAN: Those shares were sold subsequent to the corporation offers, but I believe the shares sold previous to that fetched about £67 or £68 each.

Cross-examination resumed: There are 81 shareholders in the company, holding in all 1599 shares. I had nothing to do with getting up the petition against the Bill of the corporation, although I signed it on behalf of a coal company. My brothers and myself are sole owners of the Limehouse Coal Company, and have supplied a portion of the coal required by the gas company, but I think the larger portion of their coal has come from Dukinfield. The reason we are applying for our Bill is because we have exhausted all our capital powers, and an increased supply of gas is necessary. I do not admit that the supply is insufficient at present, but we must look ahead, and take the natural rate of progression we have had before. After obtaining power to raise fresh capital, it will take probably two or three years to erect the necessary works. All corporate bodies are supplied on precisely the same terms as private consumers; the only difference is that the more gas they consume the larger discount they get. The £6000 which was capitalized in 1847 had been spent out of profits, so that the shareholders lost their dividends to that amount. At one period we had a reserve-fund, but it has been exhausted, and we owe money to our bankers. When we sold our pipes to the Dukinfield Gas Company, the company had a concurrent power with ourselves for the supply of that place, and we thought it was better to come to a friendly agreement than to have a collision. That district is very populous now. Supposing the supply of the Dukinfield district to have been remunerative to some extent, the consumers of Ashton-under-Lyne have been disadvantaged by the transfer. If we could have made a very large profit there, it would have had a tendency to lessen the price of gas a little; but there is this question to consider, that in Dukinfield, in my opinion, it would not have been a remunerative business, because we were in competition with another company, and anything we had done there we should have had to do probably without any profit at all. Our works at Ashton are closely surrounded by houses on all sides; they are between 250 and 300 yards from the town-hall. If gas could be manufactured in a less populous place, it would, no doubt, be better, but the works have been there for 50 years. We are only proposing to add a small piece to that station. I think it is probable we might procure land elsewhere for our works if we paid a sufficient price for it. I think the price charged by the Ashton Company is low, in comparison with any of the towns in the district, excepting, perhaps, Manchester, but they have there a very large area of supply, and consequently can make gas cheaper than we can. I believe it is a usual thing for large consumers to get gas cheaper than small ones. I am not aware it is inserted in Acts of Parliament, but there is nothing to prevent companies from doing so, and, as a matter of practice, I think it is done. With regard to the offer of purchase, speaking as a consumer, I should want something more than the offer of 10 per cent.; I should want the corporation, if they purchased, to be restrained from making an unreasonable profit. If I were a millowner, I should lose far more by an increased price for gas than I should gain by a reduction of rates. In the adjoining parish of Oldham, they make an enormous profit out of the gas, and I think their price is something more than ours. I will pledge myself that the average price is more.

Mr. BROWNE: If the corporation have not to pay 10 per cent. on capital they can make profits where a company could not, even keeping the price charged for gas low?

Witness: I do not say you could in this instance, because you have offered such a price for the works—£125,000.

Mr. BROWNE: You think that is too much?

Witness: It is such a price that you would have to get something back for it, and the more you pay the more you will have to get back.

Mr. BROWNE: But you say by your Bill that £60,000 are required for additional works in the district.

Witness: It is not required for to-day, but for the future.

Mr. BROWNE: You are asking parliamentary sanction to your raising £50,000 by share capital at 7 per cent., will not the gas consumer have to pay that 7 per cent.?

Witness: I am not aware that he will, because we shall have so many more consumers that we shall be able to let him off so much cheaper. I do not think the corporation could borrow £50,000 at 3½ per cent.; they might perhaps at 4 per cent.

Mr. T. W. Mellor, M.P., examined by Mr. GOULDTHORP.

I am a member of Parliament for the borough of Ashton-under-Lyne, and am deputy-chairman of the Ashton Gas Company. The board consists of eight members, and meets regularly on the third Monday in every month, or more frequently, if necessary. The directors also attend to the management of the works; I have myself, when in Ashton, gone through the works at least once a week, to examine the working plant,

and see that everything is in proper order. I have heard very few complaints about the supply of the gas; but there are always discontented persons to be found in every community. I consider the gas of a very good quality compared with neighbouring towns, not even excluding Manchester. There may have been complaints in the Audenshaw Local Board district, owing to insufficient pressure; but a station governor has been added to remedy that, and I have heard no complaints since. I attribute the excellent quality of our gas to the care and watchfulness bestowed on the works. We always select the very best materials, and the cannels and coals which give gas of the greatest illuminating power. I certainly consider the discount to large consumers a proper principle. I find that the corporation themselves, in some cases, allow a discount of 75 per cent. in the water supply, and in other cases 47 per cent., according to the quantity consumed. A large consumer ought to be supplied at a less cost than a small consumer, because the leakage is less, the cost of collection is reduced, and, in fact, considered in every way, he is entitled to a less price than people who simply burn 10,000 or 20,000 feet per annum. In the case of a cotton mill the leakage would be reduced, there being only one supply-pipe, instead of 50 small ones. If we did not make reductions, the large consumers would make their own gas; I believe four do so at present. I do not think it is at all desirable for the corporation to become possessed of the gas-works, and I speak as a shareholder, a ratepayer, and an inhabitant of the borough. To ask my opinion as to whether the Ashton Company have carried out their duties, is asking me to pass an opinion upon my own conduct as a member of the board, because I believe we have all been prompted with one consideration, and that is to do the best for ourselves and the public. I think if the same principle were carried out in the borough of Ashton by the corporate body, in the event of their becoming possessed of these works, which is adopted in Manchester, it would seriously affect the outlying district, because they would become indirectly contributory to keeping up all the highways, and to meet other charges incurred by the corporate body in administering the affairs of the borough. I am acquainted with all the towns within a few miles radius of Manchester. Comparing our supply inside and outside the borough with that inside and outside Manchester, Ashton comes out very favourably. I heard Sir Joseph Heron the other day state that the outside price was 4s. 8d. At Oldham the maximum price inside is 3s. 8d., and outside 4s. At Stockport the maximum price inside is 4s., and the minimum 3s. 10d.; but outside the borough the price is 4s. 8d. In fact, the average price of all the corporate towns in the county of Lancaster is 3s. 11d., and the maximum price ruling in Ashton at the present time is 3s. 8d., so that we are below the average of the entire county, where the gas is manufactured by corporate bodies. The gas consumed in the year ending June 30, 1876, in mills and workshops, was 133 million cubic feet. The amount consumed by the directors was about 8,579,500 cubic feet. One of the directors is the largest consumer of gas in the town; another is also a large consumer; and there is a third who is largely interested in ship property, which is a consuming property. I do not think the Corporation of Ashton, as consumers of gas, are sufficiently interested in the making of it. I believe 15 per cent. of the gas at present produced is retailed outside the borough. The consumption by the corporation for the year ending June 30, 1876, was 5,527,180 cubic feet, which is not 5 per cent. of the whole quantity produced at the works. I am not aware that the Bill of the corporation makes any provision for any increased demand, nor for the purchase of any extra land, and it is very necessary that the works should be enlarged to meet the increasing requirements of the neighbourhood. I do not believe the compulsory purchase of the gas company would be advantageous, because, in my opinion, the management would not be so good as it is. The profits accruing would also, I presume, be applied in reducing the highway and other rates, and how far that would operate is a matter of conjecture. With regard to the position of the works, all the property, with the exception of two streets, has come to the works. I have never heard of any complaint from the corporation, or any request that the works should be removed. If the corporation were to buy the property, and erect extra works, if their statement is true, there must be an increased nuisance. There have been considerable alterations in the works during the last few years; there are always improvements going on in the mode of manufacturing gas, and these we have availed ourselves of at different times. We cannot meet the requirements of the neighbourhood unless we acquire the additional land, marked No. 4. The cottages around our works are worth about £8 or £12 a year, and many of them are of recent construction. The sight we propose to take is the only eligible land available. We would rather have had a green field, but it is not there. I have not heard that anybody has objected to our proposed No. 4 site. The allegation in the petition of the corporation, that our application is in consequence of their action, is not true, because the matter was talked about two years ago, and our lawyer was consulted about the matter, and also an engineer from Leeds, whose name, I think, was Arnott.

Cross-examined by Mr. MICHAEL: Strictly speaking, if the maximum dividend is guaranteed to the shareholders, they would have no further interest in the concern; but we are desirous of retaining the works in our own hands, because we believe they cannot be so well managed as they are at present.

Mr. MICHAEL: Will you turn to the accounts of profit and loss for the year 1875, and tell me the amount of profit in that year?

Witness: The sum was £1425, and the amount of capital on which we had to pay 10 per cent. that year was about £45,000, which would require £4500.

Mr. MICHAEL: It is clear from your accounts you only made a profit of £1425, which would leave a deficiency of over £3000. Would it not have been a benefit to the shareholders, at least in that year, that instead of having the loss of £3000, you should have had the guaranteed dividend?

Witness: In that case it would have been all the better, evidently. The guaranteed dividend, looking at it from a shareholders point of view, is certainly better, but it is not beneficial in other ways.

Mr. MICHAEL: What other prospective advantage can there be to your company, whatever the amount of future capital you raise?

Witness: Whatever future capital we raise is of no advantage whatever to the present shareholders.

Mr. MICHAEL: Quite so; and as you have to equalize the dividends it is possible that the new capital may not be so productive as the old, and therefore will diminish your dividend; consequently, with every increase of capital under the conditions on which you have raised it, there is a greater prospective possible loss to the shareholders from the increase in the works?

Witness: I do not see that, because we have always gone carefully in our extensions. We have not gone hastily to work until there was some consumption guaranteed, which would realize us at least from 4s to 5 per cent. profit. We have never taken into account any depreciation of works, and the repairs that have been going on we consider have been equivalent to any depreciation. Some years ago we had a reserve-fund amounting to about £4000, a portion of which was invested in Sheffield and Lincolnshire stock, but we were obliged to sell out in order to expend it upon extensions.

Mr. MICHAEL: Do you think it was competent for you to do that? Do you not know that the Act of Parliament expressly says you shall invest

it in Government securities, and allow it to accumulate at compound interest, and not expend it on works?

Witness: I must, of course, plead guilty to the charge that we did not do so. It was expended in extensions, together with a large sum we owed to the bank, and that is one of our reasons for coming to Parliament to raise additional capital.

Mr. MICHAEL: You have exceeded your statutory powers, owing to the necessity for giving an increased supply of gas?

Witness: Exactly; and at the time we undertook it we were not aware the gasholder would have cost so much as it did. There was a great difference between the estimate and the actual cost. I cannot tell the actual amount of unaccounted-for gas, but a great deal of it is owing to the way in which the public lamps are fitted. We have frequently complained to the corporation on the matter, and also because we found they were burning gas at the town-hall without passing it through a meter. At one time I know it was nearly 40 per cent., but that was the time we had the township of Dukinfield to supply, and the enormous amount of colliery workings, and the subsidence of the earth was continually breaking the pipes and causing leakage, and that was one strong reason why we relinquished possession of that district, and handed it over to our neighbours. It is greatly in the interest of the district that some increase should be made in the works. Large mills are being erected in all directions, and there is also an increasing population, and these demands will have to be met. We are constrained to increase our works on their present site because we have no other land, except we go beyond the boundary of the borough. On the ground of economy, we wish to keep the plant together, because less surveillance is necessary. Our gasholders are in different places, because no surveillance is necessary with reference to the storage of gas.

Mr. MICHAEL (pointing to plan): Will you look at this plan, and tell me whether the site of 3½ acres called Westmill would not be available for the extension of the works.

Witness: It is on the wrong side of the town, and any nuisance that might be caused by the manufacture of gas would go over all the borough of Ashton, extending from east to west. The point we have selected for extension is between two lines of railway, but there is no necessity at present to secure it, because the Earl of Stamford will be glad to come to terms with us for the sale of it when required. We have sufficient at present to last for five or six years, and therefore we do not wish to go on at too rapid a pace. I think the initial pressure we use at the time of greatest consumption—which is between six and seven in the evening—is 3½ inches at the works. I cannot give the committee any idea as to the number of consumers on the last mile of main and the first mile of main from our works. There is a smaller amount of consumption on the last mile, but the thing must be taken as a whole.

Mr. MICHAEL: Here we have two distinct districts, the borough of Ashton, and the Audenshaw Local Board. Does it bring you in as much profit to supply the Audenshaw Local Board district, as it does to supply the borough of Ashton?

Witness: We have not the measure of gas consumed, except through the meter, and of course we cannot take in the leakage, inasmuch as that leakage is measured at the station-meter.

Mr. MICHAEL: Without reference to meters or leakage, or any matters of that kind, can you have as much profit when there is a very much smaller consumption at the end of a main as compared with the main which is close to the works?

Witness: Certainly not.

Mr. MICHAEL: Therefore you are obliged to charge a higher price in the borough of Ashton to make up for the comparatively small profit in the district of Audenshaw?

Witness: I do not see that.

Mr. MICHAEL: If you get 1s. of profit in the borough of Ashton on every 1000 feet of gas, and only 6d. in Audenshaw, is it not a loss to the consumer of every single 1000 feet you supply in Ashton, so far as relates to the supply of gas to him.

Witness: I say, if that argument is to be applied, it would apply equally to the distant parts of the borough itself.

FRIDAY, APRIL 20.

Mr. Mellor recalled, and further cross-examined by Mr. MICHAEL. We have hitherto had no fixed limit with regard to the illuminating power of our gas, but the quality we have supplied has been over 19 candles; we now propose to reduce that to 14.

Re-examined by Mr. GOULDTHORP: The reason our profit was so small in 1875 was owing to the high price of coal. In Ashton we are almost entirely surrounded by coal mines, and the earth is continually subsiding. The mines extend right under the centre of the town, but the coal cannot be got from there, because compensation would have to be paid in every case. I have myself discovered leakages where the earth has sunk something like 6 inches, and broken the joints of the pipes; but the leakage has been very much reduced by the repairs which have taken place in all directions—from 35 to 12½ per cent.

Mr. J. F. Buckley, examined by Mr. CRIPPS.

I am one of the directors of the Ashton Gas Company, and have considered the questions raised by the present Bill. My opinion is very strong that the works cannot be removed without saddling the company with expense, and the gas consumers with a considerable increase in price. I do not think there is such a nuisance from the works as would warrant the expense of their removal. Gas-works are always disagreeable, but the companies can be indicted under the Public Health Act if they commit a nuisance. Nothing of the kind has been attempted at Ashton. In my opinion, there are many greater nuisances in the borough than the gas-works. There are many ponds of stagnant water which are used by the cotton mills for condensing, and which get very warm in summer time, and emit most offensive smells, far more prejudicial to health than the smell from gas-works. There is also a depot for the deposit of night soil within a short distance of the gas-works, on the north side, and from that, at times, the smell is very much worse than I ever knew it to be from the gas-works. In the Bill for the purchase of the works there is no proposition for the purchase of any additional land. I consider our original position of 7 per cent. on the additional capital a fair allowance for the risk and trouble of carrying on the business. Compared with other towns, our capital is small in proportion to our make of gas. If our proposal of 7 per cent. were not allowed, but an adequate sliding scale given to us, I think it would be an inducement for us to persevere with our Bill; that is, assuming that the initial price fixed is a fair one.

Cross-examined by Mr. MICHAEL: I cannot say whether the directors have determined what the initial price ought to be. I believe there are precedents for a sliding scale, and no doubt we shall be bound by them. In January, 1876, a resolution was passed by the directors to the effect that the management of the works had been for some time unsatisfactory, upon which the then manager resigned. He had formerly been in the service of the company as accountant, and was promoted manager about 2½ years previously to his retirement. So long as his duties were confined to the manufacture of gas, pure and simple, he gave satisfaction to the board, but when it came to the erection and superintendence of new works, such as those on which we have been spending our capital lately

he found himself not equal to the task. With regard to the amounts expended on the works during the last three years, I feel myself quite responsible for the course which was adopted. In 1876 the sum of £4965 was taken out of the revenue account for depreciation and repair of the works, but £3600 of that amount was written off in consequence of the destruction of two gasholders, after deducting the value of them as old materials. It has been our practice hitherto to charge for depreciation and repairs, not as some companies do, by an annual deduction of so much per cent., but by charging the sums which are actually expended from year to year as they arise. I believe the usual amount written off varies from $\frac{7}{8}$ to $2\frac{1}{2}$ per cent., according to the various kinds of plant. The length of time a gasholder will last depends on circumstances. We have been in existence as a company for 50 years, and every gasholder that was established then is now destroyed. Since I have been connected with the company, our average charge for depreciation and repairs has been about 4 per cent. In 1876 it was about 9 per cent., but in other years we have only taken 1 or 2 per cent. In the previous year we expended £3770, but in that year also two gasholders were destroyed. In 1873 the same item amounted to £3329; but, although no gasholders were destroyed that year, we replaced other plant. We ought, at least, to take from £2000 to £2500 a year for repairs of the works, if they are to be kept in an efficient state, and I consider we have not repaired them to more than that extent, if several years are taken together.

Cross-examined by Mr. YATES: It does not matter what the dividend is with the auction clauses, but 10 per cent. would simplify our accounts, no doubt.

Re-examined by Mr. CRIPPS: During the year when we charged £3600 against revenue, we also charged £7471 for works against capital, which was twice as much. As a millowner, I manufacture my own gas upon my own premises.

Dr. W. Gardiner, examined by Mr. GOULDTHORP.

I am a doctor of medicine at Ashton, and have resided about 100 yards from the gas-works for the last 20 years. I know the district very well; and there are two or three factories in the immediate neighbourhood. From my experience I have not found the gas-works injurious to health. I consider tar to be a valuable antiseptic. There are many other products of combustion which are also antiseptics, such as the tarry particles given off from the combustion of coal, the minute particles of carbon, and likewise the sulphurous acid. The district of Childstown is noted for many very old people, and that is within a radius of 200 yards from the works. From my experience the area of 300 yards from the gas-works will compare very favourably, as regards health, with any equally densely populated town.

Cross-examined by Mr. BROWNE: I know more of that district than the sanitary officer does, and I should be very much surprised to hear that the death-rate there is much higher than in any other part of Ashton. Sulphuretted hydrogen would not be favourable to a proper condition of health, if much concentrated, but the greater portion is absorbed by lime used for the purpose. I have not noticed the paint on the shutters and doors in the immediate vicinity of the gas-works, and, therefore, cannot say whether any change has taken place in consequence of the noxious vapours from the gas-works. I think it would be more satisfactory to have the gas-works a little way from such a dense population. I have not detected any escape of gas from the ground.

Mr. C. T. Bradbury, examined by Mr. GOULDTHORP.

I am managing director of the firm of John H. Garside and Co., cotton spinners, &c., at Ashton and also at Dukinfield. At the Wellington Mills, Ashton, we are supplied with gas by the Ashton Gas Company, and during the year ending the 22nd of December last we consumed there 3,441,300 cubic feet. We are decidedly the largest consumers in the district. I have been connected with the Wellington Mills for nearly 3½ years, and during that time the quantity and quality of the gas supplied have been quite satisfactory. I also consider the price to be reasonable. I think it would be a great disadvantage for the works to be in the hands of the corporation. We consume at the Wellington Mills over £600 worth of gas in the year, and the municipal rates we paid last year amounted to £102 3s. 4d.

Mr. BROWNE: I do not see what that has to do with it.

Witness: If the Ashton Corporation make profits to go in reduction of the rates, we should have a reduction on £100, but we should have to pay on £600. At present all the profits which the gas company make above that which is allowed by Act of Parliament have to go in reduction of the price of gas. The corporation, I presume, would buy at the full price—viz., the 10 per cent. which is allowed by Act of Parliament, but then there would be no further restriction upon them; they could make any profit that they were able to make, so long as they did not exceed the maximum price, and kept up the minimum illuminating power. Then, again, I do not think a fluctuating body like the corporation would manage the works so well as the directors who have been connected with it for a long period, and have had more experience in the matter. As regards large and small consumers, I certainly think the large consumers ought to have the greater discount, because there is less leakage in proportion to the quantity supplied, and less cost of mains; and they also increase the total quantity of gas consumed. It is produced at a cheaper rate, because there is a larger quantity; and, moreover, if they did not get the reduction, they would make their own gas.

Cross-examined by Mr. BROWNE: I am aware that it is proposed to transfer the works of the Dukinfield Gas Company to the Dukinfield Local Board, but our firm are opposed to that transfer, and have signed a petition to that effect. I was not aware that the price at Manchester is less than the price at Ashton, but I am aware that in several of the large towns round Ashton the gas-works are in the hands of the corporations. I should not think our mill at Ashton is favourably situated with regard to the supply of gas, because it is nearly on the level of the river on the south side, and therefore low. I have not heard that there have been grave complaints from people on the north side of the river with regard to the supply of gas. The only complaint I have heard was at some distance where the pipes were limited. I did not know that the company propose to take power to supply only 14-candle gas, because that would not be satisfactory to me. I should like to see a higher illuminating power than that. I believe the small consumers in Ashton would benefit more by a reduction of rates than by a reduction in the price of gas, but they would be receiving money out of the pockets of the large consumers.

Mr. BROWNE: Supposing the new capital which the company require of £50,000 could be raised at 4 per cent. instead of 7 per cent., would you not be benefited by the transfer of the works to the corporation?

Witness: Yes, in that respect, if all the profits went to reduce the price of gas.

Mr. BROWNE: Do you not think that it would be more to the advantage of the public that the breaking-up of the streets which is necessary in connexion with gas should be in the hands of the local authority?

Witness: I believe practically that would make no difference from what it is at present, because there would be two departments which would have to communicate with each other, and the company and the corporation can do that now. I am not aware that there have been serious complaints with regard to the way in which the company have broken up the streets.

Mr. BROWNE: You say that a fluctuating body would not be so well qualified to manage a gas concern as a non-fluctuating body. The Government are a fluctuating body, are they not?

Witness: In a sense; but there are permanent officials who have the real management.

Mr. BROWNE: In the case of a gas company there would be permanent officials, and, therefore, although the members of the Town Council might be changed, the gas manager would remain the same?

Witness: In all probability.

Mr. BROWNE: Does it not occur to you as an advantage that the fluctuation which would take place would give the consumer a voice in the management?

Witness: It does not occur to me. Unless they had a special knowledge of gas, I do not see that it would benefit them.

Mr. J. B. Grundy, examined by Mr. GOULDTHORP.

I live at Beardsall, about one and three-quarter miles from Ashton, and am a member of the firm of Dodson and Grundy, cotton spinners. I have had six years experience of the gas supply, and with regard both to quality and quantity it has been everything we could desire. Our consumption is 324,000 feet at the mill, and 25,000 at my house. I agree with the previous witness respecting discounts to large consumers.

Cross-examined by Mr. BROWNE: Should the Ashton Corporation acquire the gas-works, I am sure we should have worse gas. I was born and brought up at Oldham, and if I thought we were to have the gas merely as they have it at Oldham, I should certainly want to remove our mill. Not only have they no discounts there, but when the late town-clerk died they immediately raised the price in the Lees district 5d. per 1000 feet. Perhaps I may state that if their largest consumer had his works at Lees instead of at Oldham, he would be paying £1200 per annum in rates to Oldham without receiving one halfpenny benefit. The town-clerk gave his word of honour that he would see the matter put right, and so long as he lived he kept his word, but when he died they would not abide by what he had said. Our mill stands a few feet above the town of Ashton, and in that way we are in a good position for the supply of gas.

Mr. POPE said the promoters had several more consumers as witnesses, but he did not think it was necessary to carry that evidence any further.

Mr. J. Kelsall, examined by Mr. POPE.

I am a merchant, carrying on business at Ashton-under-Lyne. Until March, 1873, I was employed in the gas-works, first as clerk, and subsequently as manager in 1865. During the year ending June 30, 1870, our average illuminating power was 19.54 candles; about 17 tests were taken during that year. In 1871 the average of 34 tests was 20.04 candles. In 1872 the average of 68 tests gave 18.9 candles. The gas was tested by the best photometer, and the best mode of testing with which I was acquainted. During the whole time I was manager we had no complaints from the private consumers, but we had from the corporation, with reference to the quality. On one occasion they made the quality appear as low as 14 candles, and I offered to go with the person who made that test on behalf of the corporation to see their photometer and mode of testing, and allow him to see ours, so as to arrive at the cause of the difference, but I was not allowed to do so. I do not know what their testing apparatus was, but I have no doubt that my tests were correct.

Cross-examined by Mr. BROWNE: At one time the corporation complained when we were using nothing but cannel, in consequence of the imperfect burners some of the consumers employed. I never remember a complaint from the corporation as to the way the works were managed, nor yet as to the way in which the streets were relaid after being broken up. At the time I was appointed manager, the leakage was 30 per cent., but it was reduced to 18 per cent., while I was there. I do not know whether it has risen subsequently. Many of the mains have been laid down a long time—some over 20 years, but I should not think they are in a bad and corroded condition. I used a Bunsen photometer in my tests. I certainly consider 17 tests in a year a very small number, but I did not begin to test at the commencement of the year in that case. I know a piece of land called Walk Mill, but I do not know that it is a better site for the extension of the gas-works than the one selected by the company. We used to test for sulphuretted hydrogen, and whenever it was discovered, we changed the lime-vessels, and the gas had to go through a clean vessel even then. Those tests were taken either two or three times a day.

Mr. D. Clark, examined by Mr. POPE.

I am the manager of the Ashton Gas Company, and was appointed in February, 1876. Previous to that time I was for six years manager of the Glossop Gas-Works. The lands of the company consist of three plots. No. 1 plot is occupied by the theatre and concert tavern, the offices of the gas company, and the whole of the plant for manufacturing gas and for the storage of coal and residual products. Plot No. 2 is occupied by two telescopic gasholders and governor-house, with a capacity for storage of 400,000 cubic feet. On plot No. 3 there is only one telescopic gasholder, the remainder of the land being vacant. The manufacturing plant of the company consists of two retort-houses, in which are 96 ovens. We have storage room for about 800 tons of coal. We have engines, condensers, scrubbers, purifying-houses, and all other belongings to a gas-works. Our present production is about 800,000 cubic feet per day, which enables us to keep in reserve about 15 per cent. of our retort power, which I consider a fair reserve. Our purifying apparatus is fully occupied, and upon our present limited space it will not be possible to increase that power in a satisfactory way. We are also cramped for room for coal storage. Our actual production in the year 1865 was 68,144,000 cubic feet; in 1866, 82,651,000; 1867, 87,060,000; 1868, 99,552,000; 1869, 99,213,000; 1870, 101,758,000; 1871, 110,983,000; 1872, 116,552,000; 1873, 120,773,000; 1874, 124,059,000; 1875, 130,456,000; 1876, 133,633,000. Our power of production of 800,000 cubic feet per day would work out to 150 millions, so that we are very near to our maximum. The actual amount of gas sold in 1876 was 115,758,946 feet, used in offices and works about 1,200,000, leaving unaccounted for 16,674,954, or 12.48 per cent. Our production per ton of coals was 9872 cubic feet, and the quantity sold 8552 cubic feet. The quantity of coal carbonized was 8028 tons 11 cwt., and cannel 5507 tons. The capital employed per ton of coals was £4 8s. 5½d., and the amount per 1000 feet 10s. 4d. The net proceeds of coke and other residuals was 38.77 per cent. The per centage of common coal used was 59.31, and of cannel 40.69, which enabled us to give gas of a high illuminating power. I have also worked out a statement showing the amount of profit upon the manufacture of gas, charging it with all the coals consumed, of which the following is a summary:—

Profit on gas manufacture.	£4693 10 7
Add, not included in above—	
Rental of meters	£8 5 6
Rents	69 0 0
Weighing	0 18 6
Fittings	62 6 10
	140 10 4
Less income-tax, not included in above	£4834 0 11
	13 10 10
Profit, as per balance-sheet	£4820 10 1

I think we produce a good gas at a moderate price. Our total length of mains is 33 miles, earning a rental of £688 per mile. The district is thoroughly undermined, which causes more or less leakage. The largest quantity of gas produced in 24 hours was on the 21st of December last—751,000 cubic feet; the least was in July—126,000 cubic feet. Our average illuminating power during 1876 was 19.02 candles; the total number of tests being 179. The total number of public lamps we supply is 774, of which the Ashton Corporation own 644, the Audenshaw Local Board 93, and the Hurst Local Board 37. We have contracts with those public bodies to keep the lamps, fittings, and governors in repair, at a cost of 1s. 7d. per annum. The demand for gas is increasing, and to provide for that it is necessary to procure additional land. The site proposed is a convenient one for the purpose, and would enable us to utilize our present works to the greatest possible extent. I have framed an estimate of what additional capital would be required, independently of the land, to outfit the works. It is as follows:—

Retort-house to hold 140 retorts, at £25	£3,500	0	0
182 mouthpieces (including 10 per cent. as reserve), at £17	3,094	0	0
Valves, connexions, &c., for ditto	100	0	0
Coal store	2,500	0	0
Purifiers and revivifying-shed	4,000	0	0
Scrubbers	1,200	0	0
Engines, boilers, and exhausters.	1,400	0	0
Meter and house.	1,000	0	0
Tar-well, pumps, cisterns, &c.	500	0	0
Condensers	500	0	0
Extension of mains, services, and workshops	6,206	0	0
Gasholder and tank to hold 800,000 feet	16,000	0	0
	£40,000	0	0

Cross-examined by Mr. MICHAEL: We have not now a gasholder on No. 1 site; there was one, but we are going to convert the site of it into storage for coals. Our tar-tank is situated in the yard, but I cannot state the size exactly. We sell our ammoniacal liquor at the strength of 6°. In the year 1876 we produced about 890 tons, which was purified with oxidizable lime. When we draw the retorts, we wheel out the coke and deposit it in the yard. We throw water on it in the retort-house, but not in the yard. I am not aware of any nuisance during the changing of the purifiers; we never had a complaint. The gasholder which was destroyed had been erected nearly 30 years. That on No. 2 site has been erected about 20 years. There is nothing exceptional in the atmosphere of Ashton, to make a gasholder wear out in a shorter time than the average, which, in my opinion, is 30 years. We have other gasholders which have been erected 12 years, and they are in pretty fair condition. We have ample retort power at present, although we have not absolutely the power of production equal to our greatest daily demand, and have to draw upon our stock. During the last week we distributed exactly the same quantity as we manufactured. I estimated the mean price of gas to private consumers in 1876 to be 47.09d. per 1000, and the total mean price 47.36d. I arrived at that by taking the total quantity at the various prices and working that out, and then dividing the total quantity supplied. That left a profit of 9.73d. per 1000, which is the amount of money with which to pay our 10 per cent. dividend. We require somewhere about 9d. to pay that dividend.

Mr. MICHAEL: But you did earn 9½, and therefore you had ¾ per cent. in excess to go to a reserve-fund. You also spent 11.10d. per cent. in the repair of works in that year, and therefore you earned enough to pay 20 per cent., leaving 2d. per 1000 for repairs of works, which I venture to say is ample.

Witness: I think we acted perfectly right, because there were exceptional circumstances in that year. There was a certain sum taken off for destruction of plant, which had not been taken off every year for the simple reason that it had been renewed, and consequently paid for at the time. I do not see anything unreasonable in writing off £3600 in one item. [Witness was cross-examined at some length as to the removal of the old and disused gasholders during the last four or five years.] I do not know that it is altogether essential to charge income year by year with a certain amount calculated over the whole, and representing the life of the works.

Mr. MICHAEL: Supposing the amount of profit in the last year had been £4900, and the directors had chosen to write off £4900, would you not have thought it very hard upon you, in your first year of office, that it should be represented that you had so conducted the works that not a single halfpenny of profit had been given to the shareholders?

Witness: In that case I should.

Mr. MICHAEL: What is the difference, because you have an excess of double that sum, and you have to pay your 10 per cent., and then you crowd into one year £5000 for repairs?

Witness: Because we are able to do it.

Re-examined by Mr. GOULDTHORP: It is the custom in Lancashire, instead of taking the average over a number of years, to put it down as we have done in this case.

By the REFEREE: The average price for coal and cannel during the year 1876 was 18s. 5.33d. per ton. Our object in putting 14 candles into our Bill was not with the intention of carrying it out, because it would require something like 16 candles to keep it above the standard. If 16 is more satisfactory to the committee, we will insert it.

Mr. G. W. Stevenson, C.E., examined by Mr. CRIEFS.

I have perused both the Bill of the company, and also the petition of the corporation against it, and I have visited Ashton specially with reference to this inquiry. The books show that the growth of the company's business for the last 20 years has been at the rate of 9 per cent. per annum. The company are now seriously inconvenienced from the want of more space in which to conduct their manufacturing operations. They must also have more capital if they are to fulfil their obligations to the public. When a company have a prosperous career like this, when their business grows at the rate this company's has done, an amount of capital is asked for which will last from 10 to 15 years. The £50,000 proposed by the present Bill will be quite exhausted, I should think, in 15 years. It is a very reasonable sum to ask for, and, judging by past experience of the company's operations, I think they may be safely entrusted with even more than the usual sum. The present invested capital is very small in proportion to the work done. The capital employed is £4 8s. 6d. per ton of coal carbonized, and 10s. 6d. per 1000 feet of gas sold, and, with some half dozen exceptions, perhaps, that is the smallest amount of capital employed, for the amount of business done, throughout the kingdom. The smaller the amount of capital, the smaller the sum per 1000 feet required for dividend, and, therefore, the cheaper the gas can be sold. The average of the London companies per ton of coal carbonized is £7 6s. 3d., and per 1000 feet sold, 16s. 2d. At the present moment there is not one of the London companies who have so small an amount of capital for their business as the Ashton Gas Company. The structural value of the whole of the works and distributing apparatus exceeds £8000. That sum is very much larger than is represented by the nominal capital of the company, showing that a very much larger amount has been taken into the concern, either from premiums obtained by the sale of shares, or the application of what is called the renewal-fund to the restoration of the fabric. As a con-

sequence of that, only 10d. per 1000 feet is required to pay a dividend of 10 per cent., against 14½d. in the case of the London companies. The yield of gas also compares favourably with that of other companies. Mr. Clarke gave the figures of 9872 cubic feet per ton made, and 8552 feet per ton sold, the unaccounted-for gas being 13.37 per cent. on the gross; but, deducting the quantity used on the works, it brings out about 12½ per cent., and that would be very much reduced if the town were not undermined, causing the mains to be constantly fractured. The general working expenses of the company are also unusually moderate. If the sum spent upon renewals be excluded, the working expenses are less than 1s. per 1000 feet, the average of the London companies being 16½d. I expect wages are somewhat higher in London than they are in Ashton, although they are not materially different. Including renewals, the working expenses would be 1s. 9½d. per 1000 feet; but it is not the practice in London to ask anything for renewals. I have visited a great many gas-works, and I do not think there is any company in the kingdom conducting their business better than the Ashton Gas Company, and only a limited number doing as well. It is simply impossible that the corporation could carry the business on better than the company. The great evil of corporate management is the changing body, and the want of continuity of direction. The Gas Committee of a corporation are changed every year, and frequently the chairman of a committee is not a continuing member of the direction. The policy which is inaugurated one year is upset the next; but that is not so when a company manage a trading concern, in which the directors have the largest stake. I have made out a table in reference to the gas-works in Lancashire and neighbourhood which belong to the local authorities.

The following table was handed in:—

Gas-Works belonging to Local Authorities, mostly in Lancashire.

Name of Town.	Quantity of Gas produced per Annum. Cubic Feet.	Net Present Price of Gas within the Borough.	Net Present Price of Gas without the Borough.	Invested Capital.	Invested Capital per 1000 Feet Made.
Barrow-in-Furness	95,000,000	5/.	5/.	66,966	14/1
Blackpool	35,000,000	4/2	4/2	20,000	11/5
Bolton	400,000,000	3/6	4/3—4/.	264,633	13/3
Burnley	150,000,000	3/.	4/.	100,000	13/4
Bury (Lanc.)	145,000,000	3/9	3/9	91,592	12/8
Halifax	276,000,000	3/4½—3/2½	4/10½—4/3	233,524	16/11
Heywood	60,000,000	4/.	5/7	46,000	15/4
Macclesfield	90,000,000	4/.	4/.	70,898	15/9
Manchester	1,972,696,000	3/4	3/10	742,560	7/7
Middleton	60,000,000	4/1	4/1	33,000	11/.
Oldham	450,000,000	3/8	4/.	278,229	12/5
Rochdale	240,000,000	4/2—3/11	4/10—4/7	106,000	12/2
Salford	580,000,000	4/.—3/11	5/.—4/8	339,374	11/8
Southport	130,000,000	4/.	4/.	100,000	15/5
Stockton	208,000,000	4/.—3/10	4/8—4/.	89,826	8/8
Widnes	63,000,000	4/6	4/6	45,000	14/3
Ashton	133,633,000	3/8—3/2	3/8—3/2	60,000	9/.

Taking the invested capital per 1000 feet, Ashton is the lowest, with the exception of Stockport and Manchester, and it is well known that at Manchester the corporation write off a large sum every year for depreciation, and really write it off their capital, and in that way the amount of the capital is kept down in relation to the business done. They take the amount of money standing to the capital account at the end of the year, and they add that to the amount of money spent on capital account during the year, and then they deduct 2 per cent. on structural capital from the whole amount, and the balance represents the capital invested in the concern at that time. That is done year by year, and they do the same thing at Walsall. There is no reason assigned in the preamble of the corporation Bill, and no reason assigned in the petition, beyond that of general expediency, why they should be permitted to purchase. If this company had been guilty of negligence or wrong-doing, in regard to the supply of gas to their consumers, I should not have been a witness, because when a gas or water company misconduct themselves I say their affairs ought to be transferred to the local authority. There have been only two cases of compulsory purchase—the Rotherham Gas Company and the Stockton and Middlesbrough Water Company, and, in those cases, very grievous allegations were made and established against both companies. The Corporation of Ashton state in their petition that the situation of the gas-works, as regards the town, is very objectionable, but they ask the committee to give them power to buy the undertaking, and allow them to perpetuate that nuisance, if it be one. There is no suggestion of going elsewhere. I am quite prepared to say that, if entirely new works were to be erected in Ashton, the present site is not one I should recommend; but, the works being erected, there is no valid reason for removing them. The south-western wind is the one which prevails there, and, whatever smell there may be, is carried into the country immediately. The property in the neighbourhood is now of a very valuable character, and the works are extremely well conducted. There is as little disagreeable smell from these gas-works as it is possible to have. There have not been many cases since 1865 in which the auction clauses have been introduced—not more than 20. With reference to the new capital sought to be raised at 7 per cent., I do not see why the restriction of selling by auction should be continued. The auction clauses are very properly applicable to companies having an exaggerated capital according to the amount of business they do; but this company manage their affairs so well, that I do not see why those clauses should not be abandoned. That has been done in the case of the Sunderland Water Bill, and also in a gas Bill, the name of which I have forgotten. If a gas company have a capital exceeding 15s. per 1000 feet, then it is very fair to say that the auction clauses ought to be introduced with a view of bringing the capital down in relation to the amount of business they do. I know very well that in recent legislation the auction clauses have been mixed up and taken together with the sliding scale, as was the case with the metropolitan companies last year, and that is a case of mutual benefit, because it might enable, after a time, the sliding scale to operate more favourably to the consumer. I company, while it also operated more favourably to the consumer. I think I brought the sliding scale under the notice of the Board of Trade, and before the committee who had charge of the metropolitan gas Bills of last year. Of course, I am assuming that the sliding scale is given with reference to a fair fixed initial price. With an unfair initial price it might be made unfair, either to the company or to the consumer. I should consider it an unfair thing if the auction clauses, without the sliding scale, were put into a Bill of this kind. Without the sliding scale there is no inducement to a company having auction clauses to conduct their business with economy. The Ashton Gas Company ought certainly to remove their purifiers, and all their condensing and revivifying apparatus, to the new station they are proposing to acquire, and then they would have more yard room for the storage of coke, and be able to conduct their business more economically. I am sure they cannot carry on their business successfully and properly without more land and more capital.

MONDAY, APRIL 23.

Mr. CRIPPS intimated to the committee that, if the Bill of the company were passed, they would introduce auction clauses and the sliding scale.

Mr. BROWNE said that, with or without those clauses, the corporation would oppose the Bill out and out.

The CHAIRMAN said that being the position, the question of price had better be entered upon at once.

Mr. STEVENSON recalled, and further examined by Mr. CRIPPS.

Assuming a sliding scale to be adopted by the Ashton Gas Company, I have made some calculations as to what would be a fair initial price to start from. According to figures furnished by Mr. Clark, the net cost of coal last year was 1s. 3⁸/₅d. per 1000 feet, and the total working expenses 21⁵/₁₂d., but that latter item also includes a sum which was carried from profits to renewals, and which ought to have been separately stated. I, therefore, propose to reduce that 21⁵/₁₂d. to 18d.

The REFEREE: Including cost of coal, and repairs and maintenance? Witness: No; excluding coal. Take first of all 1s. 3⁸/₅d. net cost of raw material, and then add 18d. for working expenses, and 10d. for dividends.

By the CHAIRMAN: To make the 10 per cent. dividend upon their present authorized and expended capital. We are endeavouring to arrive at what the standard price of gas should be at the present moment, quite irrespective of the future, and of any future expenditure of capital.

Examination resumed: The future expenditure is supposed to produce its own revenue and its own profit. Those figures give us 43⁸/₅d., or, practically, 3s. 8d. per 1000 feet. It is a question whether last year's working should be taken as a fair record of what the standard price should be, because coal was low in price, and the company may not be able next year to make their 10d. for dividend with a price of 3s. 8d. It is just a question whether another penny should not be given, and the standard fixed at 3s. 9d. The standard price of The Gaslight and Coke Company, who supply two-thirds or three-fourths of the Metropolis, is 3s. 9d. but that of the South Metropolitan—a small company on the south of the Thames—is 3s. 6d. The whole of the new capital of those companies is entitled to 10 per cent., but it is to be raised by means of the auction clauses.

Mr. CRIPPS: Prospectively the London companies would be getting a larger amount relatively to the basis of the past, because they had not the auction clauses hitherto, but we have; and, therefore, our capital has been diminished by the auction clauses, while theirs has not?

Witness: Yes.

Mr. CRIPPS: Therefore, the new capital raised in a different way will tell more in favour of the London companies than it could for us?

Witness: Yes. There is no doubt the price of coal at Ashton is very much cheaper than in London, but, in the same degree, coke sells for a very little money. The value of coke is always in inverse ratio to the price of coal. What is to be looked to in the price of coal is not the gross but the net—that is, after the coke and other residual products have been sold. The consumption in London per mile of main is very much larger than it could possibly be with the Ashton Company. I should think one mile of main in the densest part of the Metropolis—say the Strand, for instance—would give as much revenue as the whole 33 miles of this company. As the mains are extended there are all the extra expenses of the leakage, and matters of that kind, to consider.

Cross-examined by Mr. MICHAEL: I am not a believer in large discounts, although I am in small ones. I do not know whether, under the sliding scale, the company propose to abolish the system of discounts. The sliding scale will work very well, if the company give fair discounts, for two things—supply of gas through large service pipes, by which they save unaccounted-for gas, and security for payment.

Mr. MICHAEL: How are you going to estimate the price? Taking your initial price of 3s. 8d., there will be persons who will be charged 2s. 8d., if the existing system of discounts is continued. How, then, is the sliding scale to operate?

Witness: I presume it will be upon the average of the whole. The whole of the gas sold and the total revenue derived will be taken and divided one into the other.

Mr. MICHAEL: How is that to be done? I am a supposed consumer, and I burn in such a way that I have no discount whatever, and I pay you 3s. 8d. initial price?

Witness: That will all be ascertainable under the form of accounts prescribed by the Act of 1871; but 6d. is absolutely allowed to everybody for prompt payment.

Mr. MICHAEL: No small consumer of gas would know what was the price charged for gas over the whole district?

Witness: He would, if he had those annual accounts in his hand.

Mr. MICHAEL: Do you mean that a shoemaker, burning 5000 or 6000 feet of gas, would be able to go through those complicated accounts and find the mean price?

Witness: Do you think it important that he should?

Mr. MICHAEL: It is very important with respect to the dividend to be paid according to the sliding scale?

Witness: It is very important, for those who represent the interest of the corporation, that they should be able to ascertain whether the company are dividing their proper rate of dividend according to the price they charge for gas; and the accounts are so straightforward that it is utterly impossible the borough accountant could fail to understand them, and to advise his employers whether the company were doing right or wrong. I am not prepared to say what difference ought to be made in the discounts between the large and small consumers, but I should have thought a reducing scale to the largest consumer of 3d. would have met the question. I do not approve of the principle that, however sparse the population, the price should be equalized over the whole district, but I do not think that the borough boundary should be the line of demarcation. I think the radius would be the proper mode. I do not like to confuse the two items "repairs" and "renewals." Repairs ought to be done year by year before a division of profits out of revenue; renewals should be done by setting aside a certain sum annually to reproduce the cost of the original article at the expiration of its life. I presume the Ashton Company have done the right thing in the wrong way. They have let the matter of the renewal or depreciation fund go by, and when the necessity for renewing a worn-out piece of their plant has arisen, they have taken the amount out of profits (which they were happily able to do) in one, two, or three years, instead of spreading it over 10, 15, 20, or 30 years.

Mr. MICHAEL: In 1876 a sum of £5400, in round numbers, was expended in repairs and renewals; but if that were abstracted, the company might have paid their dividends, and then only have charged 36²/₅d. for their gas?

Witness: On the contrary, if we had not expended that amount we should not have been able to supply gas at all. Ever since 1872 the company have been renewing their plant, and they have spent about £17,000 on those renewals. They have exhausted their profits, and have also carried profits to capital account, for the purpose of replacing destroyed plant. That is quite at variance with the plan adopted in London, because at the present time the works of the Chartered Company at Brick Lane, Curtain Road, and Blackfriars have been abolished, and yet the whole of the capital represented by those places is receiving dividend from the consumer, and I think most unjustly. With regard to the alternative site of

3½ acres which has been mentioned, I do not think it at all advantageous because the noxious vapours would be carried directly over the whole of the town. There are some advantages in gas-works being in the hands of corporations, one of which is that the controlling body has also the command of the streets. Generally also the corporations are amongst the largest consumers of gas for public lighting purposes, but I do not know whether it is so here; I expect some of the millowners are quite as large. There is also another reason—there is less grumbling. It is no use grumbling at the corporation, but a company are always fair game for consumers to grumble at.

Mr. MICHAEL: Is it not better to have a maximum dividend guaranteed upon the whole of the property of the borough, rather than a fluctuating and possibly diminished dividend, which would accrue from the conduct of a commercial enterprise?

Witness: All things being equal, it would be so, but in this case there is no possibility of the dividend of the company being in jeopardy; it is practically safe.

Mr. MICHAEL: Then the works have such a reserve-fund of profit that, whatever the price of coal may be, the dividend is secure?

Witness: No; there is no reserve-fund; that has been abolished and applied to capital.

Mr. MICHAEL: What per centage do you think fair to take out of the revenue of a company to meet the expenses of depreciation, repairs, and renewals?

Witness: One per cent. on the structural value over the whole of the plant—that is for repairs, not renewals.

The CHAIRMAN: I wish you would clear up this point.

Mr. MICHAEL: There was a sum of £5400 taken for repairs and renewals in 1876, and the same item for the ten previous years amounts to £27,000, which represents 5 per cent. on the capital. I wish to show that that is in excess of what it should have been, and how it enures to the injury of the gas consumer; and also how it will bear upon the subsequent question of the initial price to be fixed in the Bill if the sliding scale is adopted.

The CHAIRMAN: It appears to me that one of the great sources of embarrassment is that this company have mixed up their affairs.

Cross-examination resumed: The per centage for renewals must depend upon the requirements of the structure year by year, and also upon the number of million feet turned out. In the present case I should reckon for retorts the company would require 4d. per 1000 feet; for the general structures about the works, perhaps 1½d. per 1000 feet; for mains, services, and meters, another 2d. per 1000 feet, making 7½d. In the company's accounts those items are not charged sufficiently, and that is one reason why every now and then they have to make such large claims for renewals. They do not keep up the stock properly, and cannot do so for the money.

The CHAIRMAN: You know the amount of business of the company, tell us how much a year ought to be the average for repairs?

[The profit and loss accounts for the ten years from 1867 to 1876 were here handed in.]

Witness: Assuming a rental of £22,712, £3600 ought to be taken for repairs.

Mr. MICHAEL: You have no power under the Gas-Works Clauses Act to make depreciation-funds?

Witness: No, nor under any other Act. Under the Companies Clauses Act, there is a contingency-fund, but that is not a renewal-fund.

By the CHAIRMAN: The 1 per cent. for renewals is only upon the structural value of the works, and is arrived at in this way: We will say the life of a gasholder is 25 years; of a meter 10 years; of a main-pipe 50 years; of a tank 80 years, and so on. All these worked out in the form of a sinking-fund, to replace the original structure at the expiration of the life of each thing, works out to about 1 per cent. on the structural value.

Mr. MICHAEL: Is it not the fact, in large companies conducted on a proper principle, that 1 per cent. covers the repairs, and that 2 per cent. covers renewals and repairs?

Witness: I have never looked at it in that way.

Mr. MICHAEL: Two per cent. would work out about £1200 a year, and you have been taking £5000 a year without calculating compound interest?

Witness: I do not follow you.

Mr. MICHAEL: Under the Gas-Works Clauses Act, if you have any excess of profits more than sufficient to pay your maximum dividend, the surplus goes in reduction of price?

Witness: It goes first of all to the formation of a reserve-fund.

Mr. MICHAEL: I am supposing the reserve-fund to be full; ought not the amount of surplus profit in the following year to go in reduction of price?

Witness: Yes. I have said there is no power in any general Act to set aside a sum annually for a renewal or depreciation fund; but the Companies Clauses Act does give power to set aside a sum for contingencies, and does not say how much or how little should be set aside.

Mr. MICHAEL: But you know that does not apply in the case of a gas company, because that contingency is swallowed up in the reserve-fund.

Witness: I have never known that.

Mr. MICHAEL: But is it not the fact that the contingency-fund was for almost expressly the same purpose as the reserve-fund?

Witness: I think it was quite the contrary.

Cross-examined by Mr. YATES: I have never suggested any other price than 3s. 8d. over the whole of the company's district, supposing that to be the standard price. The difference in the cost of supply would be very small between the different points of the district. We could not supply the town at present at a cheaper rate than 3s. 8d.; but as the company's operations increase, they may hope to supply it lower; and, certainly, if a standard price and a sliding scale be put upon them, they will use their best exertions to get the price reduced and the dividends increased.

Re-examined by Mr. CRIPPS: There must be an imaginary line drawn somewhere if a differential rate of price is made, and that would cause a grievance. Supposing the customers are very far apart, then companies generally make a differential charge; but that is not the case at Ashton. I conceive that, as a fact, gas companies have power to form a reserve-fund and a contingency-fund, but as a fact they do not usually create the latter. The London companies have an insurance-fund in addition to their reserve-fund.

Mr. CRIPPS: And if the contingency and reserve-funds are full, then, by law, the balance must be carried to profit and loss account of the next year—in other words, to aid the consumer?

Witness: Yes; and the operation of that clause prohibits companies paying back dividends, unless the latter are put in before it.

Sir E. BECKETT: As a matter of fact, both are not usually put in together.

Mr. CRIPPS: This company, at any rate, have neither a contingency nor a reserve fund, and, therefore, if they have spent a portion of their profits upon renewals, they have taken that from the sum which might have been a guarantee-fund for their dividend, and that has been directly against their interest, and to the interests of the public?

Witness: Yes. The money was spent in replacing worn-out plant, and I am advising the Colchester Company to do just the same; one-third of the whole of their expenditure is being taken out of the profits instead of out of capital, because it is to replace worn-out and disused plant. They

are doing that year by year, and not suddenly, as this company have done. There are many local circumstances which affect the amount of repairs a company may have to do at a particular place, particularly if there are mines and underground works which disturb the surface. At Ashton, not a week passes without their having fractured mains.

Mr. CRIPPS: In considering the question of whether in any particular place it is desirable that the corporation should purchase the works, would not the case very mainly depend upon whether the works, when purchased, were such works as would supply the corporation only, or whether they would include any large area besides?

Witness: If you mean that the works of this company are only sufficient for the supply of the borough, and that the consequence of the works passing into the hands of the corporation would be that, eventually, those works would be entirely required for the borough, and that the outlying districts would have to provide works of their own, I think that would be the case. If the works of the gas company were confined to the municipal boundary, the corporation could acquire the undertaking under the Public Health Act of last session, without coming to Parliament at all. As regards the discounts, there is nothing which would necessarily affect the question of ascertaining how the sliding scale would apply. The average price will be worked out, and that will show whether the company are charging more or less than 3s. 8d., or whatever the standard price may be. The discount is simply given for prompt payment within a certain time.

By the CHAIRMAN: Labour is rather cheaper in Lancashire than in London, and so is coal; but they do not get so good a price for their residuals, so the net cost of the raw material is greater in Lancashire than in London. I would prefer to make and sell gas as a profitable thing in London rather than in Lancashire, especially in a mining district.

By Sir E. BECKETT: I should think the price of gas coal in London at the present time would be about 14s. 6d. per ton, delivered.

The REFEREE: Taking a company of this size with £50,000 capital, and an income of £5000 per year, what amount would you set aside for the contingency-fund or the reserve-fund you mentioned just now?

Witness: I have never been in the habit of advising companies to set aside a contingency-fund at all, but to wait till the contingency arises. I think if works are fully kept in repair there ought not to be any necessity for such a fund. A contingency-fund appears to me to come in appropriately where an accident occurs, such as the Wood Street fire or the Leicester Square explosion, or something of that kind, which cannot be guarded against.

Mr. J. Holmes, examined by Mr. GOULDTHORP.

I am a member of the firm of Fletcher, Andrew, and Holmes, land surveyors and valuers at Ashton. I have been intimately acquainted with the district for over 20 years. I have prepared a plan showing the boundary of the borough, and the limits of the Ashton Gas Company. The acreage within the borough of Ashton is 1373 acres, the population 32,000, and the rateable value £107,274. The district outside the borough but within the company's limits is 2333 acres, the population 16,255, and the rateable value £48,000. There is also another district outside the borough, within the company's limit of supply, but not yet supplied with gas, of 4881 acres, population 11,759, and rateable value £43,000. With the exception of a small piece of land to the south-east of the borough, there are practically no sites in the borough suitable for large manufacturing works. The principal area of open land lies on the western and easterly sides of the town, but the westerly side is not suitable for building purposes, owing to its being of a mossy or peaty nature. The districts which have been hitherto unsupplied are being developed very rapidly. I know the neighbourhood of the gas-works, and during the last 20 years there has been a considerable amount of building going on there. I should certainly say that the gas-works have not had any appreciable effect upon those buildings. The land proposed to be acquired by the company is a foundry, with the exception of a small piece on which stand two cottages. It is the most suitable piece of land which could be taken for the extension. I consider the site adjoining No. 3 plot—the one suggested by the corporation—one of the most unsuitable that could be selected as a site for manufacturing gas within the borough. I have seen the petition of the owners and occupiers of Ashton against the gas company's Bill. That petition was signed by 38 persons out of 1700 on whom we had served notices. I have never heard of any nuisance arising from the gas-works.

Cross-examined by Sir E. BECKETT: There are many smells near to Ashton Gas-Works which are far worse than that from the works themselves. As a rule, it is better to have gas-works as low as possible. [Witness was cross-examined at some length as to the description of property situated within the 300 yards radius.]

Mr. CRIPPS said that was the case for the Ashton-under-Lyne Gas Company.

Sir E. BECKETT said he would open the case on behalf of the Ashton-under-Lyne Improvement Bill by calling his witnesses first.

(To be continued.)

Legal Intelligence.

HOUSE OF LORDS.—TUESDAY, MAY 1.

PATTERSON v. THE GASLIGHT AND COKE COMPANY.

Petitions of the appellant, for leave to sue *in formâ pauperis*, and to allow the printed documents used in evidence in the Courts below to be used on the argument of the appeal at the bar, were read and referred to the Appeal Committee.

HIGHGATE POLICE COURT.—WEDNESDAY, MAY 2.

ALLEGED EMBEZZLEMENT BY THE ASSISTANT SECRETARY OF THE COLNEY HATCH GAS COMPANY.

The adjourned examination of *William Henry Wood* took place this day, the charge against him being that of embezzling more than £900, the property of the company, in whose service he was.

Mr. CROOME prosecuted, and Mr. GRAIN defended.

The evidence against the prisoner was completed, and he was fully committed for trial at the Central Criminal Court.

The prisoner was then charged with obtaining from Mr. R. Higdon the sum of £463 by fraud. The prosecutor stated that he was a baker at 185, Bishopsgate Street Without. He had known the prisoner for years, and had some dealings with him with regard to gas shares. In September last the prisoner induced him to buy 45 shares of the Colney Hatch Gas Company for £463 12s. 3d., and received that amount from him. Prosecutor had not received the shares, nor had the money been returned.

James Dantizer, chief clerk to Messrs. Mortimer and Sons, stockbrokers, said that in September last the firm had 150 shares to sell for a lunatic. He was introduced to the prisoner, and had some conversation with him respecting the sale of the shares. His offer not being high enough, witness did not sell them to him. The firm afterwards sold them.

Evidence was then given, showing that the prosecutor's bank notes were changed at the Bank of England for gold, and for that gold a draught on the Bank of New Zealand for £450.

A formal remand took place until Saturday, when, the evidence being completed, the prisoner was committed for trial on this charge also.

Miscellaneous News.

CORPORATION OF SALFORD.

ABSTRACT OF GAS-FUND ACCOUNTS.

Dr.—Gas-Fund, from June 30, 1875, to June 30, 1876.

To Balance at June 30, 1875 £39,417 10 8

REVENUE ACCOUNT.

Gas sold, and hire of meters	96,303 12 4
Gas for street-lamps	7,459 13 5
Lighting, &c., lamps	552 0 0
Residuary products—	
Coke sold for cash	3,471 9 3
Ditto on credit	2,416 0 9
Tar	7,434 6 8
Ammonia water	4,187 13 1
Carbon	8 5 0
Old iron sold	657 3 10
Lamp-pillars, &c.	613 7 11
Sundries	46 18 4

CAPITAL ACCOUNT.

No. 1 station—	
Service-pipes, accounts charged	403 16 8
No. 2 station—	
London and North-Western Railway Company—Moiety of cost of Egerton Street bridge	170 13 3
Loans received	31,695 0 0
	£194,837 11 2

Cr.—Gas-Fund.

REVENUE ACCOUNT.

By Salaries, poundage, and wages—	£800 0 0
Proportion of Borough Treasurer's Department	£50 0 0
Analytical chemist, R. A. Smith	520 16 8
Manager	260 0 0
Deputy-manager	190 0 0
Outdoor superintendent	1,418 7 11
Collectors	18,402 9 8
Wages of workmen, including clerks, &c.	64,462 0 5
Cannel	4,701 4 4
Coal	
Purifying materials—	
Lime	140 14 0
Oxide of iron	720 8 0
Fire-bricks and clay	1,618 17 11
Retorts	1,507 15 3
Ironwork and castings	599 7 8
Tow, rope, oil, paint, &c.	110 14 7
Tools, implements, repairs, &c.	496 10 0
Horse and cart hire	68 5 9
Water	368 4 9
Provender and farriery	183 0 9
Printing, stationery, account books, and advertising	271 4 2
Interest on mortgages	11,814 6 9
Ditto gas deposits	41 13 7
Ditto bank interest	255 17 3
Compensation—	
Re Nolan	118 13 7
Two houses, West Street	12 10 0
Miscellaneous—	
Stamps and sundries	183 0 3
Clothing for inspectors	34 6 0
Travelling expenses	133 16 4
Cab hire	83 12 3
Carting and carriage	37 6 5
Cleaning materials	23 6 0
Writing collecting books	14 9 2
Loan—Procuration fees and stamping mortgages	48 5 4
Insurance, steam-boilers	10 18 6
Rents—	
Rent of telegraph	27 8 4
Expenses of siding, No. 2 station	18 6 3
Chief rent, No. 1 station	£284 1 8
Less repayable by Salford Town-Hall Committee	103 8 4
	180 13 4
Rates	3,269 0 1
Property-tax	46 6 0
Salford township-fund—Annuity to June 30, 1876	2,530 0 0
Annual contributions—	
Sinking-fund	6,545 16 6
Depreciation-fund (general)	720 13 0
Ditto (hired meter)	310 3 10

CAPITAL ACCOUNT.

No. 1 station—	
Wages of workmen	2,508 16 1
Iron mains	4,461 11 7
Lead piping	51 10 6
Repairing streets	306 14 3
Horse and cart hire	126 17 6
Oil, paint, and sundries	67 15 6
Tools and implements	38 10 6
Timber	9 3 8
Horse	76 0 0
Meters	2,713 0 9
No. 2 station—	
Wages of workmen	214 8 10
Ironwork	578 4 2
Oil, paint, &c.	0 13 0
No. 3 station—	
Ironwork	276 6 5
Implements and sundries	124 5 2
Fire-bricks and retorts	895 4 8
Brickwork	40 0 0
Timber, &c.	7 0 7
Paving	61 8 10
Carriage and cartage	38 1 11
Oil, paint, &c.	0 11 5
Loans repaid	5,900 0 0
Balance at June 30, 1876	53,190 15 3
	£194,837 11 2

Dr.—Depreciation-Fund (Hired Meters).

To Balance at June 30, 1875	£7,456 6 8
Interest allowed by bankers, less commission	238 4 3
Revenue account—One year's contributions	310 3 10
	£8,004 14 9

Cr.—Depreciation-Fund (Hired Meters).

By Meters—Altering and stamping	£10 18 10
Wages of workmen	78 16 10
Amount paid out of capital account for meters purchased to replace others broken up	423 2 0
Balance at June 30, 1876—	
Balance in bank	7,994 8 9
Owing to revenue account	502 11 8
	£8,004 14 9

Dr.—Depreciation-Fund (Works and Plant).

(Under the 413th Clause of the Salford Improvement Act, 1862.)

To Balance at June 30, 1875	£14,030 14 10
Interest allowed by bankers	363 16 11
Revenue account—Contribution	720 13 0
	£15,115 4 9

Cr.—Depreciation-Fund (Works and Plant).

By Wages of workmen	£3,024 6 1
Materials	8,359 4 3
Balance at June 30, 1876—	
Balance in bank	9,623 2 6
Due to revenue account	5,891 8 1
	£15,115 4 9

Dr.—Sinking-Fund.

(Under the Provisions of the Salford Improvement Acts, 1862-67.)

To Balance at June 30, 1875	£7,732 17 2
Interest allowed by bankers	75 7 7
Revenue account—One year's contribution to June 30, 1876	6,545 16 6
	£14,354 1 3

Cr.—Sinking-Fund.

By Loans repaid	£5,580 0 0
Balance in the bank	8,774 1 3
	£14,354 1 3

Dr.—Gas-Fund Deposits Account.

To Deposits for security of gas-rents—	
Amount in hand, June 30, 1875	£1,486 13 11
Ditto received since	442 5 6
	£1,928 19 5
Deposits for security of hired meters—	
Amount in hand, June 30, 1875	£3,808 10 2
Ditto received since	1,378 1 6
	£5,186 11 8

Cr.—Gas-Fund Deposits Account.

By Deposits for security of gas-rents—	
Amount repaid during the year	£328 5 1
Balance in hand	1,600 14 4
	£1,928 19 5
Deposits for security of hired meters—	
Amount repaid during the year	£992 16 6
Balance in hand	4,193 15 2
	£5,186 11 8

Dr.—Gas-Fund Stock Account.

Assets.	Outlay, as per last Abstract.	Additions during past Year, as per this Abstract.	Total.
To Works and plant—			
No. 1 station, including mains	£163,813 12 2	£7,243 2 11	£171,056 15 1
No. 2 station, including 13,208 square yards of land, £4126 10s.	63,875 15 9	622 12 9	64,498 8 6
No. 3 station, including 40,799 square yards of land, £18,400	92,443 11 4	1,442 19 0	93,886 10 4
Gas-meters and fittings on hire	19,245 15 5	2,713 0 9	21,958 16 2
	£339,378 14 8	£12,021 15 5	£351,400 10 1
Floating assets, viz. (exclusive of the sinking and depreciation fund balances)—	Sums Owning to the Council.	Sums Owning by the Council.	
Sundry debts and materials on hand, and gas-rents owing	£42,437 17 0	£8,413 12 11	
Hired meter depreciation-fund	502 11 8		
Gas-works ditto	5,891 8 1		
Deposits for security of gas-rents		1,600 14 4	
Ditto hired meters		4,193 15 2	
Manchester and Salford Bank	17,700 15 1		
Cash due to treasurer	866 5 10		
	£67,398 17 8	£14,208 2 5	£81,606 19 3
			£404,591 5 4

Cr.—Gas-Fund Stock Account.

By Mortgages under the Salford Acts, total	£305,391 12 7
Balance, excess of assets	99,199 12 9
	£404,591 5 4

Summary of the Gas-Fund Stock Account.

To Balance brought down	£99,199 12 9
Sinking-fund account	8,774 1 3
Depreciation account—	
Works and plant	3,731 14 5
Hired meters	7,491 17 1
	£119,197 5 6

The gas-fund is chargeable under the Salford Improvement Act, 1862, with an annuity of £2530, payable to the Salford district.

MAURITIUS GAS COMPANY, LIMITED.

The Ordinary General Meeting of Shareholders was held at the London Offices of the Company, Great St. Helen's, on Tuesday, the 1st inst.—W. WHITE, Esq., in the chair.

The SECRETARY (Mr. A. Hersee) read the following report of the directors and the accounts:—

The directors have the pleasure to submit the audited accounts for the past year, and are able to report a slight improvement in the amount of profit realized.

The number of public street-lamps has remained stationary at 724, owing to the funds of the Municipality not admitting of any addition; but the total of Government and private lights has increased from 4378 to 4559.

The gas and meter rental shows only a nominal advance upon the previous year, and the want of progress in the consumption of gas at Port Louis continues to be a great disappointment to the directors. Trade has not improved so quickly as was expected (consequent upon the improved sugar crop obtained in Mauritius last season), and still remains depressed, which, the manager states, has induced a general economy, and operated against the extended use of gas.

The demand for coke and tar has also been affected by the depression of trade; and the prices realized on sales have, however, been satisfactory.

In consequence of favourable arrangements the average cost of coal was greatly reduced during the past year, and it is hoped that a further reduction may be practicable in the current year.

The depreciation in the value of silver has occasioned a heavy loss on remittances, and has seriously diminished the profits. The existing rates of exchange, though less unfavourable than they have been, are such as to cause the directors extreme regret.

The local interests of the company continue to receive the valued supervision of the resident committee, Messrs. H. Adam, M. Connal, and J. A. Ferguson, and the manufacture and distribution of the gas have been satisfactorily conducted by the manager, Mr. Delache.

The general revenue account shows a balance of £1459 5s. 6d., out of which the directors recommend a dividend of 2½ per cent., free of income-tax, payable on the 10th day of May inst.

The retiring director is James Sydney Stopford, Esq., and the retiring auditors are John Robinson Peill, and Thomas Newton Stokes, Esqs., all of whom, being eligible, offer themselves for re-election.

The CHAIRMAN, in moving the adoption of the report, said he must, to a great extent, repeat the remarks which he addressed to the shareholders at the last annual meeting. It was some satisfaction to find there was a little improvement again in the affairs of the company, and they were now able to pay a little better dividend while entertaining the reasonable expectation of making further progress in the current year. The effect of the previous bad seasons in Mauritius seemed not yet to have worn off, and the recovery of trade was not yet visible. They must bear in mind, however, that this depression was not confined entirely to Mauritius; it had existed at home and abroad for the last two or three years. The company's manager, whom the directors had repeatedly consulted on the question, did not recommend as a remedy any reduction in the price of gas, and it would be certainly undesirable to sacrifice a portion of the present revenue, unless they were certain to recoup themselves in a very short time. The company, it would be seen, had not stood still, as during the past year they had obtained as many as 637 new lights. The great bulk of the present residents at Port Louis were evidently dispirited with the bad times which had so long prevailed, and were unable or unwilling to make the necessary outlay for the supply of gas. The directors were prepared to deal liberally with consumers in respect of fittings, but still there was a lack of business. A revival of prosperity must surely come some day, and the company might reasonably expect their share in the improvement. Meanwhile, they were languishing for want of an extension of business, for in this, as in all great undertakings, growth was of vital necessity. The works were built for an increase in the consumption of gas, and the fixed expenses of the company would be about the same if the present quantity supplied were doubled. The directors had had some encouragement in former years, although things fell short of their original expectations, and he thought they might confidently look forward for better times. Unfortunately, a small concern like this could not bear an exceptional strain, and the succession of trials they had undergone had permanently increased its burden. The chief difficulty in the past year had been the onerous rate of exchange on the remittances of money home. It was a charge against revenue of £600, or about 1½ per cent. upon the capital of the company. The losses by bad debts also had been heavier than usual. The diminished cost of coal, as representing the heaviest item of expenditure, was very gratifying. The cost per ton in 1873 was 53s. 9d.; in 1874, 49s. 6d.; in 1875, 46s.; while in 1876 it worked out to about 37s., and as regarded the present year he might state that they had landed a cargo of English coal at a rate even below this minimum, and the directors hoped, in the absence of political complications, to continue the supply of coal on equally favourable terms. He could assure the meeting that every effort had been made by the board to keep down the expenses, and the manager was frequently reminded of the necessity for economy. The gasholder had continued to work well, and the extra storage had proved of great service. The mains in the town were carefully looked after, and the loss of gas by leakage was very moderate. The plant and machinery were adequate for all requirements, and the provision of a small auxiliary boiler was all that was necessary. The company were on good terms with the authorities, and the manager made every endeavour to give satisfaction to the public. The directors did not hear of any complaints being made as to the supply of gas. The municipal arrangements of the town did not appear to give satisfaction, and a change of local administration was not unlikely to occur, in which case the directors would avail themselves of any favourable opportunity for increasing the prosperity of the company. As to their prospects he could only repeat that extended business was the necessary condition of returning prosperity, and this he thought they might hope for. Coals might be expected to remain at a moderate figure, though in the case of this company the rate of freight was of more consequence than the actual cost of the raw material. Exchange was still unfavourable, but this was believed to be only temporary, and therefore he was encouraged to expect that the present year would again show a further improvement, and be more satisfactory to the shareholders.

Mr. STOPFORD seconded the motion.

Mr. ELGER said the chairman had given a most straightforward statement of affairs. He had not concealed what was bad in the past while encouraging a hope of better results in the future. The only thing that seemed to need further explanation was the item of bad debts. He hoped that there was due diligence exercised in the collection of the accounts.

The CHAIRMAN said the bad debts were heavier than usual, owing to failures arising out of the bad times of the last two or three years. He believed they would not have to make the same complaints again.

The SECRETARY said the loss upon gas-rental was not large. The rental was collected monthly, as was the custom in the East.

The motion was put and carried.

On the motion of the CHAIRMAN, seconded by Mr. PEILL, the retiring director, Mr. Stopford, was re-elected, and returned thanks.

Mr. H. M'L. BACKLER moved, and Mr. CARTER seconded, the re-election of the retiring auditors, Mr. Peill and Mr. Stokes, which was agreed to.

Mr. PEILL, in acknowledging the compliment of his re-election, said he was sorry that he could not quite confirm the sanguine expectations held out by the chairman, of a probable increase in the prosperity of the company. It appeared to him that they had got to the minimum price of coal. He did not think freights were likely to be reduced, while, if political complications arose, they would be most likely to rise. One of the most serious, and he believed the real drawback of the company, was that the rental was not sufficient to pay the fixed expenses necessary in an undertaking of this kind. The chairman had told the meeting that, if they could double their rental, the profit on the increase would be undisturbed by the expenses. With a rental of less than £10,000, they had at the present time administrative expenses amounting to £900, even while practising the greatest possible economy. It was idle, therefore, to anticipate any great increase of dividend unless the profits were enormous, which they were not. The undertaking, indeed, was too small for a public company; it might do very well as a private enterprise, but as a public company it would not pay, so that, unless some miraculous change took place, which he did not look forward to, the shareholders must not anticipate much addition to the dividend for some time to come. He hoped he might be disappointed in the matter, and he was sure that, as far as energy and zeal in the management of the company were concerned, the shareholders could not have better men at the head of their affairs.

On the motion of Mr. ELGER, a vote of thanks was given to the chairman and directors for their attention to the business of the company.

The CHAIRMAN, in acknowledging the vote, said he had been a little taken by surprise by the remarks made by Mr. PEILL, and certainly he could not agree with that gentleman that there was no prospect of the company doing better in the future than in the past. If the rates of exchange became more favourable, and there was no rise in the price of coal, and the proportion of bad debts was reduced, he (the chairman), who was not usually over-sanguine, thought they might expect a much more satisfactory result.

On the motion of Mr. PEILL, seconded by Mr. STOKES, a cordial vote of thanks was given to the secretary.

Mr. HERSER said he appreciated the kindness which had prompted the compliment just paid to him. It would, of course, be more pleasant for him to stand before the meeting if there was a larger dividend to declare, and he was inclined to think that the prospects of the undertaking were not so depressing as depicted. Indeed, he thought there were some very encouraging features, which would be apparent to the shareholders at the end of the year.

The proceedings then terminated.

CITY OF MELBOURNE (AUSTRALIA) GAS AND COKE COMPANY.

A Special General Meeting of Shareholders was held at the Company's Offices, on Tuesday, Jan. 23—Mr. THOMAS MOUBRAY, J.P., Chairman of the Board of Directors, in the chair.

The SECRETARY (Mr. J. Scott) read the following report and financial statements:—

Your directors submit the usual audited statements of account for the half year ended Dec. 31, 1876.

The general reduction in the price of gas to 7s. 6d., which took effect on the 1st day of July last, has, of course, diminished the revenue from that source, although, taken as a whole, under the circumstances, results, it is thought, will not be considered unsatisfactory.

The half years, working, with the balance brought forward, has left a credit of profit and loss of £9317 5s. 9d., from which a dividend is now declared at the rate of 6 per cent. per annum, absorbing £7500, leaving unappropriated and carried forward to next half year £1817 5s. 9d.

The works have been carefully maintained in an efficient state, and operations throughout have been conducted with economy and regularity. The construction of an out-station gasholder, for the better supply of districts south of the Yarra, is being pushed forward diligently, and will, it is confidently expected, be available for next winter's requirements.

Dr. General Balance-Sheet, for the Six Months ending Dec. 31, 1876. Cr.			
Capital account	£250,000	0	0
Debitures	30,000	0	0
Interest on debentures	750	0	0
Debiture redemption-fund.	22,073	15	5
Insurance account.	4,005	3	9
Meter replacement account	4,500	0	0
Bills payable	1,727	13	0
Deposits	29	17	3
Unclaimed dividend account	476	17	4
Sundry sums due by the company	5,038	13	7
Wear and tear account	19,058	12	9
Profit and loss, as per statement	9,317	5	9
	£346,977	18	10

Profit and Loss Account.			
Coal carbonized.	£21,153	11	9
Coal used for fuel	28	0	0
Cost of purifying	911	3	2
Directors allowance	300	0	0
Auditors fees	21	0	0
Salaries.	1,862	1	8
Management of works, inspector's and timekeeper's wages	1,106	5	4
Stokers and labourers wages	4,012	4	10
Lamplighters, &c.	1,510	16	6
Rent and taxes	768	3	4
Subscriptions and donations	39	19	0
Law expenses	59	9	0
Cartage	414	0	4
Water, travelling expenses, and sundries	723	1	3
Stationery, printing, advertising, &c.	265	2	8
Bad and doubtful debts	744	18	6
Fines, overcharges, &c.	76	9	6
Oil, engine packing, &c.	59	7	0
Coal and coke sacks	53	2	6
Meter replacement account	500	0	0
Wear and tear account	4,000	0	0
Service laying	1,038	19	8
Insurance account	250	0	0
Interest on debentures for half year.	750	0	0
Balance	7,467	10	11
	£48,115	6	11

By Balance at credit of profit and loss at June 30, 1876	£9,349	14	10
To Amount required for dividend, ditto	7,500	0	0
	£1,849	14	10
By Balance, as above, brought down	7,467	10	11
	£9,317	5	9

The CHAIRMAN moved the adoption of the report and balance-sheet, and in doing so said the directors considered that the financial position of the company was very satisfactory. Their constant aim had been to carry on the works with economy and efficiency, and in this object they had been ably seconded by the secretary, Mr. Scott, and the manager, Mr. Kelly. The directors had entered into a very satisfactory contract for coal for the incoming year, and altogether the affairs of the company were much more satisfactory than at the meeting of the company in July last.

Mr. M. BENJAMIN seconded the motion, which was carried unanimously.

Mr. CROPPER referred to the item in the accounts, "Bad debts." He thought the amount rather large, and for the benefit of the company, in future, he suggested the advisability of allowing a discount of, say, 5 per cent. on all accounts paid during the month.

The CHAIRMAN said that he too thought the item rather large and unsatisfactory. The matter had caused the directors some consideration, and the suggestion should have due attention.

On the motion of Mr. R. COHEN, a vote of thanks to the board of directors and officers of the company was unanimously carried, and the proceedings terminated.

SOUTH MELBOURNE (AUSTRALIA) GAS COMPANY.

The Ninth General Meeting of Shareholders was held at the Mechanics Institute, Emerald Hill, on Wednesday, the 31st of January last—Mr. J. W. RANDELL in the chair.

The report read by the SECRETARY showed that the profit for the half year was £1809 13s. 9d., from which had to be written off for preliminary and parliamentary expenses, £600; £100 for wear and tear; and £30 for bad and doubtful debts, leaving £1079 13s. 9d., which, added to the balance from last year, left a total credit to profit and loss of £1447 1s. 10d.

The CHAIRMAN, in moving the adoption of the report, congratulated the shareholders on the steady and satisfactory progress of the company. No doubt the directors expected that they would be better supported than they had been. If the persons who had promised to support the company had only honoured their signatures, and consumed the company's gas, as they promised, the balance-sheet would have been a great deal better than it was. If all the parties who had promised to take the gas had acted as some of them had done, they (the public) would have been handed over to the old companies, who would speedily recoup themselves for any loss by an advance in price. The other companies, however, had now begun to find out that this company were not to be snuffed out, and they also found out that the reduction of price to 5s. 10d. would act more detrimentally to them than to this company. Those companies had large capital invested, and with the price of gas at 5s. 10d. they could not pay those dividends that the shareholders had a right to expect. It was to the interests of all the companies to have a uniform price for gas. When the Collingwood Company's Bill was before Parliament, the South Melbourne Company were charged with offering a factious opposition, and wasting the time of the House. But the directors were fighting for the interests of the shareholders, and it was a matter of life and death to them not to allow the other company to raise a sum of money which would prove injurious to this company, and which would, in the time to come, prevent a Metropolitan Board of Works obtaining the gas-works on fair terms. All that the South Melbourne Company fought for was that the same clause should be inserted in the Collingwood Company's Bill, that there should be a uniform price of gas not exceeding 7s. 6d., which had been inserted in the South Melbourne Bill through the instrumentality of the Melbourne and Collingwood Companies. That would have been satisfactory to the Legislature and the general public, but the Collingwood Company would not agree to it. He thought, however, that that company would be no more successful in the next session than they had been in the past one. In regard to the South Melbourne Gas Company, he might say that the whole of their works were in the most satisfactory condition. Mr. A. K. Smith had made a most elaborate report upon the works, and without the expenditure of another shilling the company could turn out three times the amount of gas that they now did. He hoped that at the next meeting the directors would be in a position to pay a better dividend than hitherto. They might have declared a dividend this half year of 6 per cent.; but, from what had occurred at previous meetings, they believed that the shareholders would be better satisfied to carry the balance forward to next account. The company had a large body of shareholders, twice as many as the other two companies put together, and if those shareholders would consume only this company's gas, the consumption would greatly exceed that of those companies.

Mr. MALLETT seconded the motion for the adoption of the report, which was agreed to.

The retiring auditor, Mr. Runting, having been re-elected,

Mr. BUTTERS moved—"That as the object for which this company was established—namely, a great and permanent reduction in the price of gas, has been accomplished, it now desirable to protect the interests of the shareholders by making an amicable arrangement, if possible, with the other companies to establish a uniform rate of 7s. 6d."

Mr. DERHAM seconded the motion, which, after some conversation, was adopted.

On the motion of Mr. PAGE, a vote of thanks was awarded to the chairman and directors for their management of the company's business.

This terminated the proceedings.

COLLINGWOOD (AUSTRALIA) GAS COMPANY.

The Half-Yearly Meeting of Shareholders in the Collingwood, Fitzroy, and District Gas Company was held on Jan. 31 last—Mr. GEORGE JAMIESON in the chair.

The CHAIRMAN moved the adoption of the directors report, and the motion was seconded by Colonel STEVENS.

Mr. A. K. SMITH suggested a conference of the different companies to put an end to the present suicidal competition. He recommended a reduction of expenses. If there was to be any permanent reduction in the price of gas, it could only be done by preventing abnormal and unnecessary expenditure.

After a few words from Mr. ROBERTSON in support of a conference, The CHAIRMAN said that the directors had no desire to cut the price of gas down further than was necessary; and the low average of the last six months (6s. 10d.) arose from the introduction of the South Melbourne Gas Company into the system. He thought he could see a way to considerable improvement. The determination of the directors was to spend as little money as possible. If the other companies wished a conference, the directors would be ready to join, but he confessed that the prospect did not seem very clear. They must wait a little longer, and see what they were to make of the South Melbourne Company.

In the course of a short discussion,

Dr. EMBLING suggested that the shareholders should give the directors their undivided support.

The report was adopted, and a dividend of 6s. per share declared.

Mr. W. H. Barlow was re-elected auditor.

The meeting closed with a vote of thanks to the chairman and directors.

METROPOLIS GAS SUPPLY.

Dr. Stevenson's report on the gas supplied by The Gaslight and Coke Company to the Vestry of St. Pancras, during the month of April:—Maximum light, estimated by sperm candles, according to the Act—18.2 Minimum light, sperm candles—16.0. Average light, sperm candles—16.7. Traces of ammonia, indicated by turmeric test-paper—Traces on all occasions. Traces of sulphuretted hydrogen, indicated by lead test-paper—none on any occasion. Sulphur, 10.76 grains per 100 cubic feet.

QUALITY OF THE NEWCASTLE-ON-TYNE GAS.—Mr. John Pattinson reports as the results of his examinations for the month of April of the quality of the gas supplied to the borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Date.	Illuminating Power in Sperm Candles.	Grains of Sulphur in 100 Cubic Feet of Gas.	Sulphuretted Hydrogen.
April 3	15.1	6.74	Nil.
" 6	15.2	7.25	"
" 10	15.0	8.71	"
" 13	14.7	19.31	"
" 17	15.0	19.03	"
" 20	14.3	18.64	"
" 24	14.5	10.39	"
" 27	14.5	30.02	"

A Sugg-Letheby standard Argand burner is used in testing. According to Act of Parliament, the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas.

THE CHEMISTRY OF GAS MANUFACTURE.

By A. VERNON HARCOURT, Esq., F.R.S.,
One of the Metropolitan Gas Referees.

[A course of Four Cantor Lectures delivered at the Society of Arts, London.]

FOURTH LECTURE.—MONDAY, MARCH 26.

In the preceding lectures I have dealt with those products of the destructive distillation of coal, which are mainly eliminated in the course of the manufacture of coal gas, and I have to speak to night of those substances which are the ingredients of purified coal gas. In the table on my right there are given the results of the analyses of various samples of coal gas made some years ago by Dr. Frankland. The figures show that the principal constituents are two—hydrogen and marsh gas. The relative proportions of hydrogen and marsh gas vary to some extent, but, as a rule, that of hydrogen is the larger, so that an average sample of coal gas contains nearly 50 per cent. of hydrogen, and about 36 per cent. of marsh gas. The proportion of the gas next in amount is much smaller; of carbonic oxide there is generally about 8 per cent. Next comes a group of constituents—comparatively small in quantity, but chief in importance—olefiant gas and its homologues, which may be regarded as condensed forms of olefiant gas, and of these the proportion is about 5 per cent.

I have here some bottles filled with these principal ingredients of coal gas—hydrogen, marsh gas, carbonic oxide, and olefiant gas. They are all as colourless and transparent as air. I will endeavour, in the first place, to show you some of the differences in their properties, and, in the next, to effect the synthesis of coal gas, by mixing them in the proportions in which they are found to co-exist. I pour hydrogen from this bottle upwards, through the water of the pneumatic trough, into a bell jar, which is fitted with a bat's-wing burner on the top, so that I may be able to burn the gases in succession, and you may be able to judge of the difference in their illuminating power. I will pass up sufficient of each to show you the kind of flame which the gas produces, and, as I shall burn them all under the same pressure, and with the same burner, you will be able to make a very fair comparison of their illuminating power. I have now some hydrogen in the jar, and by depressing the jar into the water of the pneumatic trough, I have put it under pressure, and on lighting it you see the kind of flame with which hydrogen burns—a flame of very high heating power, but by itself of very small illuminating power. You see how colourless and non-luminous it is, but also to what intense brightness it ignites a coil of platinum wire which I hold in it.

Now I will repeat the experiment with marsh gas. Here you see I have, as compared with hydrogen, a gas burning with considerable illuminating power; and although the gas, which has been prepared in the ordinary way, by heating together soda-lime and sodium acetate, is probably not perfectly pure, and the illuminating power may be somewhat greater than it would be with pure marsh gas, yet I have never seen a sample of marsh gas which had not some illuminating power; and I think, therefore, the statement frequently made, that marsh gas is to be regarded, like hydrogen and carbonic oxide, simply as a diluent of coal gas, combustible but non-luminous, must be accepted with some reserve.

Next I will take the carbonic oxide. There you have the characteristic blue colour, and a scarcely luminous flame. In this case, as in the case of hydrogen, I may show you that this non-luminous flame has an exceedingly high heating power by holding in it the spiral of platinum wire.

I have still one other of these principal ingredients to examine—namely, olefiant gas; but while that is being brought into the bell-jar, I may pass on to the consideration of the heat which is produced by the combustion of these gases. I have a table here, which Dr. Frankland has kindly lent me, showing some of the different effects of burning marsh gas, carbonic oxide and hydrogen. There is a difference, though not an important one for any practical purpose, between the quantities of oxygen which are consumed by the three, marsh gas consuming four times as much oxygen as is consumed by either carbonic oxide or hydrogen, the two latter consuming it to the same amount. As to the carbonic acid generated, marsh gas and carbonic oxide both produce their own volume of carbonic acid, while hydrogen, of course, produces none. There is a difference also in the amount of heat that is generated by the combustion of equal volumes of these three gases. One cubic foot of marsh gas, measured under standard conditions—that is, at a temperature of 60° Fahr., and under a pressure of 30 inches of mercury—will heat, by its combustion, 6 lbs. of water from freezing-point to boiling-point. One cubic foot of carbonic oxide would heat 2 lbs. of water through the same range of temperature—that is, it produces only one-third the amount of heat which is produced by the combustion of an equal volume of marsh gas. Lastly, the heating power of hydrogen is very nearly the same as that of carbonic oxide, comparing, of course, volume with volume, not weight with weight.

Now I will return to the experiment with the olefiant gas, and you see that I have here a gas which really is too powerfully illuminating to be burnt in such a burner; that is to say, it gives a brilliant light, but burns with a smoky flame, and the full illuminating value of it is not produced. Although I think marsh gas should not quite be regarded as hydrogen and carbonic oxide are regarded, as merely combustible diluents, yet no doubt the principal source of the illuminating power of coal gas is the relatively small proportion of olefiant gas which it contains.

Now I will make from the residues of these gases, which remain in the bottles, a mixture to represent coal gas. I mix first those three having least illuminating power—the hydrogen, the marsh gas, and the carbonic oxide; and I will show you what amount of light is obtained by burning a mixture of these three gases by themselves. Then I will add the proper dose of olefiant gas, 5 per cent. or so, which coal gas ordinarily contains, and show the difference in the illuminating power thus produced. I have now about one-half the bell-jar full of hydrogen; next I put in marsh gas to about one-third of its capacity, and then about one-tenth of carbonic oxide. I cannot allow them much time for diffusion, but in a vessel of this diameter gases mix very rapidly; and I will now burn a little of the mixture as it is, this being in fact coal gas, *minus* olefiant gas. You see that we have a gas of very poor illuminating power. The illuminating power is not *nil*, but it is exceedingly small. I have here a cylinder on which I have measured off a volume which is one-nineteenth of the volume of this bell-jar measured down to the point to which it is now filled with the mixture of gases, so that if I pass up into the bell-jar the olefiant gas which this cylinder contains, I shall have added 5 per cent. of olefiant gas to the mixture, whose small illuminating power you have already seen. I must allow it a few moments for diffusion, and in this case I cannot freely stir the gases together by agitating the water beneath them, because olefiant gas is sensibly soluble in water. I now expel the mixture through the burner and light it, and you see that I have a gas which has about the ordinary illuminating power of coal gas.

I propose now to make a few observations upon the nature of flames. I have arranged here an experiment in order to illustrate this fact, that what we speak of as flame is a phenomenon occurring at the common surface of two gases capable of acting chemically one upon another with the production of a temperature of incandescence, that incandescence being either the incandescence of a solid or of a gaseous substance. Thus we may either have coal gas or any other so-called combustible gas burning in the air, or we may have the gas which I have now succeeded in lighting, namely air, burning in coal gas.

I have fitted up a large lamp-chimney with a cork at each end. Two glass tubes pass through the lower cork; one, of a quarter of an inch in diameter and 5 inches in length, is central, and rises one inch within the chimney; the other, by its side, passes just through the cork, and is connected with the gas supply. A third tube passes through the cork in the top of the chimney, and serves as outlet. I am sending through the chimney a slow stream of coal gas, which is now burning at the top of the apparatus. The coal gas within the chimney, being lighter than air, produces a small diminution of pressure towards the bottom, and therefore a slow current of air enters the chimney by the open tube. The jet of air thus produced, having been lighted at the end of the tube within the chimney, and being in an atmosphere of a gas with which it can combine, produces a flame in which air is the inside gas, and coal gas is the outside gas. Burning above is a flame differing from that below only in this respect, that common air is the outside gas and the coal gas is inside; so that here we see two phenomena which are perfectly similar, although one is much more familiar than the other. You see the degree of resemblance between the two flames. There can be no doubt that if our constitution were such that we were capable of living in an atmosphere of coal gas, and if we were able to make from any material, which would then correspond to coal, a gas having the nature of atmospheric air, we could lay it on and light our streets and houses with air as we now do with coal gas.

Now the nature of flame being of this kind, there is a further question, and a very important question, as to the nature of luminous flames, and as to what is the common property to which different flames owe their luminosity. In the case of what may be described as hydrocarbon flames, such as the flame of coal gas, the theory of Sir Humphry Davy is, I believe, the true theory—namely, that their luminosity is due to the presence of solid carbon in the flame. It has been pointed out that there are examples of highly luminous flames in which there is no solid matter. If we burn a substance of which I spoke in my last lecture—carbon bisulphide—in an atmosphere of oxygen, we have an intensely luminous flame, although the substances produced—carbonic acid and sulphurous acid—are both at the ordinary temperature gases. Even in the case of one of the most brilliant of flames, that produced by the combustion of phosphorus, the oxide of phosphorus at the high temperature at which it is formed is also gaseous; and there are some other highly luminous flames in which nothing solid is present. But there are also plenty of examples of flames, otherwise non-luminous, which are rendered luminous by the introduction into them of a solid substance.

In the case of the flame of a candle or of coal gas, a finely-divided solid substance is formed in the flame. At the high temperature which is produced by the burning of carbon and hydrogen in the outer zone of the flame, the gas which is still within this zone, and has not yet emerged into the air, or into the presence of a sufficiency of oxygen for its combustion, is decomposed and deposits its carbon; and it is to the ignition and incandescence of this carbon that the luminosity of the flame is due. In a word, what we see in the flame of coal gas or of a candle is soot heated to whiteness. I will try to illustrate this to you by a very simple experiment. I have here a Bunsen burner, burning with its well-known non-luminous flame, and I have placed round it a tray formed of a piece of stiff paper, on which there is a layer of lampblack. On shaking this paper, particles of the lampblack rise in fine dust, and pass through the openings for air at the bottom of the burner, and so rise in a fine carbonaceous cloud into the flame. You see that as long as the cloud is kept up the flame is luminous, but as soon as the agitation ceases the flame burns as usual in a non-luminous manner.

There is another experiment I need hardly make, it is so familiar. If we dip any cold substance into a luminous flame of coal gas or of a candle, a black carbonaceous coating is deposited upon it. No doubt that is not conclusive as to the presence of carbon in the flame. It might be the case that that which otherwise, at the high temperature of the flame, is gaseous, becomes solid when it is brought into contact with the cold substance upon which it is deposited. Moreover, the deposit which is thus formed does not consist of pure carbon, but contains a certain amount of hydrogen. That, however, is also true of coke and charcoal, and of every portion of carbon which is produced by the ignition of a substance in which hydrogen was once united with carbon, however high the temperature applied may have been. When coal gas or any gaseous hydrocarbon is heated to redness in a glass tube, more condensed hydrocarbons—or what are called with convenient vagueness tarry matters—are formed and deposited. And if these tarry matters are strongly ignited, air being excluded, a solid residue always remains. These conditions exist in the interior of a gas flame, and, apart from the evidence furnished by the deposition of soot on a cold object placed in the flame, it seems certain that a solid non-volatile hydrocarbon must locally and transiently be formed.

Now as to the conditions which render a flame of this kind more or less luminous. I have arranged here an experiment, for which I am indebted to Professor Heumann, which illustrates well the effect of a more or of a less rapid and intense combustion upon the flame of coal gas. I have a bottle of oxygen, fixed in an inverted position, and I will burn a small jet of coal gas in the oxygen; and while it is burning, I will describe to you what I conceive to be the nature of the changes which occur. The first thing I wish you to observe is that the gas, which was burning in the air with a fairly low and luminous flame, when placed within the oxygen gives a brighter point of flame, but so much smaller, that on the whole the light emitted is less than it was before. But that light will continually increase—it is already greater than it was when the jet was first placed within the bottle. The flame grows in size, diminishing a little in whiteness and brightness, but increasing in the total amount of light which is given out, up to a certain point; and after that point has been reached and passed, then the flame continues to increase in size, but the total production of light again diminishes. Some interesting observations have been made upon this series of changes. In the first place, it seems that the amount of light which is given by a coal-gas flame burning in air depends simply upon the degree of dilution of the oxygen with an indifferent gas, and that it is immaterial whether that gas is nitrogen, as it actually is in the case of air, or whether it is some other gas, such as carbonic acid; in any case the luminosity reaches its maximum when the proportion of the diluent gas is about that which it is in our atmosphere—that is, about four parts of diluent to one of oxygen. You observe now that the flame, burning in a mixture of oxygen and carbonic acid, has very much the same appearance as it had when burning outside in the air. At this point, I believe, if an analysis of the gas were made, we should find that one-fifth of the gas remaining in the bottle was oxygen, and that four-fifths were carbonic acid or steam. But you see as the dilution of the gas advances, the quantity of oxygen in the bottle being progressively diluted with the products of combustion, the luminosity continually diminishes whilst the size of the flame increases, and you see at last a large flame wholly non-luminous.

There are, however, several other conditions upon which the degree of luminosity of a flame depends. One of these, which has been carefully investigated by Dr. Frankland, is the density of the atmosphere in which the gas burns. His experiments began with some observations which he made upon the combustion of candles at different heights. The same candles were burnt first at Chamounix, and then at the top of Mont Blanc,

and it was found that the rate of combustion was unaffected by the considerable difference of barometric pressure at these two different elevations; but it was observed that the luminosity of the candles was much less at the higher than it had been at the lower level. The observations were afterwards carried further by burning a jet of gas in an apparatus in which the atmospheric pressure could be varied at will. The general result, expressing by 100 the illuminating power observed at the ordinary atmospheric pressure of 30 inches of mercury, was that, down to a pressure of 14 inches, each diminution of one inch of barometric pressure produced a decrease in illuminating power of 5.1; from which it follows that the ordinary variations of atmospheric pressure, amounting to 2 inches or more, produce very appreciable differences in the illuminating power of the same sample of gas. Or again, the same sample of gas burning in two towns at different levels, and thus being under a different atmospheric pressure, will exhibit different illuminating powers.

Another condition is the temperature of the flame. Other things equal, the illuminating power appears greater in proportion as the temperature of the flame is higher. An interesting experiment has recently been made by substituting for the brass tube with which Bunsen burners are ordinarily furnished, a platinum tube, which can be heated to redness without giving off any substance which will colour the flame or render it luminous; when the gas is lighted, and the tube through which it is passing is heated with a strong horizontal jet of flame from a blowpipe, the non-luminous flame becomes, to some extent, luminous. The explanation given is that a mixture of gas with so much air as to render it non-luminous at its normal temperature of combustion becomes luminous when the temperature of the flame is raised by a previous heating of the mixture. An alternative explanation, which naturally suggests itself, is that the change in the luminosity of the flame may depend, not upon the alteration in the temperature, but upon some change produced in the composition of the mixed gas and air by its being locally exposed to a high temperature previously to combustion. But it is said that if the gas, which, when it is burned immediately after it has been heated, gives a luminous flame, is conducted through a certain length of tube—so that it may have lost the high temperature without any further change in circumstances—and then is burnt, the flame is non-luminous as before. It is said also that in the tubes through which the gas is led, no deposit is observable, as would be the case if the changes were due to the production and condensation of some tarry matter by the action of the high temperature on the mixture of gas and air.

There are a number of interesting questions connected with the relation between temperature and luminosity, such as the cause of the interval seen to be interposed between the burner and the flame, that interval probably depending on the cooling influence of the metal tube of the burner. A similar effect is observable if any conducting material, such as a piece of metal, is placed within the flame. In this case a non-luminous interval may be seen, where there seems to be no flame at all, between the cold substance which is thrust in, and the body of the flame. The reason seems to be that the contact with such a substance lowers locally the temperature of the burning gas below the point at which combustion takes place. A fact that we often have occasion to observe in a chemical laboratory is this, that if we depress a large vessel containing water into a Bunsen flame, there is a smell of unburnt gas, or partly-burnt gas. No doubt the introduction of a large cold surface into the flame cools the gas so much, that a considerable portion of it no longer reaches the temperature required for combustion, and although part of the gas is burning, part of it escapes unburnt or incompletely burnt.

There is another point of very great importance as affecting the brightness of a flame—namely, the manner of contact between the gas and the air. Indeed, in the construction of burners, the point of greatest importance is to bring the two together in such a manner as that the production of finely divided carbon, in the first place, and a strong ignition of the finely divided carbon in the second place, may be promoted as far as possible. I will show you a very simple experiment, which illustrates the great importance of the manner of bringing together the coal gas and the air. I have a small gasholder here, charged with coal gas; I am able, with the column of water at the top, to obtain a stronger pressure than that at which gas is supplied. Here is an ordinary bat's-wing burner. By supplying the gas at the rate at which the burner is designed to consume it, I have the ordinary flame; but now, on turning on this tap, so as to get a more rapid flow of gas, you observe the effect. First, I have an increase in the size of the flame, and, probably some increase in the total amount of light; as I open the tap more widely, the quantity of gas that is burned continually increases, but, instead of the illuminating power being improved, it is almost destroyed. That is the effect of having gas brought into the air at a high pressure. You see that, although I am consuming much more gas, the burner yields very much less light than it does with quite a small flame. The reason is that the gas rushing thus into the air produces a rapid admixture of itself with the air.

In this experiment the distance of the flame from the burner depends upon the relation between the rate of issue of the gas and the rate at which the combustion of the mixture of air and gas travels towards the point from which the gas issues. Bunsen has made experiments upon the rate at which combustion is propagated, by charging a tube with a mixture of oxygen and hydrogen, in the proportions in which they combine, and observing at what rate the combustion of this explosive mixture travels from one end of the tube to the other. When gas is burning, there is always a race in opposite directions, the gas issuing from the burner at a certain rate, and the combustion propagating itself from the outer part of the flame inwards towards the burner at another rate. The *locus* of the inner edge of the flame depends partly upon the absorption of heat by the burner, partly upon the relation between these two rates. In the case of the roaring, non-luminous flame, which I showed you just now, the flame was a long way from the burner, the reason being that the velocity of the gas at the point of issue greatly exceeded the rate of propagation of its combustion, and only was made equal to it by the resistance of the air operating through a considerable space. We are all familiar with the principle of the steam-jet, in which a current of air is produced by sending a jet of steam under strong pressure through a tube to which the air is admitted. Its action may be compared with that of a current of gas issuing under pressure into a still atmosphere. The jet of steam carries on, by mixing with itself, the air in contact with it; and in the same way gas issuing under pressure carries along and mixes with itself the atmosphere around it. Thus by burning gas under a high pressure exactly the same state of things is brought about as in the Bunsen burner; that is to say, the gas becomes mixed with so large a proportion of air that there is no part of the flame where carbon is deposited and becomes incandescent, and consequently the flame is non-luminous.

I may illustrate this point in another way. I have here two exactly similar Argand burners, which I will adjust so that their flames may be equal, and now I am going to substitute for the chimney of one of them a much longer chimney. You will see, on comparing these two flames, that the difference between them is something like the difference between the appearance of the jet of coal gas burning in the bottle of oxygen, and that of the same jet burning in the air. The burner with a longer chimney has a whiter flame, and, considering only the unit of area, a brighter flame,

but on the whole the photometer would show that it is giving less light than the other. For we must remember that the total luminosity of a flame is the product of two factors—of the brightness of the unit of area and of the total number of such units. In other words, flames differ one from another both in brilliancy and in size, and the quantity of light emitted by a flame depends upon its brilliancy and also upon its size. In this case, the effect of putting on the longer chimney is that there is a much stronger draught, and more air is drawn through than is needed for the most advantageous combustion of the coal gas; and, consequently, although the actual flame is brighter, the total amount of light got out of the same volume of gas is less than it is in the other case.

I have here a drawing of one of these Argand burners, made to show you some of the points of importance in their construction. One I have already called attention to—namely, the proportion between the quantity of gas that is burnt and the size of the chimney. It is of great importance that the openings for the admission of air below, and that the chimney should be of the right dimensions for the quantity and quality of gas that is burnt, and these are matters of very fine adjustment; so that one ought properly to have a different chimney for the same rate of burning for each quality of gas, or for the same quality of gas burning at different rates. Then the manner in which the air reaches the gas is also of importance. This sectional drawing shows a cone, the object of which is to cause the current of air to impinge on the flame of the gas. In an Argand burner there is an admission of air through the centre, and so the flame burns in a ring, the air having access to it both within and without. Another point of great importance which the experiment I just showed illustrates is, that the gas should issue into the air very gently. If it enters with a rush, it mixes itself with the air, and there is a loss of light. Consequently, in well-made Argand burners the holes in the steatite chamber, from which the gas burns, are made very large relatively to the quantity of gas which is to pass through them.

I pass now to the measurement of the illuminating power of gas, and I will illustrate to you the manner in which the estimation of the illuminating power of gas is commonly made by taking this candle as the unit of comparison, and this burner, which is one of the standard burners that are employed in photometry, for the burner at which the gas is consumed. I have here also one of the discs which is used in photometry. It consists of three paper discs of the same size, the outer ones being of thin paper, and the inner one of stouter paper, with a star cut out in the centre. Either such a disc as this, or one with a round grease spot in the centre, will serve the purpose. If I place this disc midway between the candle and the lamp, it receives the light of the candle on one side and the light of the lamp on the other, and since the light of the gas-lamp is very much greater than the light of the candle, you see on the side on which the candle is, a dark star on a white ground. But if I bring the disc near to the candle until the light which reaches it from the candle is greater than that which reaches it from the lamp, then the conditions are reversed, and you see a bright star upon a dark ground. Now, if I move it between the two until the light which reaches each side of it is equal, the star disappears. Therefore, the disappearance of the star serves as an indication that the disc is so placed between the candle and the gas-flame as to receive equal light from each. Now we know that the light which comes from any source of light varies inversely with the square of the distance of the object illuminated from that source. We, therefore, can compare the amount of light proceeding from the gas-flame and from the candle, by simply measuring the distance between each of them and the disc. Now, if I were to measure the distances between the candle and the disc, and the lamp and the disc, when the disc is in the position of equal illumination, I should find probably that the distances were very nearly as four to one, the distance from the candle to the disc being about one-quarter of the distance between the disc and the gas-lamp. This would be the case if my standard candle were consuming sperm at the proper rate, and if the gas burning at the standard rate of five feet an hour was of the illuminating power of 16 candles. Or to argue from the observed intervals to the illuminating power: since the amount of light varies inversely with the square of the distance from the source of light, and the ratio of the two intervals is as four to one, the illuminating power of the gas, compared with the illuminating power of the candle, is as sixteen to one. It is in this way that the luminous power of a sample of gas is estimated.

It is, however, necessary that the gas should be burnt under certain fixed conditions. The rate at which the gas is to be burnt has been fixed at 5 cubic feet an hour, and the burner at which the gas is to be burnt has also been fixed. During the past year the standard burner has been defined by an exact measurement of all its important parts, the height of the cone and of the steatite chamber above the gallery on which the chimney stands, the size of the holes from which the gas issues, and the internal and external diameter of the steatite chamber. This burner was constructed by Mr. Sugg, and is a most excellent burner, although I believe he has improved upon it since. The fixing of the burner by Act of Parliament was a very important step, and one quite in the right direction, in order to establish a fixed measure of the illuminating power of the gas which the gas companies undertake to produce.

Besides a fixed manner of burning the gas, it is also necessary that there should be a standard of illuminating power, and that which is used in this country for the standard is a sperm candle, one of six to the pound, and burning 120 grains an hour. The ordinary way in which the testings are made is by using two such candles fixed side by side, and comparing their light, by means of the disc in the manner I have described, with that yielded by the gas burning at the rate of 5 cubic feet an hour at a standard burner. There are certain corrections which need to be made in using the candles. Although they are intended to burn at the rate of 120 grains per hour, sometimes, as one would expect, they burn more, and sometimes less, than that amount. It is assumed, although the assumption is only an approximation to the truth, that the light given by the candles will vary directly with the weight of the sperm consumed; and, accordingly, the candles employed are weighed before and after each testing, and a proportional correction of the result is made, if more or less than the proper quantity of sperm has been consumed. Candles are certainly a very imperfect standard of comparison. The amount of light that the candle gives varies, not only with the rate at which the grease is being consumed, but with a number of other conditions, with the curvature of the wick, with the surrounding temperature, and with the way in which the candle is burning from minute to minute, a different amount of light being produced by a candle when its cup is full of grease, and when it has been drained dry by guttering or the capillarity of the wick. These differences are by no means inconsiderable, and, consequently, photometric observations are always uncertain, however carefully they have been made, since the standard used for comparison is itself variable. I have been endeavouring for some time to obtain a substitute which should be more satisfactory than the candles, and I wish, in concluding this lecture, to bring before you a form of standard light which I have recently devised.

What are the points in a candle which are unsatisfactory, and in what is a change needed in order to obtain a more satisfactory standard? First, there is the uncertainty as to the composition of the candles. I believe

that they are not made of pure sperm, which is too brittle, and that the manufacturer needs to mix from 5 to 10 per cent. of white wax, or a small quantity of paraffin, with the sperm, to make a serviceable candle. Next, the number of strands in the wick, which is the burner of the candle, may be varied, and the size and formation of the wick have a considerable effect upon the illuminating power. Also, as has been pointed out, the mode of burning and light of the same candle fluctuates greatly from time to time.

In order to have a material which should be more definite, I propose to employ an "air gas," a mixture of light petroleum with air. Such a gas may be readily obtained of any desired illuminating power. The light petroleum may be procured in large quantities at a moderate price, and by three or four rectifications, between 50° and 60° C., a product is obtained which volatilizes into the air readily and wholly at a low temperature. The gas which I am here burning was made by passing air through the water which is contained in this Woulfe's bottle, having previously placed upon the surface of the water a measure of light petroleum. The whole operation of making the gas consists in charging a pipette with light petroleum, placing the point of the pipette within the Woulfe's bottle, and allowing the volatile liquid to flow down upon the surface of the water, quickly replacing the corks, and connecting the outlet tube of the bottle with a gasholder, increasing the weight of the counterpoise, and opening the tap. The air then bubbles up through the water, and through the layer of petroleum which floats upon the water; the petroleum volatilizes, and mixes with the air. In order that the gas may have a definite illuminating power, it is necessary to take known amounts of air and petroleum, and such a quantity of air, and petroleum so volatile and in such quantity, that the whole of the petroleum employed may volatilize into the air. The reason for having water in the bottle is, that for the volatilization to proceed regularly, there should be a level surface, which the water provides, and also that a quantity of heat should be supplied to the petroleum, for it becomes very cold by its own evaporation, and that heat the water furnishes.

Next, it is requisite to have a very definite burner. That it should be a good burner is not at all necessary; but it is essential that it should be thoroughly definable. The burner I have here is a very simple one; it is a brass tube, 4 inches long and one inch in diameter, the upper part being closed by a plug, half an inch in thickness, with a cylindrical hole in it, the diameter of which is a quarter of an inch. The gas, therefore, issues practically at no pressure at all and passes out freely into the air. A pair of such burners are fixed side by side, like the candles in the holder of the photometer. In each tube I have packed a little asbestos, in order to have the means of equalizing the proportion in which the gas divides itself between the two. That, however, has no influence at all upon the way in which the gas-flame burns; the upper part is clear, and the gas streams out freely into the air.

The first step towards obtaining a standard gas was to ascertain experimentally, with various proportions of air and petroleum, which proportion gave with this burner the most constant flame, and at what rate each sample needed to burn to give from each gas-burner the light of one candle. I find I can make the gas such that the rate of burning is a convenient round number. The gas is now passing through the meter at the rate of one cubic foot an hour, and to each of these burners, therefore, at the rate of half a cubic foot an hour; and the two flames are now giving, but much more regularly, the same light as the standard candles burning beside them.

I have made many experiments, comparing in a photometer the light of such gas-flames with the light of the candles, and altering slightly the proportion of petroleum until I have got this equality. I think that this gas-flame will have as an unit of light the advantage over the candles of greater definiteness of substance, and far greater definiteness in the conditions of burning. I find also that the flame is very much steadier in the photometer than the candle-flame. The whole experiment lies in the hands of the operator; he has not to depend on the maker of the candles, for he makes the standard combustible himself. The burner is perfectly definite, and the gas itself is very readily and quickly prepared. The rectification of the petroleum is an easy operation on a scale which yields enough light petroleum for the preparation of from 10 to 20 samples of standard gas.

This question of the unit to be employed in the measurement of the illuminating power of coal gas, which I have thus attempted to solve is the last topic on my list, and concludes the course of lectures which your Council have done me the honour to ask me to undertake.

THE RIVER THAMES.

At the Sixteenth Ordinary Meeting of the Institution of Civil Engineers—Mr. GEORGE ROBERT STEPHENSON, President, in the chair—the paper read was on "The River Thames," by Mr. J. B. REDMAN, M. Inst. C.E.

It was not known whether the Romans or the Saxons carried out the earliest engineering works on the Thames. These were the embankments of the lower reaches, which shut out about 30 square miles of saltings, formerly overflowed, but now from 3 feet to 7 feet under high-water spring tides, representing at the lesser depth 70 million tons of tidal water. The tidal column from Teddington to Gravesend was equivalent to 107,544,643 tons, so that the quantity abstracted might be said to be equal to from five-eighths to three-quarters of that volume. If the water were raised 12 inches in the upper reaches, on an average, by the embankments, one-eighth of the quantity would be returned. The low-water equivalent was even more conjectural, but no doubt the low-water régime had been deepened, and the course of the river had always been the low-water channel.

The removal of Old London Bridge, and subsequently of Blackfriars and Westminster Bridges, created a revolution in the tidal condition. On the Thames, as on the Tiber and on the Clyde, bridge engineering had been antagonistic to river conservancy. Waterloo Bridge was a case in point at the present time. The systematic removal of the low-water shoals, in addition, had developed the flood and accelerated the ebb, and about 37 per cent. had been added to the above-bridge tidal volume. The result was an earlier and a longer flood, with increased altitude, and a shorter, lower, and greater scouring agent on the ebb. Five centuries back, high water at London Bridge was three hours after the moon's transit; now it was two hours. During the last two centuries, the period of flood had been accelerated one hour and a half; and high water was at present half an hour earlier at London Bridge, as compared with Sheerness, than half a century back. This was mainly due to the removal of Old London Bridge, which had a water-way of 7300 superficial feet, as compared with 17,600 feet, that of the present structure. This correspondingly impeded the tide, which now flowed higher 12 inches and ebbed 4 feet lower above bridge than in former years.

The volume of water flowing over Teddington Weir was 3,223,125 tons daily. The present daily quantity supplied to the London Water Companies was 542,958 tons, or about one-sixth of the land water. This was equal to 198,179,670 tons annually, sometimes estimated at 250 million tons. The annual outflow of the river was 1,176,440,625 tons, equivalent to 3½ inches of rainfall over the drainage area of 5162 square miles. An annual rainfall of 24 inches would yield 8,030,597,142 tons; one-fourth of this

amount, after allowing for absorption, evaporation, &c., was 2,007,649,285 tons of available water. This, however, was one and two-thirds the actual result, so that instead of 6 inches of annual rainfall being available, not much more than about one-half, or 3½ inches, were so, and this was only four times the quantity required for the Metropolitan water supply. The average outflow was equal to from one-sixth to one-seventh of the annual rainfall.

High water at Sheerness was fixed by Colonel Lloyd, in 1830, as being 2 feet lower, and low water as being 20 inches higher than at London Bridge; but the tide now ebbed lower at London Bridge than at sea. Great tides had flooded London from an early period, varying from 3 to 4 feet above Trinity standard. Pepys mentioned that of Dec. 7, 1663, thus: "I hear there was the last night the greatest tide that ever was remembered in England to have been in this river; all Whitehall having been drowned." The extreme range at Gravesend was 27 feet. The quantity of tidal water shut out by the Thames Embankments was estimated at 365,000 tons; but they had compensated for it by raising the tidal column, and were thus recuperative. If the water surface from Blackfriars to Teddington had been raised 6 inches, that would be equivalent to 700,000 tons.

To show the impossibility of providing reservoirs for land water, Mr. Symons had estimated that storage for 714,285,714 tons would be required, equal to from three to four times the daily tidal volume from Teddington to Gravesend. The winter flood of 1875 at Windsor amounted to 33,723,925 tons daily, so that Mr. Symons's estimate of storage would be for 21 days of the great flood. The average volume of extreme tides from Teddington to Gravesend was 322,500,000 tons, so that the land flood water was one-ninth of the tidal water, or rather one-eighteenth during the day. The morning and afternoon tides of April 8, 1874, both rose 21 inches higher at Blackwall than at Gravesend, 10 inches higher at London Bridge than at Blackwall, and at Westminster and at Lambeth 4 inches higher than at London Bridge. The present low-water level was from 5 inches to 14 inches lower at London than at Sheerness; and at Gravesend low water was lower than London by 9 inches, and than Sheerness by 12 inches. The level of high water for a mean of the three years 1873-74-75 was 3 feet 10 inches higher at London than at Sheerness. The spring and neap high water differences varied from 6 feet to 2 feet. The maximum difference of range in favour of London amounted to 6 feet 7 inches, but usually it was 4 to 5 feet. Thirty years back high water was 4½ inches to 6 inches lower at Chelsea, and 12 inches lower at Battersea, than at London Bridge, and the low-water level was 15 inches higher. The tide of Nov. 15, 1875—the result of the great westerly gale of Sunday, Nov. 14—aided by a heavy land flood, was the highest on record—viz., 4 feet 9 inches above Trinity standard, and exceeded the Admiralty calculated range by 3 feet 3 inches. Of that great tide, from 3 to 4 inches were due to land water. The tide of March 20, 1874, rose the same height at Teddington as at Westminster—viz., 4 feet 4 inches above Trinity standard, rising 18 inches above the land water, with 7 feet oscillation at Teddington, and 12 inches at Kingston; and this tide was 20 inches higher at London Bridge than at Gravesend. The estimate of compensation due to the raising of the tidal column by the embankments might be largely increased, as the estimate of 6 inches was only taken above a plane, nothing being added for the former fall at high water above Westminster. There was now an additional depth of 12 inches at high water from London up to Richmond, where the tide flowed fully as high as in the Pool. Due to the increase of tidal volume and the dredging of shoals, the low water deep channel had been extended upwards past Woolwich and Blackwall. There were two artificial barriers to its continued extension, or at least to its availability for navigation. The first was the Thames Tunnel, which had only a depth of water of 8 feet over the crown at low water, with a normal depth above and below of 10 feet to 11 feet, and a similar condition of things existed at Waterloo Bridge. The highest tide of the past year, on the 19th of September last, was at Harwich 3 feet 9 inches, and at Sheerness 3 feet 6 inches below Trinity standard, while at the London Docks it was 1 foot 7 inches above that standard; the high water of that day in London being relatively 5 feet 4 inches and 5 feet 1 inch higher than at Harwich and at Sheerness. During the last two years the high water had been abnormally raised, as also the low water, due to the vast quantity of land water from the exceptionally large rainfall.

The public importance of this question was evident, when the sanitary character of the river was considered, making London (besides being the richest) one of the most healthy and beautiful cities in the world. The river was also the carrier of a commerce now amounting to nearly 9 million tons annually, which had been doubled in 20 years. The accumulated causes of tidal development, to which reference had been made, produced results of comparatively slow and gradual operation, though they were becoming more and more marked every year. During the last half century these causes had added about 33 per cent. to the above-bridge tidal volume, operating twice every 24 hours; thus showing the altered condition of the river, and the great improvement thereby effected, attended, however, by the lesser evils arising from the non-embankment of the low-lying portions of the Metropolis, and which, as these tidal improvements were developed, would be intensified year by year, and must demand a comprehensive remedy.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The week just ended has been characterized by much quietude throughout, in almost every branch of the iron trade. This has doubtless resulted in a great measure from the effects of the Russo-Turkish war, aided by the feeling of financial insecurity, which seems to have taken possession of the community during the past few weeks or so. At the same time there can be no doubt that, as the war progresses, some of the local branches of industry may possibly assume more activity, especially those devoted to the manufacture of armour plates for vessels of war or land forts, steel for bayonets or swords, and steel castings for the tubes of ordnance. In none of these particulars, however, has there, as yet, been any especial movement since the outbreak of war.

The pig iron market has ruled quiet so far, and some of the North Lincolnshire brands of forge and foundry iron of this class have declined in value to the extent of 1s. to 1s. 6d. per ton, notwithstanding the appreciably higher figures quoted for Scotch makers brands. A good deal of iron ore is coming into this locality from the mid-Lincolnshire mines near Lincoln. It is used for mixing with the black band ores of the South Yorkshire district, and is said to answer very well. In the merchant and manufactured iron branches there is very little change, and so much quietude that there is hardly any employment for the machinery at most of the works within 20 miles of this town. Some of the "limited" companies engaged in this branch are known to be in a very awkward predicament.

The pits throughout the South Yorkshire coal-field are, for the most part, engaged only for three or four days weekly, yet I am told that the miners now get as much coal in that limited time as they did in a full week three or four years ago. Low wages have had the effect of making

them more industrious, and the police reports plainly demonstrate that they are far more orderly than when their wages were so much higher. The demand for steam coal is fairly steady, and is likely to receive a very considerable impetus now that the Baltic has become navigable as far as Cronstadt and St. Petersburg. House coal, too, is moving off tolerably well, owing to the unusual coldness of the weather. Prices of all kinds of fuel, however, are quiet, and not likely to be increased.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The gas coal season is now beginning to open, and inquiries from gas companies are coming into the market; but as yet business is not being done, and quotations are not out to afford any reliable basis as to the prices which will be asked for contracts. So far as the general aspect of the coal trade is concerned, there is no material change to notice since my last report. In one or two cases there has been a little giving way in the price of best coal; the continuation of the cold weather, and the prospects of a strike in South-West Lancashire, are keeping the market very steady, and stocks are not accumulating. Common classes of coal, suitable for brick-making purposes, are in pretty good demand, but generally this class of fuel is a drug, and bulky is plentiful in the market. Slack continues scarce, and rather higher prices are being asked in some quarters. The average pit quotations are 9s. 6d. to 10s. 6d. per ton for good Arley; 8s. 6d. to 9s. for Pemberton four-feet; 6s. 6d. to 7s. for common coal; 5s. to 5s. 6d. for bulky; and 4s. to 5s. per ton for slack.

The shipping trade is still dull, and extremely low prices have to be accepted to secure orders, owing to the keen competition for any cargoes that are placed in the market.

In the iron trade there is still only a very limited amount of business passing, and the excitement which has been manifest in other markets has had no material effect here, except that holders of north country brands have not been quite such keen sellers as they were a fortnight or so back. There have been a few sales of Lancashire iron, but still the orders which makers are securing are not sufficient to replace those which are fast running off, and stocks are accumulating. Prices both of Lancashire and Middlesbrough brands of pig iron are without change. The finished iron trade shows no improvement, and very few orders are coming into the hands of either forge proprietors or founders. Lancashire bars are still offered at £6 15s., and Staffordshire bars at £6 15s. to £6 17s. 6d. per ton.

Several of the late partners in the Darwen Iron Company have, I understand, succeeded in their efforts to form a new company, and the furnaces have again been blown in.

The proposed reduction of wages in South-West Lancashire threatens to lead to a stoppage of the work. The masters having declined to meet the representatives of the men, a meeting of the miners is being held in Manchester this week, to decide upon the course to be adopted when the notices expire on the 17th inst.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The large fleets of coal-laden vessels which had crowded the northern coal ports the previous fortnight were all got to sea by Wednesday of last week. A great many cargoes of coals must have arrived in the southern ports by sailing vessels. Coal rates by steamers to the Mediterranean, which rose so rapidly on Saturday week—an advance equal to £9 a keel in the fortnight—came down £2 a keel last week; outward freights to Cronstadt, which had had a rise, likewise fell about 15s. a keel last week. In consequence of the demand there has been for steamers for the Baltic, and from the number which have been taken out of the coasting trade, freights to London by steamers have gone up about 6d. per ton, with a corresponding rise to other ports.

The shipments of best gas coals coastwise and abroad have been pretty good. Some contracts for medium qualities of gas coal have been made for the Continent. The best gas collieries are very well employed. Second-class gas collieries continue to do moderately. The demand for steam coals improves. Shipments are better, but there is no alteration of prices. The proposed reduction of the wages of the Northumberland miners will go to arbitration.

The iron trade of Cleveland and the district has been somewhat firmer. There has been an improved demand for pig iron for shipment, coastwise and abroad.

The chemical trade of the Tyne is extremely depressed. Prices have been getting lower. General manufacturing business is dull. The iron shipbuilding and marine engine building trades are active. Housebuilding in this district shows a considerable falling off.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

With reference to the Aitken and Young patent process of enriching gas of low illuminating power, a certain amount of misapprehension exists, which it may be well to correct before it becomes thoroughly stereotyped in the minds of gas managers and other persons. It has been publicly stated, with some degree of reserve, that Mr. Young is the originator of the process; but I am in a position to say that, with his usual modesty, this gentleman disclaims that position, and does not hesitate to say that to Mr. Aitken belongs the priority of the suggestion which lies at the foundation of the process. I believe, however, Mr. Young was also upon the same track as Mr. Aitken, when they were of necessity brought together in gas matters, in consequence of the death of the late Mr. Cusiter. The private history of the early suggestions and experimental investigations, which led to the patent process referred to, is one of very great interest; but it is undesirable that I should enlarge upon it in the meantime. It is well known to a number of persons that Mr. Aitken has long given attention to the question of the application of heat to bituminous minerals in closed chambers, and that he always brings a large amount of scientific knowledge and practical shrewdness to bear upon any manufacturing investigations in which he may be engaged.

In accordance with the notice previously given, the consideration of Baillie Wood's motion before the Dumfries Town Council, for the acquisition of the gas-works of that town, under the provisions of Sir Windham Anstruther's Gas Act, ought to have been considered at the monthly meeting, held last Friday; but it was eventually found desirable to postpone it till the next meeting.

The Police Commissioners of Alloa met on Monday, the 30th ultimo, for the purpose of taking further action in connexion with the adoption of the Burghs Gas Supply (Scotland) Act. The town-clerk reported that he had taken the preliminary steps with regard to the adoption of the Act, and that no objection had been lodged against carrying into effect the resolution recently come to by the Commissioners, in consequence of which he said the next steps for them to take was to apply to the sheriff to authorize such resolution to be registered in the Sheriff Court books of the county. When that was done the provisions of the Act would at once come into force, the date of registration being held as the date of the adoption of the Act. He was then instructed to proceed with the registration in accordance with the statute.

Dr. Wallace's report upon the quality of the Glasgow gas for the week ending the 28th of April shows that the average illuminating power ranged from 25.89 candles to 28.67 candles, the minimum varying from 25.00 candles to 28.39 candles. The highest maximum was noticed at the West Street (Tradeston) station; it was 29.05 candles.

The following statement refers to the illuminating power of the Perth gas during the same week. In three experiments with sperm candles these results were obtained:—Maximum light, 28.96 candles; minimum, 26.37 candles; average, 27.85 candles.

Mr. Alexander Mackellar, secretary to the Greenock Corporation Gas Commissioners, gives the following report upon the quality of the gas supplied in that town during the month of March, as made up from observations at the gas office:—

No. of Experiments.		Durability in Minutes. 4-inch Flame.
25	{ Minimum	66.00
	{ Maximum	71.00
	{ Average	68.63
Photometer.		
25	{ Minimum	26.68 candles.
	{ Maximum	29.87
	{ Average	28.28

Average temperature of gas while testing, 56°. The gas was free from sulphur and other impurities.

Mr. Dalziel, manager of the Kilmarnock Gas-Works, has just secured provisional protection for his invention of a new form of gas-meter, the same as was exhibited by him at the Linnithgow meeting of the West of Scotland Association of Gas Managers, held on Thursday week. Unfortunately, there was not time on the occasion to hear a formal description of it, or to examine into its merits.

At the ordinary meeting of the Glasgow Town Council held Thursday, the Gas Committee's minutes were submitted, from which it was seen that measures were being taken to have new premises erected for use as a gas and meter testing office. The premises in Alston Street, which have hitherto been occupied as a gas-testing station, and for repairing meters, &c., are required for the new central Caledonian Railway Station. A discussion on the subject took place, but the question as to the selection of a site was referred back to the Gas Committee.

The Dundee Gas Commissioners held their monthly meeting last Wednesday, when it was announced that contracts had been concluded for the supply of 26,500 tons of coal. With reference to the supply of gas to Invergowrie, the Finance Committee reported that they were in favour of the supply being continued from the Dundee works, on the understanding that the price should be 1s. above the Dundee prices for next year, on the footing of the consumption not falling below what it is at present, and that the price remain at that rate for another five years.

The first start was made with the Dunfermline Water-Works by Messrs. Stewart and Creber last Monday, close to the village of Saline. A good stretch of the track is already opened, and on Thursday the first pipe was safely laid.

At a meeting of the St. Andrew's Police Commissioners last Wednesday evening, notice was given of a motion for the next meeting for the introduction into St. Andrew's of a more abundant supply of water from a higher level than at present.

A good deal of firmness has been shown in the Glasgow pig iron market during the past week, and an extensive business has been done. The highest price paid on Friday was 55s. 8d. cash; but lower rates were quoted in the afternoon.

No change of any importance has arisen in the local coal trade. The shipping department is still active.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

- 1644.—CUTLER, S., Millwall, London, "Improvements in apparatus used in the purification of gas." April 27, 1877.
- 1645.—MORRIS, F., Brentford, and CUTLER, S., Millwall, London, "Improvements in condensers." April 27, 1877.
- 1668.—HAZLEHURST, G. S., Runcorn, Chester, "Improvements in apparatus for condensing noxious and other gases and vapours." April 30, 1877.
- 1677.—FRENCH, J., Commercial Street East, London, "Improvements in pump-valves." April 30, 1877.
- 1698.—LIDDON, J. J., Islington, and SIMMONDS, F. H., Goswell Road, London, "Improved valve-cocks or taps." May 1, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 4563.—KELEN, L. V. DER, Brussels, "Improvements in gas-stoves." Nov. 25, 1876.
- 196.—GIBROUD, H., Paris, "Improvements in rheometric regulators for gas-burners." Jan. 15, 1877.
- 686.—COLE, J., Kilburn, London, "Improvements in the method of and means or apparatus for extinguishing lamps." Feb. 20, 1877.
- 688.—HUNT, C., Birmingham, "Improvements in gas-meters." Feb. 20, 1877.
- 765.—BOULTON, M. P. W., Tew Park, Oxford, "Improvements in apparatus for producing heat by the combustion of inflammable gases or vapours." Feb. 24, 1877.
- 857.—BARKER, E. D., Bedford Row, and HARRIS, A. G. R., Dorset Square, London, "Improvements in ball-valves and other draw-off valves." March 3, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

- 1260.—MOULE, Rev. H., "Improvements in the production and manufacture of gas." April 11, 1874.
- 1279.—PORRI, J., and LEIGH, E., "Improvements in apparatus used in the manufacture of gas." April 14, 1874.
- 1286.—LAKE, W. R., "Improvements in double-acting lift and force pumps." April 14, 1874.
- 1308.—GOTTHEIL, R., "Improvements in apparatuses for measuring the supply of water passing through pipes." April 16, 1874.
- 1336.—THOMPSON, N., "Improvements in means for connecting together pipes or tubes, and for connecting cocks, tubes, or pipes to other articles." April 17, 1874.
- 1390.—CRAWFORD, A., "Improvements in water-closets, and in waste-preventing water supply apparatus." April 22, 1874.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

ERRATUM.—In our report of the proceedings in Parliament on the Rams-gate Local Board Bill (April 24, page 628), Mr. R. Braine, the harbour-master, is made to say, "We consume about 50 million gallons of water during the year." It should have been "Our consumption of water averages about one million gallons per annum, for which we pay the sum of £50 by agreement with the water company."

T. W., Kidsgrove.—You will find an answer to your inquiry in "Water and Sanitary Notes."

J. T. K.—The person who damaged the main is clearly liable, if your statement of facts can be substantiated.

N. T.—There is nothing to prevent the recovery of arrears of gas-rent, by the Commissioners, in a court of competent jurisdiction. To require payment of arrears from an incoming tenant is very short-sighted policy. Our advice to you would be to urge upon the Commissioners the desirability of obtaining a Provisional Order from the Board of Trade, under which you would possess power to recover debts by summary process. The cost of such an Order would not exceed £100.

W. G., Cheltenham.—Both the statements of Dr. Letheby and Mr. Vernon Harcourt are correct. If carbonic acid is not removed, as it is not in our large towns in the North, the illuminating power must be made up by the use of additional cannel.

NOTICE TO SUBSCRIBERS.

In consequence of the Whitsun Holidays, the next Number of the JOURNAL OF GAS LIGHTING will not be published until Wednesday, May 23.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 15, 1877.

Circular to Gas Companies.

NOTWITHSTANDING the adverse decision in the case of the Crystal Palace District Gas Company's Bill, which we announced last week, The Gaslight and Coke (Chartered) Company determined to proceed with the Bill they are promoting with the same purpose as that of the before-mentioned, and their case was duly opened last Wednesday. They are perfectly justified in adopting this course, seeing, as we have already pointed out, the different circumstances under which the two Companies are situated. So far as the proceedings before the Committee have gone, the case of the Company is not yet completed, the evidence of the Gas Referees having been interpolated at the express desire of the Committee. It is to be expected that the Company will yet call some of their Engineers, and possibly further expert evidence, though, as we have said, the expert evidence taken when the

Crystal Palace District Bill was before the Committee, will be accepted as evidence on the Bill now pending. On the part of the opponents, we understand that further engineering and chemical witnesses will also be called, and altogether we may anticipate that the inquiry will be prolonged some days over the Whitsuntide holidays. The time will not have been wasted if we get this Sulphur Question settled once and for all, and the minds of Gas Managers be either set at rest on the matter, or their energies be more strongly directed towards the efficient purification from "sulphur," without occasioning a nuisance. This is what the Committee have to decide, and their decision will be looked forward to with interest, not only by Gas Managers in the Metropolis, where "sulphur" purification may continue to be compulsory, but by many others in the country, who now test for sulphur merely as a matter of curiosity.

The Annual Report of the Metropolitan Board of Works for 1876 was presented to the meeting on Friday last, and we find a short abstract of it in a contemporary. Reserving a further notice until the full document is before us, we may remark that the report details, with perfect fairness, the proceedings of the Board in relation to the Metropolitan Gas Question last year, and also the abortive action of the Board of Trade. We may imagine that the existence of the Companies is not likely to be threatened for many more years to come, and, the Sulphur Question once settled, everything will go on quietly, until one party or the other gets dissatisfied with the sliding scale, which an eminent authority on gas matters prophesies will happen in about three or four years hence.

For some reason or other, it would appear that the market value of shares in the Metropolitan Gas Companies is on the decline, although the fall is not at present very considerable. The reason for this is not very apparent. They may have shared in the general fall in the value of all classes of securities. A variety of other causes suggest themselves, but we shall not encumber our columns with any specific reference to them. We need not, however, conceal the fact, that, within the last fortnight, the "electric candle" has been a topic of general conversation, and some alarm has been expressed at the prospect of its competition with gas lighting. We have nothing, at present, to add to what we said last week, beyond this, that a fuller consideration of the matter has more strongly convinced us that, be the new light what it may, it can never successfully compete with gas. We hope, then, that no shareholder will be frightened into parting with his property at a sacrifice. Recent prices may be considered to have been somewhat inflated; but if investors will be contented with four-and-a-half per cent., they can find no better security than shares in a substantial gas undertaking.

We publish to-day the report of the Committee of the West of Scotland Association of Gas Managers on Aitken and Young's process for enriching gas. Most of our readers are, no doubt, well acquainted with the process, but we may here very briefly describe it as practised at Hamilton. A mixture of low-class cannel and Westwood shale is distilled in the ordinary way, and the gas obtained passing on, the tar is conveyed to what is called the "analyzer," which appears to be a sort of dry scrubber, in which the tar is collected on trays. The materials mentioned having been distilled dead off, steam is passed into the retorts, which, coming in contact with incandescent carbonaceous matter, furnishes the usual mixture of hydrogen, carbonic oxide, and carbonic acid, and these gases, passing to the "analyzer," in a more or less heated condition, effect a partial distillation of the tar on the trays. As will be seen by a reference to the tables of results, to be found on another page, the naphtha was almost entirely removed from the tar in the experiments with the process made by the committee. Where naphtha is not an important element in the value of tar, which, we take it, is the case in the small Scottish works, and those of small English towns, the conversion, as we may say, of this ingredient into gas may be considered desirable, but in large city works, which have a good market for tar, we doubt whether its use in this way would be economical. In these, however, supposing the "analyzer" to be, as it appears to be, a good and inexpensive form of "carburetter," offering a large surface for evaporation, the process would be likely to succeed if the trays were supplied with crude petroleum oil in place of tar. Mr. Spice has demonstrated that poor common gas will hold in permanent solution a considerable amount of petroleum vapour, so that twelve or thirteen candle gas may be raised to eighteen. He failed, perhaps, from attempting too much, but it would seem clear that, by some such process, gas may be permanently and cheaply enriched to the extent of two or three candles. So far Aitken and Young's process may deserve the consideration of English Companies, who may do with Newcastle coals and petroleum what has been accomplished at Hamilton. The weak point of

the process appears to be the difficulty of keeping up the heat of the gases formed by the decomposition of the steam, but for this it can hardly be difficult to find a remedy at a comparatively small cost. The process has several points of interest, but we content ourselves with pointing out those which would appear to present advantages to English Gas Companies.

An unexpected difficulty has arisen with respect to the progress of the Burslem Gas Purchase Bill. It will be remembered that the Gas Company and the Local Board of Burslem had agreed upon terms, and the Bill was introduced to the House of Lords unopposed. But, coming before Earl Redesdale, his lordship objected to the terms, apparently on the ground that he did not think it worth the while of the Board to acquire the undertaking at such a rate. We think it an unprecedented thing for the Chairman of Committees to object to terms of purchase which have been agreed to by the respective parties to the bargain. In this case the Local Board of Burslem may be supposed to understand their own business better than the prescient Earl, with whom, however, we should perfectly agree, if he considered it better that the Company should continue to supply the district with gas. The solution of the difficulty is reserved for a conference between Earl Redesdale and Mr. Raikes, the result of which we shall shortly know.

It seems that we were wrong in stating that Earl Redesdale entertains objections to the auction clauses. Mr. Raikes's new Standing Order was, we are informed, drawn up with the concurrence of the noble Earl, and it is only to the sliding scale that he objects. This is not to be wondered at, when we remember that he has for years consistently insisted on low fixed rates of dividend.

The Bill promoted by the United General Company to obtain further powers in respect of their Limerick gas undertaking is still under the consideration of a Committee of the House of Commons, and is likely to occupy their attention for several days to come. Some extraordinary evidence has been given, as we expected would be the case, against the Corporation of Limerick, who naturally oppose the Company's Bill, being anxious to get possession of their undertaking, while the Company, we believe, are equally desirous of acquiring that of the Corporation. There is, we think, no instance of the purchase of a corporate undertaking by a Company, but we see no reason why an example should not be set which might result in advantage in more cases than this of Limerick.

The Exeter Town Council are about to make an effort to acquire the undertaking of the Gas Company. They offer the terms which it is now commonly supposed cannot be resisted—annuities equal to maximum dividends on all classes of shares. How far this will suit the Company we shall not undertake to say. In the meantime, a small section of the inhabitants are endeavouring to force the Council to take proceedings against the Company for causing a nuisance. The memorial of these people is a model in its way, for they certify that “the manufactory, building, or place known as the gas-works . . . is “used for a business, process, or manufacture causing effluvia, “which is a nuisance to divers of the inhabitants . . . “and injurious to health.” The Council have referred this curious memorial to a Committee. From the information we gather, mostly by reading the local prints, we are inclined to think that the nose of the man (was it Coleridge?) which recognized sixty distinct stenches in Cologne would be required to decide exactly the origin of the odours which annoy Captain Thompson and his followers.

The gas accounts of the Rochdale Corporation show that during the past year the net profits of their undertaking amounted to £6903, which sum has been appropriated to a reduction of the sum to be raised by a general purposes rate. The capital account of the undertaking now stands at £158,000, and £7000 profit on this is equal to about $4\frac{1}{2}$ per cent., which we cannot help thinking is more than a Corporation should exact from gas consumers. Further, we read that a penny per thousand on the present rate of consumption represents £1000, so it is clear that the Corporation can well afford to reduce the price of gas at least 3d. per 1000 feet. The proposal of the Gas Committee to erect additional works on a new site is encountering some opposition, and extensions of the present works are suggested as an economical alternative. If this should not lead to overcrowding, which is always to be deprecated, the suggestion may be worth attention. Still it seems to be admitted that, before many years are past, new works will certainly be required, and, perhaps, it would be well for the Corporation to acquire the site while they have the chance.

The fair apportioning of rates and taxes, no doubt, constitutes a formidable difficulty, possibly an insurmountable one; but to our minds nothing is more palpably unjust than to tax gas consumers twice over by exacting a large price for gas, in order to

obtain profits which may be applied in aid of rates. We are glad to see this question attracting more and more attention every day, and we hope that soon sound principles on the matter will obtain among English Corporations and Local Boards.

The subject has cropped up at Halifax, *à propos* to the question who should pay for the damage done by Lister's fire. It is stated by one authority that, to defray this, sixpence in the pound has been taken from the rates, and fourpence farthing from the gas profits; and the ratepayer is represented as having contributed more than the gas consumer. The fact, however, is passed over that the gas-consuming ratepayer has paid both these sums—viz., tenpence farthing. We are quite willing to admit that, in this case, the whole sum might with justice be taken from the gas profits, and we presume that in the end it will be, for the general opinion of the Town Council appears to be against any reduction of price, although the profit at the present time is said to be sixpence per 1000 feet.

At Congleton the question turns up in another form. There the Town Council have resolved to reduce the price of gas from 4s. 6d. to 4s. 2d. This, it would seem, will necessitate an increase in the borough rate, calculated to yield £300. Thereupon opposition arises, nominally on behalf of the poorer ratepayers, but really, we may take it, in the interest of owners of cottage property, who pay the rates, and take care to include them in the rents they demand. It does not appear likely that the resolution of the Council will be rescinded.

The Guisborough Gas Company, as our readers have been informed, applied to the Board of Trade for a Provisional Order, under the Gas and Water Works Facilities Act, to enable them, among other things, to charge a maximum rate of 6s. 8d. per 1000 feet for gas. The Order was opposed by the Local Board of Health, who contended that the price asked was exorbitant. Upon their representations, the Board of Trade cut down the price to 5s. 6d.; but against this the Company strongly remonstrated, and eventually the Board of Trade gave way, so far as to allow a maximum rate of 6s. per 1000 feet. This seems to have satisfied the Local Board, who have resolved, for the present, to abstain from making any further attempts to confiscate the Company.

Water and Sanitary Notes.

A good deal of excitement still prevails in South London, in consequence of the peremptory demand made by the Lambeth Water Company for payment of water-rates in advance, and some people seem to have got a curious notion into their heads. After reading the 70th Section of the Water-Works Clauses Act, 1847, the idea has taken possession of them that, if rates are not paid in advance, they need not be paid at all, and it is seriously recommended that tenants should offer the quarter's rate in advance, and refuse to pay the debt already incurred. The fact is overlooked that, although the Act says that the rates shall be paid in advance, the Company are left with all their common law rights to recover debts, and, if any doubt on the point existed, it will be at once dissipated by a reference to the 21st section of the Water-Works Clauses Act, 1863, which says that “if any person refuses or “neglects to pay to the undertakers any rate or sum due to “them under the special Act, they may recover the same, with “costs, in any court of competent jurisdiction; and their “remedy under the present section shall be in addition to their “other remedies for the recovery thereof.” We spoke last week of the somewhat harsh behaviour of the Company in suddenly making the demand for payment in advance, but at the same time we feel bound to caution the renters against incurring expenses for legal proceedings which can only prove disastrous to them.

We are happy to say that the Bill promoted by what is, or was, called the Bristol District Water-Works Company has been rejected by a Committee of the House of Commons. The measure had a strong family likeness to what we usually call a “Filibustering” Bill. It aimed, first of all, to set up a competing supply, and then provided for the transfer of the undertaking, at some time or other, to the Corporation of Bristol. Past experience has shown what the probable end of such competition would have been. The two Companies would have united, and the Corporation would have had to purchase two undertakings instead of one. They apparently saw through the dodge, and, although engaging in no active opposition, they declined to lend any support to the recently-promoted Bill. We may congratulate Bristolians on the result. Their city and suburbs are now adequately supplied with admirable water, and the resources of the existing Company are sufficient to supply the wants of the community for long years to come.

Mr. Mappin, the Chairman of the Sheffield United Gas Com-

pany, and at present Mayor of Sheffield, has recently busied himself with an attempt to negotiate with the Sheffield Water Company for the transfer of their undertaking to the Corporation. The Company, however, refuse to dance when Mr. Mappin pipes, and the attempt at negotiation has been abandoned. We can understand pretty well the reason for this renewed attempt on the part of the Corporation. A clause in the necessary Act would have allowed them to pay off the debts incautiously incurred by their unfortunate Town-Clerk, in consequence of placing a too implicit reliance on the honour of his employers. The design has, however, been frustrated, and Mr. Yeomans must wait a little longer for his money.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXXV.

SERVICE-PIPES (*continued*).

The following is a description of Cotterill's system, figs. 21, 22, and 23, for drilling and tapping mains, without permitting the escape of gas; *a* represents a $\frac{3}{4}$ -inch ordinary drill, and in working it, a small hole is first punched in the main as a bearing. The drilling then begins, and when the point of the drill gets through the pipe, it is removed, and the $\frac{3}{4}$ -inch tube-drill, *d*, is inserted; the drilling and tapping are then completed. This drill would be used for $\frac{3}{4}$ -inch holes. There is also a circular steel drill, *b*, adapted to all sizes from 1 inch and upwards. Instead of cutting the entire centre, as in the case of *a*, it makes a circular ring, *c*, and when the point gets through, the tube-drill is fixed in the circular groove, and the operation completed; *d* represents a $\frac{3}{4}$ -inch steel tube-drill for drilling and tapping, with the screwed end for attaching either the cock or plug; *e* is a brass cock; *f*, the plug to fix into the ratchet-brace. It is essential that the plugs fit with exactness, to give accuracy to the drill, and the working must be with care; *g* is the brass union for screwing on the cock or tube and soldering to the leaden pipe. This is used only when the service-pipe is of lead; *h* is a clamp, or three-pronged fork, hammered into the ground, and against this the ratchet-brace is affixed. Fig. 22 represents a clamp with chains to fasten round small pipes. For pipes above ground, or when the fork is inapplicable, this instrument would also be generally used. Fig. 23 is a side view, showing the practical operation of drilling and tapping. *A* is an end view of a 6-inch pipe, and *B* represents the ratchet-brace; *d* is the tube-drill; *e*, the brass cock, when such is employed; *f*, the iron plug; *h*, the three-pronged fork; and *C*, an iron wedge. The steel tubes for drilling and tapping are left in the pipe, and the service-pipe attached to them, and completed.

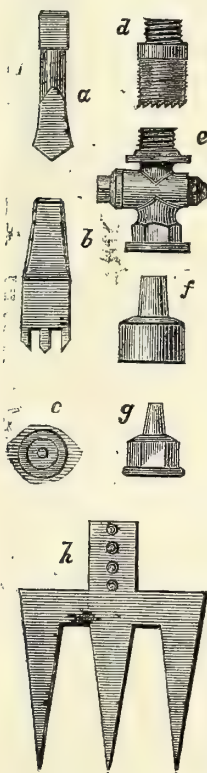


FIG. 21.

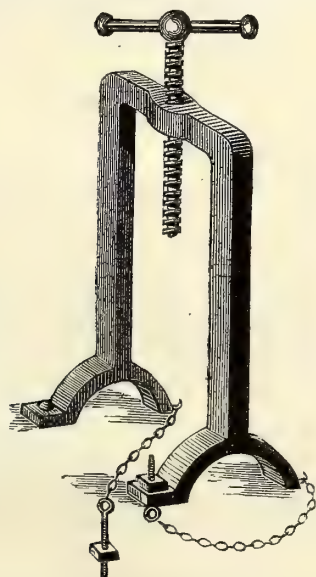


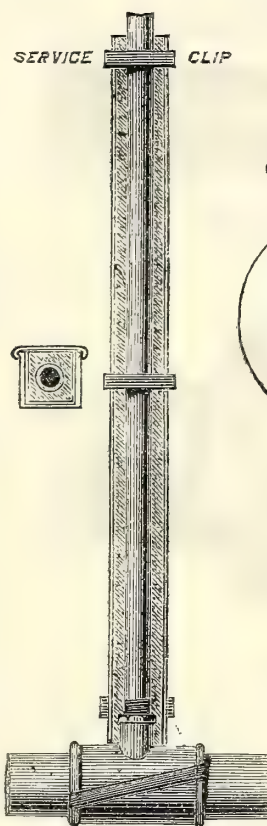
FIG. 22.

on the collar passing through and on to the plug. To the collar is fixed the stand-pipe, which is provided with an ordinary stopcock and gas-burner at its upper end. The action of the apparatus is simple. When it is desired to make the attachment, a stand-pipe furnished with a collar, as described, is thrust down through the cover, and, on being turned, will jam itself tightly, so as to remain firmly upright, and, at the same time, turn on the gas from the main beneath. The action of removing the pipe effectually shuts off the gas, thereby ensuring great security against fraud and leakage.

In order to strengthen small mains at the points of junction with the services, Mr. Warner employs a segmental clip in the form of a T-piece. The clip joint is first made (see description, vol. xxix., p. 192), and then the hole is drilled in the main, after which the service-pipe is screwed into the socket, ready tapped to receive it. Fig. 24 shows the arrangement, with the service-pipe embedded in a mixture of tar and sawdust, contained in a wooden trough.

The patent removable stand-pipe, also invented by Mr. Warner, is suitable for open market-places, fair grounds, and for other purposes, where only occasional or periodical additional public lights or connexions are required. The apparatus consists of a vertical pipe, the lower end of which is fixed to the main, or to a T-clip as above described, and the upper end to a cast-iron box, in which is fastened a plate, having a plug or valve thereon. The valve is fitted to a fixed seat or plug capable of turning upon it, and is square on the outside, and of such size as to fit into a collar made to slip over it, the joint between the collar and the plug being made gas-tight by the former being forced down upon a vulcanized india-

SERVICE CLIP



SEGMENTAL CLIP TEE

FIG. 24.

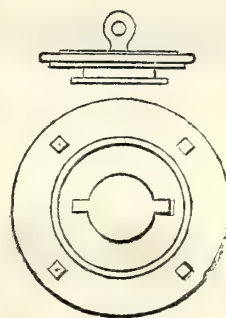


FIG. 26.

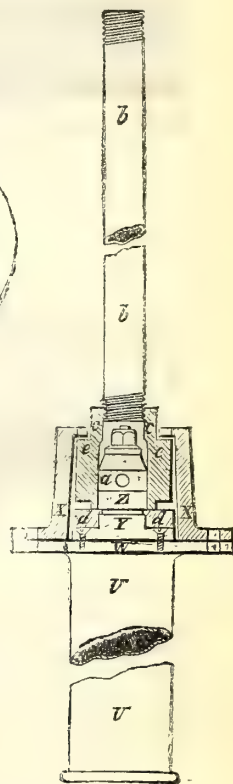


FIG. 25.

rubber washer, by certain projections coming in contact with other projections, formed in the interior of a cap, which surrounds the valve and collar before described. The top of the cover has a round hole, with a notch on its opposite sides, to admit of the projections

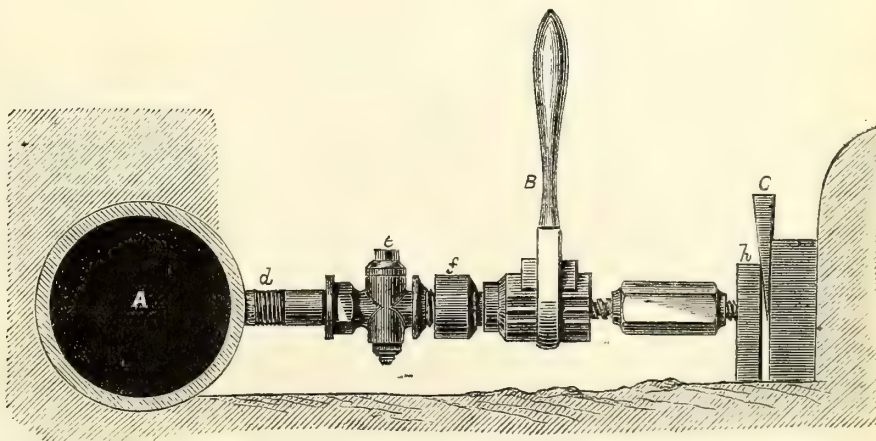


FIG. 23.

Fig. 25 represents the arrangement. The view is a side elevation and part section. To the top of the service, *U*, is fixed a plate, *W*, and upon that is fastened, by bolts, the case or box, *X*. To the plate, *W*, is also fixed, by screws, the plug or valve, *Y*, and upon this plug the barrel, *Z*, is free to turn. That part of the barrel marked *a* is square. The stand-pipe, *b*, has attached to its lower end the collar, *c*, which is square in the interior, so as to slip over and turn the barrel by the square part, *a*, until the hole in the plug and that in the barrel coincide, when a gas-way will be established between the

service, U, and the stand-pipe, b. A gas-tight joint between the collar, c, and the plate of the plug or valve, Y, is made by the former being forced down upon the india-rubber washer, d, by the upper part of the projections, e, of the collar, c, coming in contact with inclined projections cast on the inner side of the box, X. Fig. 26 is a plan of the top of the box or case containing the valve.

Various methods of coupling lead pipes, dispensing with the use of solder, have been invented. One of the best of these is that known as Leland's (American), represented in the engravings, figs. 27 and 28 being a sectional and exterior view of the joint. A is a ferrule of brass or other metal tapered inside, having an inner shoulder, a collar, B, and threaded end. The ferrule is first slipped over the end of the lead pipe, which is then opened by means of a shouldered tamp-pin, struck a few blows with a hammer, the shoulder of the tamp-pin forming a facing of the pipe against the inner shoulder of the ferrule.

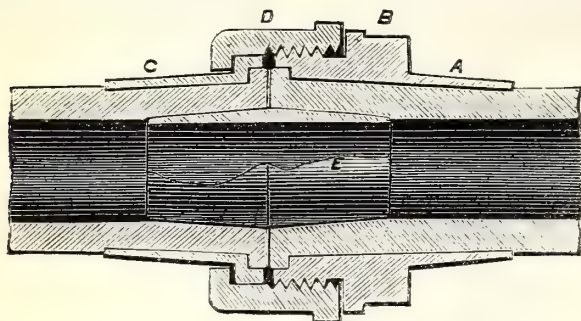


Fig. 27.

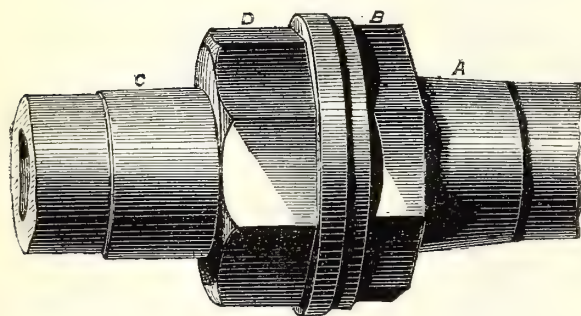


Fig. 28.

On the end of the other pipe, the ferrule, C, is similarly applied, secured by a shoulder on which is the other portion of the union, D. A thimble, E, of brass or iron is then inserted in the mouth at one end, the other end is brought over it, and the union, on being screwed up, draws the parts together till the two ends of the lead pipe meet, when a gas-tight joint is formed. The time occupied in making the connexion does not exceed two minutes, and it is applicable also to the connecting of lead to wrought-iron service-pipes.

(To be continued.)

BURSLEM GAS BILL.—It will be remembered that this Bill, for the purchase of the gas-works by the Board of Health, was delayed in its passage through the House of Lords by Earl Redesdale, Chairman of Committees, raising a question as to whether the gas company had a right to sell at so high a price as had been agreed upon. On Tuesday, however, Messrs. Tomkinson and Furnival, solicitors to the board, received a communication, stating that his lordship, after hearing the explanations tendered by the Chief Bailiff (Mr. Hulme), the chairman of the gas company (Mr. A. Shaw), and other gentlemen, had decided to withdraw his objection, and that the Bill will come before the committee on Tuesday (this day).—*Staffordshire Sentinel*.

FAILURE OF MESSRS. BLEWS AND SONS.—At the Birmingham County Court, on Saturday, a petition for liquidation by arrangement or composition was filed on behalf of Mr. W. H. M. Blews, carrying on, under the style of "William Blews and Sons," the business of bell and brass founders, chandelier manufacturers, and gas-works contractors, at Nos. 9 to 15, New Bartholomew Street, Birmingham, and at West Bromwich and Moscow. The estimated amount of liabilities is £66,000. The assets, which will be considerable, are not yet ascertained. Upon the application of the debtor's solicitors, Mr. C. A. Harrison, public accountant, was appointed receiver of the estate; and the Registrar granted four interim injunctions to restrain proceedings by creditors. In a circular issued by the debtor's solicitors, notifying the failure, it is stated that "the stoppage is owing to various causes, amongst which may be mentioned the great depression in trade generally, and a large outlay of capital in the establishment of the Barbadoes Gas-Works, and of a valuable business in Moscow, both of which, it is believed, will ultimately prove prosperous undertakings."

THEFTON CORPORATION WATER-WORKS.—These works, which have been constructed from the designs and under the superintendence of Mr. Jabez Church, C.E., of Great George Street, Westminster, the engineer appointed to carry out the works, were handed over to the Town Council, in a complete state, on the 7th inst., at the Guild Hall, when a vote of thanks, which was proposed by Mr. Fyson, the ex-mayor, and seconded by Major Marsham, the mayor, was tendered to Mr. Church, upon the successful termination of his labours. After the meeting, the Town Council accompanied that gentleman to the works, which were much admired for their pleasing and businesslike appearance. The water, of which there is an abundant supply, of a very superior quality, is obtained from an artesian well, sunk about 160 feet into the chalk, and is pumped therefrom into a reservoir constructed of brick, in cement, from whence the town is supplied by gravitation. The engine and boiler houses, together with the coal store, are grouped in one block, and have a handsome elevation, in white brick, facing the road. There is also a well-built house for the manager, with a board-room therein, for the use of the Water Committee, corresponding in architectural character with the rest of the buildings. The cost of these works will amount to about £7500, or 30s. per head of the population.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

DR. FRANKLAND AND THE LATE DR. LETHEBY.

SIR,—In reply to a private note, in which I enclosed a copy of the letter you printed last week, I have received the following answer from Dr. Frankland, for which I ask your space:—

"Dear Sir,—In stating that my 'words convey a grave imputation,' and in omitting from your letter a subsequent answer which explained the meaning I wished to convey, you have done me great injustice.

"At the time the sulphur question was attracting attention, I was frequently associated with Dr. Letheby, and I repeatedly heard him express the opinion that the sulphur ought to be determined by the apparatus which he used when the Act was passed, and that it was unfair towards the gas companies to employ any modification of that apparatus, or any new apparatus, by which more sulphur could be obtained. It seems to me that this was a reasonable opinion, and certainly no imputation—grave or otherwise—can rest upon the late Dr. Letheby for entertaining it.

"I am, &c.,

"Royal College of Chemistry,
"South Kensington Museum, May 11, 1877."

"E. FRANKLAND.

The reason I did not refer to the answer following the one I quoted was that, well acquainted as I fancied myself with the evidence given publicly by Dr. Letheby, I could not remember any occasion on which he expressed the opinion Dr. Frankland put into his mouth; and, moreover, I had in my mind the fact that in 1863 we commenced the official testings in the City of London, under the Act of 1860, with the smaller cylinder, the Act having passed with the maximum allowance of 20 grains of sulphur, fixed mainly on the advice of Dr. Letheby when he was using the larger cylinder. With the explanation of Dr. Frankland, however, these facts are of no importance, and I have only to sincerely apologize to him for having done him the injustice of which he complains.

13A, Great George Street, May 12, 1877.

W. T. FEWTELL.

LIGHTING RAILWAY CARRIAGES WITH GAS.

SIR,—"A prophet hath no honour in his own country" was said thousands of years ago, and still holds good. This occurs to me on seeing your remarks on Messrs. Pintsch and Co.'s plan of lighting railway carriages with gas, because, whatever merit may be due to them, it is incontestable that some fifteen years ago I published a mode which, in every essential particular, is precisely that which Messrs. Pintsch and Co. have adopted.

At the time I published my "Gas Engineer's Book of Reference," Boghead was comparatively cheap, and shale oil or petroleum dear, and almost unknown; now, the former is dear and the latter cheap, so that, as a matter of course, gas for portable purposes would be made from oil. But even then there was nothing new in compressing gas into cylinders at high, and burning it at low, pressures, as many cities had been wholly and partially lighted in this way.

I send you the engraved blocks and a letter-press section of my "Book of Reference," to show that what Messrs. Jules Pintsch and Co. are now doing I was ready to do fifteen years ago, and as my book has circulated throughout Europe, it is quite possible Messrs. Pintsch may have seen it in common with others.

You will see that I place my cylinders at the top of the end of a carriage, which, I think, is better than underneath, on the ground of safety from their bursting, and from an escape of gas, which might so fill the compartment of a carriage as to form an explosive compound.

The description of the whole arrangement is entirely at your service. St. Neots, Hunts, May 12, 1877.

GEORGE BOWER.

[The description of Mr. Bower's arrangement reached us too late for insertion this week. We shall refer to the subject again in an early number.—ED. J. G. L.]

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MAY 7, 1877.

The Louth Gas Bill, brought from the Commons, was read the first time, and referred to the Examiners.

TUESDAY, MAY 8.

The Examiners reported that the Standing Order applicable to the Gas and Water Orders Confirmation (Brotton, &c.) Bill has been complied with. The Bill was afterwards read a second time and committed.

The Alliance and Dublin Consumers Gas (Bray Supply) Bill, brought from the Commons, was read the first time, and referred to the Examiners.

The Maryport District and Harbour Gas and the Stamford Water Bills were read a second time and committed.

GAS AND WATER ORDERS CONFIRMATION (ABINGDON, &c.) BILL.—This Bill, for confirming certain Provisional Orders made by the Board of Trade under the Gas and Water Works Facilities Act, 1870, relating to Abingdon Gas, Cranleigh Gas, Horsham Gas, Ilkeston Gas, Mansfield Gas, Newcastle-under-Lyme Gas, North Camp and Farnborough District Gas, and Southbank and Normanby Gas, was read the first time, and referred to the Examiners.

FRIDAY, MAY 11.

The Examiners reported that the further Standing Orders applicable to the Carnforth District Water Bill have been complied with; and that no further Standing Orders are applicable to the Leeds Improvement Bill.

The Newport (Monmouthshire) Gas, North Cheshire Water, and Stretford Gas Bills, brought from the Commons, were read the first time, and referred to the Examiners.

The Edinburgh and District Water Bill was read the third time, with the amendments, and passed.

The Rotherham Corporation Bill was reported, without amendment.

The following Bills were reported, with amendments:—Dundee Gas; East Worcestershire Water; Londonderry Gas; Longton Corporation; Maryport District and Harbour Gas; Middlesbrough Corporation; Sittingbourne Gas; Warrington Corporation Gas.

HOUSE OF COMMONS.

MONDAY, MAY 7, 1877.

The Newcastle-under-Lyme Borough Extension and Improvement Bill was reported.

The Alliance and Dublin Consumers Gas (Bray Supply) Bill was read the third time and passed.

The Stretford Gas Bill, as amended, was considered.

TUESDAY, MAY 8.

The Examiners reported that the Standing Order applicable to the Local Government (Gas) Provisional Orders (Penrith, &c.) Bill has been complied with.

The following Bills were reported:—Colne Gas; Croydon Commercial Gas; Heywood Water; Wakefield Improvement.

The Bristol District Water Bill was reported, "Preamble not proved."

The Newport (Monmouthshire) Gas and the North Cheshire Water Bills were read the third time and passed.

A petition in favour of the United General Gas Company (Limerick) Bill was presented from Merchants, ratepayers, &c., of Limerick.

WEDNESDAY, MAY 9.

On the motion of Sir CHARLES FORSTER, it was ordered that the report and evidence of the Commission on Local Government and Taxation of Towns (Ireland) be referred to the Select Committee on the United General Gas Company (Limerick) Bill.

A petition against alteration in the Blackburn Borough Gas, Water, and Extension Bill (Lords) was presented from John Towneley.

THURSDAY, MAY 10.

The Stretford Gas Bill was read the third time and passed.

The Ashton-under-Lyne Gas, Coatbridge Gas, and Perth Water Bills, as amended, were considered, and amendments made.

The Bishop Auckland District Gas and Bristol United Gas Bills were reported.

The Local Government (Gas) Provisional Orders (Penrith, &c.) Bill was read a second time and committed.

PROCEEDINGS FOR NUISANCE UNDER THE PUBLIC HEALTH ACT, 1875.

Mr. A. MILLS asked the President of the Local Government Board whether, having regard to the terms of the Public Health Act, 1875, sec. 91, it was necessary, when summary proceedings against a nuisance were taken, to show that the nuisance complained of was injurious to health.

Mr. SCLATER-BOOTH: By the 91st and following sections of the Public Health Act, 1875, a summary remedy is provided supplementary to the proceedings against a nuisance which may be instituted at Common Law or in Equity, but although the disjunctive word "or" is used in the section—viz., "a nuisance or injurious to health"—the Court have held that, looking to the whole scope of the Sanitary Acts, some injury to health must in all cases be proved. It was proposed by the honourable gentleman, when the Public Health Act of 1875 was passing through Parliament, to make the disjunctive proposition stronger by prefixing the word "either" to "nuisance," so that the sentence would have run, "either a nuisance or injurious to health," &c.; but the highest legal authorities were of opinion that the same construction as before would, nevertheless, be adopted by the Courts. I am glad to say that the whole subject of noxious trades and vapours is now under the consideration of a Royal Commission, who will probably report within the present session of Parliament.

FRIDAY, MAY 11.

The Ashton-under-Lyne Improvement and Wakefield Gas Bills, as amended, were considered, and amendments made.

The Dukinfield and Denton Local Boards of Health Bill, as amended, was considered.

The Thanet Gas Bill, as amended, was considered, and an amendment made.

The following Bills were reported:—Carshalton Gas; Christchurch Gas; Lowestoft Water, Gas, and Market; Southend Gas.

LOANS TO LOCAL AUTHORITIES UNDER THE PUBLIC HEALTH ACTS, 1872 AND 1875.

On the motion of Mr. ALEXANDER BROWN, a return was ordered showing the amount of money authorized by the Local Government Board to be borrowed by local authorities (distinguishing urban from rural) under the Public Health Act, 1872, and the Public Health Act, 1875, during each of the years 1872, 1873, 1874, 1875, and 1876, for the purpose of supplying water to their respective districts; the amount of such loans recommended to be advanced by the Public Works Loan Commissioners, and the number of years allowed for the repayment of such loans.

HOUSE OF LORDS COMMITTEE.

MONDAY, APRIL 30.

(Before Lord MONTEAGLE, Chairman; Earl MANVERS, Lord DELAMERE, Lord KENY, and Lord SHERBORNE.)

LONDONDERRY GAS BILL.

Mr. LITTLE, Q.C., Mr. MICHAEL, Q.C., and Mr. M'CORKELL appeared for the promoters; Mr. CRIPPS, Q.C., and Mr. HAMILTON, Q.C., for the Corporation of Londonderry, petitioners against the Bill.

Mr. LITTLE, in opening the case on behalf of company, said that in 1829 certain persons associated together for the purpose of supplying the city of Londonderry with gas, their capital being £6000. The company thus formed were to exist for 21 years, but they went on from that time, without any reference to that limitation, until they were registered as a company under the Companies Acts of 1862 and 1867. Owing to the increase of the city, the company also extended their works. The nominal capital of the company at present amounted to £36,000, which was proposed to be treated as original capital, and they had not borrowed on bond any sum of money. The company now desired to increase their capital by £24,000 in £10 shares, which was to be considered as new capital, in order to meet the enlarged requirements of Londonderry, and also to obtain the ordinary powers of a gas company as to opening streets, &c. In the Bill the maximum price of gas was limited to 6s. per 1000 cubic feet, and the company offered to give gas of 14-candle illuminating power. The Londonderry Corporation opposed the Bill, and it was now offered to make the illuminating power 16 candles.

Mr. W. M'Carter, examined by Mr. MICHAEL.

I am chairman of the Londonderry Gaslight Company, a magistrate of the city, and an alderman of the corporation. I have been chairman of the gas company on five several occasions. It has always been our policy to deal liberally with the consumers, and we have been satisfied with what we considered reasonable profit. We have made reductions in the price of gas as often as circumstances would permit. When new shares have been issued, they have always been offered first to the outside public, and were never appropriated to any member of the board or of the company until the outsiders ceased to apply for them. We were anxious to make the concern a consumers company. I believe the consumers, as a body, are satisfied, and always have been, and they do not join in the opposition

to this Bill. We have been advised that it is necessary, in the interests of the gas company, to have parliamentary powers conferred upon us, and also to put ourselves under parliamentary restrictions. Years ago I urged this step upon the company, but I was overruled by the majority of the committee at that time, as it was feared the expenditure would be more than the company could conveniently bear. We have met the committee of the corporation on several occasions with a view, if possible, to arrange terms upon which the opposition to our Bill should be withdrawn. We have received from that committee several suggestions, and have endeavoured, as far as possible, to meet those suggestions, the result being the Bill now before the committee. The city of Derry has extended very much since I was a boy, the population being about three times as many as it was when I was at school. It has doubled since the gas company were established; and its commerce and business have very largely increased. There is a peculiarity with respect to the rates which the corporation can make in regard to new streets—viz., that until they are lighted with gas the rates are one-third less than the lighted portions. The company have never refused to lay mains in new streets when required, so as to allow the corporation to get the benefit of the increased rates. Supposing this Bill passes, any person can, under the Act of 1871, enforce from the company a supply of gas. We are soon to have a toll-free bridge, and that will give a great impetus to building, especially on the south side of the river. No objection has ever been raised by the corporation with respect to our opening the streets. The streets at Derry are almost all steep, and if the opening of those streets was prevented, it would altogether deprive the great majority of the inhabitants of light. No complaint has been made of any damage done to the streets, with the exception that the corporation during the winter, after the streets have been opened, might have complained of the gasmen not having properly reconstructed a portion which they had opened; but an arrangement has been come to with the corporation that their surveyor, in such cases, if there was any fault found, should have the right of perfecting it at the expense of the gas company. We seek for no powers for opening the streets other than the general powers given by the Gas-Works Clauses Act, 1847.

Cross-examined by Mr. HAMILTON: The original shares of the company were 600 in number; the original capital subscribed, I see by the books, was £6000, and the shares were considered nominal shares of £10 each. We estimate the value of our works at present at £36,000?

Mr. HAMILTON: Will you tell the committee how many new shares you have issued so as to bring that £6000 up to £36,000.

Mr. STEPHENS objected to the question of the intermediate circumstances of the capital issued between 1829 and 1876 being entered into, and contended that that point was not raised in the petition of the corporation.

Mr. HAMILTON said the corporation stated in their petition that the additional capital sought for was quite unnecessary, and the committee could not possibly judge of that matter unless they knew something of the antecedent history of the company.

The CHAIRMAN said that Mr. Hamilton was perfectly right in asking the question.

Cross-examination resumed: In 1853 there were 50 shares issued at £22 each, but there had been a great many additions to capital before that. The next issue was in 1860, of 130 shares, at £25 each, paid in cash. The next was in 1864—420 shares, at £27 10s. each. These several issues were all offered to the general public.

Mr. HAMILTON: Then all the rest of the £36,000 is made up out of your profits?

Witness: I cannot tell you from my own knowledge. I only take the statement as correct from the books of the company.

By the COMMITTEE: I may point out that there were two calls made on the shares paid in cash in the interval, besides the amount out of profits; in the year 1831 there was a call of £1, and in 1846 a further call of £2.

Cross-examination resumed: I see from the books that instead of the shareholders taking dividends they paid the dividends into capital, and so capitalized the dividends which they were fairly entitled to receive. There were some years in which no dividend was paid, but for the last 17 years we have paid a dividend of from £1 to £2 per share.

Mr. HAMILTON: Did you ever perform this financial operation—viz., call in the £10 shares, and divide each share into three?

Witness: When preparing for this Bill we estimated the value of the property of the shareholders at £30 a share. In fact, we had nominally no value for those shares, but we estimated the value at £30; and in place of putting that amount in the Bill we considered it right to adopt the custom of making it into three tens, £27 10s. having been paid up; and then there was the reserve-fund which belonged to the shareholders, a portion of which was added to the £27 10s. to make up the £30. I believe the actual money paid in amounts to about £24,000, and the profits which should have been applied to dividend, and might have been so appropriated by the company, make up the £36,000, upon which we wish to secure a dividend of 10 per cent. We apply for an additional £24,000 because we cannot extend the works without money. I estimate the present population of Derry at about 30,000; in 1829 it was about 10,000 or 11,000. There were few establishments there then which required much gas; all the factories have been erected within the last 20 years or so. The factories are often used up to a late hour in the night; they have to be lighted both day and night. I believe our gas-works to be model works. I know that the price of gas in Belfast is 3s. 9d., and that the works there have been purchased by the corporation. The gas in Belfast is very inferior to that in Derry, and the number of consumers within the same radius is three or four, and sometimes ten, times in excess of Derry. There are six miles of pipes in Belfast, where they consume more than we consume in Derry over 17 miles of pipes. There is a difference in the price of coal between Belfast and Derry of from 1s. to 2s. a ton. I believe the facilities for discharging, and storing, and other things, make it cheaper to them.

Mr. LITTLE objected to any questions being put about Belfast, the purchase there being by agreement.

Cross-examination resumed: I made a proposal to the corporation to sell the works some three years ago—at the time of the coal famine—when there was great discontent expressed at the price we were obliged to charge for the gas, but from that time until we promoted our present Bill they never availed themselves of the offer. We made the proposal again during these negotiations. We offered to give them a purchase clause conditionally that they would withdraw opposition to the Bill. I may say that only a few members of the corporation are opposing it. I am aware that if we obtain our Bill the value of our works will be increased; but I think that, like every other company, we have a right to protection as we have a right to be under control.

Mr. HAMILTON: In point of fact, you would not sell your works at their present value, but you would sell them at the increased value which the Bill would give them. You want a legislative value given to your works to make the corporation pay 50 or 100 per cent. more than they are actually worth?

Witness: When we proposed to go for the Bill, we had no idea of the corporation buying, seeing that they made no overtures, and that the thing was never mooted from the time of the proposal to sell the works until we promoted the Bill. I am not aware that the corporation are willing to purchase at a price to be fixed by arbitration. A small minority passed a

resolution to that effect, but they have not been supported by the people of Derry.

By the COMMITTEE: Nine members of the corporation are prosecuting this opposition to us, but the majority are not. Some of the members, being gas proprietors, could not vote, and it was left in the hands of the non-gas proprietors to arrange the matter—a majority of whom then determined on opposing us.

Re-examined by Mr. LITTLER: During the negotiations there were a number of conditions introduced, which were wholly inadmissible; but after we came to terms—for we did come to an agreement—they repudiated that agreement. Since then we have been better advised; we found that we were sacrificing the interests of others, and seeing that they have repudiated the agreement we had made, we did not feel bound any longer to confer with them. The corporation wished us to withdraw the clause in our Bill authorizing the company to open the streets without the consent of the corporation, and that we thought unreasonable. We also refused to alter the clause allowing 6s. as a maximum price, because we found that that price during the famine period would not pay a dividend. We have agreed to increase the illuminating power to 16 candles. The corporation also sought for powers to purchase within five years, the fact of the company having obtained their Act not to be considered as any increase in the value of the works. That clause we thought most unreasonable and absurd. They also proposed a maximum price of 5s. 6d. per 1000 feet; and should the public at any time feel aggrieved as to the price of gas, the matter should be referred to arbitration, on the application of 20 or more ratepayers of not less than £15 valuation; and that we also considered unreasonable and unusual.

Mr. R. W. Newton, examined by Mr. LITTLER.

I have resided in Londonderry for the last 21 years, and am in extensive business as a miller and importer of grain. My rateable value is over £500 a year. I was chairman of the Londonderry Gas Company last year. In my judgment a considerable amount of capital will be requisite within the next few years in extending mains to new districts. Generally speaking, I hear no complaints of the company; but, of course, there are some people who are always complaining about something. I am a very large consumer of gas, and am more interested in having gas good and cheap than I am in my stake in the gas company. Previous to the coal famine I had induced the directors to make a large contract for coal, owing to which we kept off the evil day as long as possible. I think for a year we were working with the coals we had, but at last we were obliged to raise the price; it went up first, I think, 10d. per 1000 feet, and then 5d. afterwards. When the price went up to 6s. 3d., we submitted to a reduction of 12s. per cent.

Cross-examined by Mr. CRIPPS: I have heard of cases in which 10 per cent. has been allowed on capitalized profits; and I am not aware that that capital is universally cut down to 5 per cent.

Mr. CRIPPS: Companies have never been allowed to divide 10 per cent. upon them, but that is actually part of the proposition before this committee, that you are to take 10 per cent. upon them?

Witness: Yes.

Mr. CRIPPS: Then there is this new capital upon which you are to be entitled to divide 10 per cent. If to-morrow you were to propose to sell the works to the corporation, then these matters would be brought in to enhance the value of your present property, would they not?

Witness: Of course, the sellers would put their own price upon it, but it would be referred to independent persons to form a judgment. I am aware that in the Bill there is a section proposed, by which the standard price, under the sliding scale, is to vary either way from the price of 5s. 9d. per 1000. I am not prepared to say what is the highest price that has been admitted into any gas company's Bill as the standard price from which the sliding scale is to go either way.

Mr. LITTLER: It was 6s. last year at Colney Hatch.

Mr. CRIPPS: You do not assume that the maximum price and the standard price, from which your scale is to slide, is the same thing. The maximum price is the highest price you are allowed to receive under circumstances of difficulty in the matter of coal and so on, is it not?

Witness: The directors have no desire to charge that price. I am a large consumer, and it is very much more important to me that I should have cheap gas than have large dividends, when it is divided over the whole community. At present we have no limit whatever as to price. I do not know much about the object or effect of the sliding scale.

Mr. A. Hogg, examined by Mr. M'CORKELL.

I formerly resided in Derry for between 20 and 25 years, and am a member of a firm who still carry on business there, employing from 500 to 1000 hands. While I was living in Derry I never heard a single complaint against the company. I was asked to take part in the opposition against this Bill, and on the representations made to me, I consented, and promised to subscribe £50 towards the expenses of the opposition. I have withdrawn from that promise now, simply because the very point to which I objected—viz., that the gas company proposed too low a lighting power, was conceded, as they offered to raise that power from 14 to 16 candles.

Cross-examined by Mr. HAMILTON: We are amongst the largest consumers, and my main object was to obtain a good light.

Mr. B. M'Corkell, examined by Mr. LITTLER.

I am a merchant and shipowner, and have lived all my life in Derry. I have also been connected with nearly all the public institutions in the city. As a general merchant my import of bread stuffs amounts to fully one-half of the entire imports of Derry. I am a shareholder and director of the Londonderry Gas Company. The trade of the port of Londonderry has more than doubled of late years, and there has been a great deal of building going on; streets are formed almost every week. As a general man of business, and as a person residing in my native city all my days, my opinion is that the business should not be allowed to pass out of the hands of the company. The very best reason I can give for that opinion is that one of the opponents of the Bill, while the matter was being discussed, stated that his only object in opposing was that he had no guarantee as to who were to be the directors in future; that, so far as the present directors were concerned, he was confident they would do what was straightforward, honourable, and right, but that he did not know what futurity was going to bring forward. I think, with regard to the corporation, that the subject would be quite as problematical.

Cross-examined by Mr. CRIPPS: I consider that the gas company have been acting altogether wrongly in carrying on the works without applying to Parliament and obtaining the proper powers to enable them to act with justice to themselves and to the public.

Mr. CRIPPS: About the real object of the Bill, you want, first of all, to become a chartered company instead of a limited company; and, further, you want to obtain parliamentary title to have a right to divide 10 per cent. upon £36,000.

Witness: We certainly want parliamentary powers to divide what is right, and what their lordships will give us.

Mr. CRIPPS: If you had parliamentary power, that £36,000 is at once converted into double, is it not, if it is entitled to carry 10 per cent. dividend?

A MEMBER OF THE COMMITTEE: The Bill does not guarantee 10 per cent.

Witness: No; it only authorizes it.

Mr. LITTLER: It limits it to 10 per cent.

Mr. CRIPPS: I will show, when we come to the sliding scale, that it really does authorize more; but for my present purpose I will say that it authorizes 10 per cent.; and the arbitrator will take it at that per centage, of course, unless it appeared clear that you could not divide it, because we know that every gas company can divide 10 per cent., for they have the power. As regards the rest of the capital, whatever it may be—say £24,000 at 7 per cent.—having paid the full 7 per cent., that would at once convert the capital value of that £24,000 into a very much larger sum?

Witness: You, of course, are stating that; I am not prepared to go into it.

Cross-examination continued: The extra money required is for general improvements. Those who know anything of gas-works must be aware that the expenditure of money is very general. The improvements in the city are going on so extensively that I believe our mains will shortly be too small, and I am advocating the greater portion of those mains being lifted, and larger ones laid down.

Mr. D. J. M'Gowan, examined by Mr. M'CORKELL.

I am largely engaged in the coal trade in Derry, and have heard a good deal of talk about the agitation on the gas question. Coals can be delivered to the gas-works in Belfast a very great deal cheaper than they can be delivered in Derry. In the first place, they are 1s. 6d. a ton less in freight; and in the second place, the quantity they use in Belfast is so large that they are enabled to employ steam in their operations; and having their own carts and conveyances, they can bring the coal to the works in Belfast at a much cheaper rate than they can in Derry. The total difference would be at least from 2s. to 2s. 3d. a ton.

Cross-examined by Mr. CRIPPS: I could not say what difference it would make in the price per 1000 feet if coal at these works were 1s. 6d. per ton cheaper in Belfast than in Londonderry.

Mr. R. P. Spice, examined by Mr. LITTLER.

I have been consulted by the Londonderry Gas Company, and have visited the town, for the purpose of this inquiry, on two or three occasions. I have carefully examined the works, and have gone through their history with their books before me. I have also carefully examined the state and character and extent of their district.

Mr. LITTLER: What do you say with regard to the probability of there being a development of their undertaking? My learned friend, Mr. Cripps, seems to think that unless there is an increase of population there will not be any increase in the demand for gas.

Witness: Increase of population has, in some cases, nothing to do with increase in the consumption of gas. I have known stationary populations where the increase has been considerable. Business undertakings may develop wants for gas, and the cheapening of the price of gas also adds largely to the increase of consumption. I have known cases of populations going backwards—being less at one census than the previous one—and, nevertheless, an important addition has been made to the business of the gas company. Increase is certain to take place in Londonderry, which town is not like some places I have seen—sleepy, dull, and heavy, and not prosperous; it is evidently a thriving place, and it must be notorious to everybody that it is one of the principal towns in Ireland. Under those circumstances, I think a reasonable provision ought to be made.

Mr. LITTLER: Assuming for a moment that £36,000 is the fair price or value of the existing works, what do you say to the additional capital of £24,000?

Witness: The addition that the company should have asked for, as I told them, was about £70,000; that would have been a fair sum to have asked for, but I put it eventually at two-thirds, when I was advising them seriously. The company thought £24,000 would carry them on, and that £48,000 was more than they wanted. I said I thought they were not asking for enough. The only difference between asking for enough and asking for a little more than enough, is that a company have to incur the expense of coming to Parliament again sooner than they otherwise need do, and that expense is added to capital—it does not come out of dividend, and, therefore, it is a burden upon the consumers of gas. There is nothing selfish about it on the part of the gas company; it falls upon the consumers.

Mr. LITTLER: More especially now, as since, by the Standing Order, there is an auction clause, so that the present shareholders could only get the additional capital at the same price as the outside public, there is not the slightest temptation to add to the capital?

Witness: Not the slightest. There never has been in this case, because before the company have added anything to capital, they offered the opportunity to the outside public to take shares, previously to allotting anything to themselves; they have only taken the remainder. The directors, both past and present, have always been exceedingly liberal in the way in which they have been carrying on the business of the undertaking. When they found that the profits did not afford enough for what they wanted, they said, "We must subscribe so much more capital," and they also said, "Let us offer it to the consumers." That has been done, and what was not issued in that way they have taken themselves at par, and all the shareholders are on the same footing. Those who have paid £27 10s or £25 per share, have got no more than those who were in the concern from the first.

Mr. LITTLER: The shareholders have contributed their money by leaving their profits in, after dividing only a very moderate per centage?

Witness: Yes; rather than take 12 or 14 per cent., they have left the balance of the profits in, and they have capitalized it. I have seen for myself that, in round numbers, £40,000 has been expended, and that only stands in the company's book at an even sum of £36,000, while the concern is certainly worth more than that. I find, on the whole, that they have not divided more than from 5 to 5½ per cent., and have put the rest of the profit into the concern. Once or twice they have put the whole in.

Mr. LITTLER: Seeing that they have not been tied by any legislation to divide less than a particular sum, do you see any difference between acting in that way, and making a call upon themselves?

Witness: There is no difference; it is simply avoiding the trouble of putting it into one pocket, and then taking it out and putting it into another. They have not been a company, it is to be borne in mind, but merely a private partnership, and have not been under any regulations at all. There is no rule about 5 per cent. in such a case. If they like to leave all the profits in, instead of taking them out, it is one and the same thing. With regard to the works, one must go a very long way indeed—whether in England, Scotland, or Ireland—to find such works; they are admirable, substantial, well designed, and exceedingly well adapted for what is required of them. The distillation and purification is exceedingly good, and the gas is as pure as it can come out of a gas-works. The works are in a peculiarly good position for increasing their productive power; they have nothing to pull down when they want to make an alteration, and that is a great point. It is too often the case that gas-works are planned without sufficient regard to their ultimate extension; but these works are set out in such a way that they may last for two generations, without having to pull down a house or anything else; they have only to add.

Mr. LITTLER: With regard to the geographical position of the city, does that involve any heavier expense than is the case in many other places?

Witness: It is under the disadvantage of being subjected to heavy expense for getting rid of the products which have to be manufactured again—the tar and ammoniacal liquor. The consequence is that the Londonderry Gas Company get only a net return of about one-third of the cost of coals, instead of from one-half to two-thirds, which some companies do. It is a common thing for a gas company to reckon upon getting, in the way of return from the residual products—coke, tar, and ammoniacal liquor—about half the cost of the coal; but in Londonderry they do not amount to one-third, and the reason is that the expense of getting them to market has to be deducted from whatever price they sell at. They may realize a good price wherever they are sent to, but to get them there they have to pay so much for bringing about that result, and this is a drawback for which they are in no way responsible.

Mr. LITTLE: That is a reduction of 15 to 20 per cent. on the returns usually realized by gas companies?

Witness: Yes; I have worked it out, and it comes to 2½ per cent. on £36,000, which is a considerable drawback to carrying on the business of the company. I have prepared an analysis of the accounts to show the cost per 1000 feet of gas sold within the last twelve months. The net price for coals and working expenses, less residuals, is 45.18d., that is 3s. 9d. per 1000 feet. The item for coals carbonized is 4.42d.; for wages at the works, 2.19d., which is a low figure, and will compare favourably with the average in the Metropolis; wages for mains and services, .83d.; wages for lamps, 1.54d.; salaries, 3.98d., which is not a high figure; general expenses, wear and tear, 6.39d., which is also low, from 7d. to 8d. being the general run in gas companies; rents, rates, and taxes, 2.46d.; meters, 1.46d.; and bad debts, .66d. Having regard to the exceptional position of Derry, and the cost of coal there, it is a result of which the directors of the concern may be proud; it is a very economical and well-managed concern. I have never been into and never knew a more thoroughly honest and good thing than the Londonderry gas undertaking.

Mr. LITTLE: Having regard to that working out of the 3s. 9d. for the last year, will you explain the principle upon which the sliding scale has been started? Why do you commence with an initial standard price of 5s. 9d.?

Witness: Until the sliding scale was established this session—within the last few days indeed—I had no idea of the auction clauses being forced upon any gas company, nor of the sliding scale. I may say that if auction clauses are to be forced upon the company, then the sliding scale should follow; and it should give them a chance, by way of compensation, for losing the privilege of allotting shares amongst themselves according to the Companies Clauses Act, 1863. The rule, which I understood has always been the law, is a right that all shareholders have, of allotting amongst themselves shares at par, and those shares in a healthy going concern would command a premium, and if they had occasion to sell those shares, they would benefit by realizing that premium; in the meantime, they would have the benefit of employing money at par, which would bring them in 7 per cent. In either event, if they are to be deprived of that privilege in the interest of the general public or the gas consumers, then this sliding scale is to come in designedly as a sort of compensation balance. What is to be considered in establishing a sliding scale is the starting point—the standard price. Not thinking either about auction clauses or sliding scale when I was advising the company, until within the last few days, I had suggested a maximum price of 6s. to cover the risks attendant upon carrying on the business in a time of coal famine, or any extraordinary circumstance. The war, for instance, which has just commenced, in all probability will have an effect upon the rate of freights, and increase the cost of coals to gas companies. It all depends upon the extent to which they may go, and whether the gas company are to have another season of trials as they had in 1872 and 1873. Then, abandoning the 6s. as a maximum price, I have arrived at the conclusion that 5s. 9d. ought to be the standard price, because to give the 10 per cent. upon the reduced capital, as I prefer to call it—contradistinguished from the idea that obtains, upon the part of the advisers of the corporation, that it is an exaggerated capital—I say that there has been £40,000, in round numbers, expended, and that written off now stands at £36,000, which, I think, is a very fair arrangement of the capital account. I say, that to pay the usual 10 per cent. dividend upon the £36,000, and 7 per cent. upon the new capital, which will be immediately required for extending the concern, they will require 5s. 9d. per 1000 feet. If there comes a time of suffering, and they have to pay more for their coals, there will be no chance of their getting anything more than their 10 per cent., and they cannot get that 10 per cent. until their business has increased; but I have drawn the line, so that I am prepared to defend it, at 5s. 9d., abandoning the extra 3d.

Mr. LITTLE: You think, with all the experience you have gained in Metropolitan cases, that the 5s. 9d., having regard to Londonderry, is a fair standard price to start with?

Witness: Certainly. The company want a profit of 2s. per 1000 feet to pay a dividend on a cost of 3s. 9d.

Mr. LITTLE: The price actually charged from time to time has only been sufficient to yield an average profit of 7.82d. per 1000 feet?

Witness: That is all the profit amounts to, and that has not been divided. On an average of all the years they have been in existence, they have only divided as much as will amount to 5½ per cent.

Mr. LITTLE: What do you say to the corporation objecting to the gas company having the right to break up the streets for the purposes of their undertaking?

Witness: It is like the old story of requiring bricks to be made without straw. The company would be placed under a strict obligation to supply gas to everybody who demanded it—and everybody would have a right to demand it, under the Gas-Works Clauses Act of 1871, and if the gas company, through caprice, or if the parties got at loggerheads about any question, if the power of opening the streets rested with the corporation, it would be very hard and unjust that the gas company should be required to comply with the Gas-Works Clauses Act, 1871. It is monstrous nonsense. There is no gas company in England, Scotland, or Wales who are under such regulations; nobody ever hears of its being asked for. The corporation must have been dreaming, and somebody else became infected with the dream; there is no sound sense about it.

By the **COMMITTEE:** If the power rested with the corporation to open the streets—that is to say, if the company could not do so without the permission of the corporation—then I say it would be an absurd position for the company to be placed in, because they are put under very stringent obligations and penalties to supply anybody that demands it under the Gas-Works Clauses Act, 1871. With regard to the allegation in the petition that it would be conducive to the general convenience that the undertaking of the company should be transferred to the corporation, I hardly know what to say to that. It is a common thing now for local authorities, corporations, and local boards, to desire to become owners of gas-works and of water-works for supplying towns and cities; but before steps can be taken to bring about such a state of things, the ratepayers, in every case, must be consulted, and, in this case, the ratepayers have not been consulted at all. It is a mere loss of time to talk about it in a gossip kind of way with a fraction of the corporation; they have no power to buy, and if an arrangement were entered into in this room, the company would have no security whatever, and they could have no security for any such

arrangement being carried out, either next year, or at any future time; the ratepayers might, and I believe would, veto it altogether. Up to the present time Parliament has invariably refused to grant compulsory powers of purchase. The only case I know of was that given to the Middlesbrough Corporation to purchase the water company's undertaking, but in that case the water had been obtained from an undoubtedly impure source, and the company persisted in standing in their own light. If a gas company misbehave themselves, there are plenty of means of bringing them to book under the general Acts, which are incorporated with every special Act. During the present session the Blackburn Corporation applied for compulsory powers, but those clauses were struck out of the Bill.

Mr. LITTLE: Having regard to the state of things here, and to the uncertainty whether or not the corporation will be able to obtain the works, do you think there is any reason why they should seek to prevent the company from getting an Act under the pretence that it will increase the value of the works?

Witness: The effect, in point of fact, will be to prevent the company carrying on their business properly. To put £36,000 in jeopardy would be unwise, but it would be still more unwise to add another £5000 or £6000 to it. The company have no money for new mains, and therefore people wanting gas will not be able to have it until two or three years have been frittered away in useless contests. The effect of obtaining an Act would certainly not be the doubling of the value of the undertaking; but it might add five years purchase to that value.

Mr. LITTLE: Even then, it may quite well be that an arbitrator, if he found such a well-secured concern as this appears to be, and in such capital order, might give quite as much without an Act as with it?

Witness: Certainly. If I were before an arbitrator I should argue—and I believe successfully—that this concern is worth at least twenty years purchase, because it is of an extraordinary character, built with limestone and thick walls, and its capacity being equal to something like 50 per cent. more than it is required to do. In my opinion no district ought to be left without a controlling power over the gas company supplying it. An illuminating power of 14 candles was established some years ago, because it was found that Newcastle coals naturally gave that amount, and anything beyond that is not to be manufactured without the aid of cannel or something of that kind, which adds from 3d. to 6d. per 1000 to the cost, according to where the works may be. In the present case the increase of illuminating power to 16 candles is equivalent to a reduction of 6d. per 1000 feet upon the amount charged, and that is the item to consider in fixing the standard price.

Cross-examined by Mr. CRIPPS: About £12,000 out of the £36,000 have been profits applied to capital.

Mr. CRIPPS: Surely you know enough about gas-making to know that when a company have done that, and the works are complete, and there is new capital raised, they never have more than 5 per cent. allowed upon that sum?

Witness: If you mean statutory companies, I agree with you.

Mr. CRIPPS: Assume that this were an unopposed Bill, and that it went before Lord Redesdale, do you mean that more than 5 per cent. would be allowed?

Witness: Certainly Lord Redesdale would allow it, when the small amount of profit they have divided is considered. It is not as if they had paid themselves 10 or 12 per cent., because they have done nothing of the sort.

Mr. CRIPPS: It is said there is greater risk in raising money for the purpose of first establishing gas-works, and if persons embarked their money for that risk, they might be entitled to large dividends if they succeeded, but that does not apply to a company who have once been established, and who get into their own hands the profits, which they may either put into their pockets, or invest elsewhere. There is no longer any apprehension of the loss of the money which is derived from the established profits of the gas-works, and surely you are aware that, under those circumstances, upon that money 5 per cent. is the dividend that is always allowed?

Witness: That rule cannot be applied in this case. I do not know of a case in London which accords, with regard to facts, with your theory.

Mr. CRIPPS: In the case of every London company who have capitalized their profits, and subsequently applied for an Act, that is the general dividend upon their capitalized profits?

Witness: Yes; but in those cases you will find they have paid their maximum dividends.

Mr. CRIPPS: Give me the case of any one company who have had capitalized profits allowed, and any dividend upon them more than 5 per cent.

Witness: I think I could find several, although I have not the names of them now. But, before you can apply that rule, you must understand that those shareholders have come in at different periods, and that what the old shareholders have spent—those who paid £27 10s. for their shares—is original capital. The sliding scale was introduced by the Metropolitan Board in 1875, and therefore we have had but little experience of it. The highest initial price in London is 3s. 9d., and 3s. 6d. in the case of the South Metropolitan Company. Those prices were fixed because there has been a certainty of profit. We are not looking for a considerable increase in the supply of gas, but for a gradual increase. An outlay of £5000 is necessary at once, but there will not be a corresponding increase in the consumption of gas to pay for it. On the south side of the river Foyle a considerable sum of money is necessary to be laid out to make the small work there equal to the present requirements. The gross price of coal at Londonderry is about 23s. per ton; the cost per ton of coal carbonized is 24s. 3d. The return per ton for coke, tar, and liquor is 8s. 8.62d. Meters are never looked upon as a source of profit. I know there is the old story of charging 10 per cent. for them, and 5 per cent. of that being profit, but that is not always carried out in practice. They only last about ten years, and therefore there is nothing hanging to them. There is a difficulty now between the corporation and the company with regard to the breaking up of the streets, but I do not know whether there ever was one before.

TUESDAY, MAY 1.

Mr. Spice recalled, and further cross-examined by **Mr. CRIPPS.** The proportion of cannel used in Londonderry in 1876 was 14 per cent., the result being that they had a very good quality of gas.

Re-examined by Mr. LITTLE: The Londonderry undertaking is not a company at all; it is a private partnership, and they chose to leave in much of their money as was required to build up the concern, enlarge it from time to time.

Mr. LITTLE: If a statutory company have, in addition to paying the maximum statutory dividends, been spending money in extending their works, it would, in effect, be evading the limits imposed by Parliament if they were allowed to capitalize such expenditure at the same rate as the maximum dividend; and that is the reason why, when a company have done that, Parliament insists upon capitalizing it as a common investment?

Witness: Quite so; but I believe that if a statutory company had pursued the same course as has been done here—keeping capital down and dividing only half what they might have divided, the capital so built up would be allowed to rank as original capital, and not cut down to 5 per

cent. I do not know of any case where private partnerships have applied to Parliament in this way, and have not been allowed to capitalize the entire value of their works.

Mr. CRIPPS: Give me an instance where they have been allowed to do so?

Witness: My opinion and belief is that it is the rule, when non-statutory companies come to Parliament, unless there is something very special, the accounts as they stand in the preceding year are taken as the original accounts.

Mr. LITTLE: As to the works being taken by the corporation, is it not the rule that the corporation should be in possession of funds which will give the sellers of the undertaking some security beyond the mere value of the undertaking?

Witness: I do not know a case in which the security has not been upon the rates of the city or town, and there should always be a margin to make the security ample. The corporation have no rating powers, I think, beyond 4s. in the pound.

Mr. LITTLE: They can now give no security beyond taking your works and giving them again as security?

Witness: I believe they have not enough to pay the expenses of this inquiry. There is a standing debt in the books of the company against the corporation of £1000, upon which they have paid interest at the rate of 5 per cent. to the gas company; it is now on the books, and for aught I know will have to remain there. I think they are about the last people to whom I should like to sell anything. If we obtain our Act, we shall be compelled, under the Gas-Works Clauses Act, 1871, to supply any premises within 25 yards of our main, and we shall also be bound to supply gas at a good and sufficient pressure, and also gas that shall not exhibit any trace of sulphuretted hydrogen. We shall likewise have to erect a testing-place for the gas examiners, who will be appointed by the justices. Copies of the accounts must also be forwarded to the local authorities, and also to any consumer who applies for them. On the other hand, one of the advantages will be that we shall have a summary method of recovering our charges for gas, and also the power, subject to the local authority, of breaking up the streets.

Mr. J. Macnie, examined by Mr. MICHAEL.

I am manager and secretary of the Londonderry Gas Company, and have been previously manager of the Stirling Gas-Works and engineer to the Limerick Corporation. I have made myself thoroughly acquainted with the history of the company from their origin in 1829. The original works were erected in Foyle Street, which was the most populous and busy portion of the city. They had to be enlarged from time to time, but they subsequently became so surrounded by houses that there was actually no land for further extending the works. The city is divided into two portions by the river Foyle, and the smaller portion of the city is called the Waterside part. The gas for the whole city was supplied from Foyle Street, and a main was carried over a wooden bridge across the river. There was a swivel arch at one part of the bridge, and every time that arch was opened the communication of gas to the waterside was cut off, so that if it happened in the evening, the residents in that district were left entirely in darkness. That was obviated in 1855, by putting a pipe under the bed of the river. It was shortly afterwards found that the works of the company were too small, and they were removed outside the town altogether; those works are called the Leckey Road works. When I took charge of the works in 1867, those works were just completed. They were in very good condition indeed, with the exception of some slight addition in the shape of governors, washers, and so forth. Those works were remarkably well laid out; so much so that no alteration in the arrangement of the blocks would be required, although the consumption was doubled. Since that time different apparatus has been put up as required, and new mains laid as fresh streets were opened. The structural value of the undertaking is much more than the £36,000 we are asking for. We now require, to meet the increased supply, new gasholders and other apparatus which will cost altogether about £5000. The population of the city has nearly trebled since the works were originally erected, and new houses are now springing up in every direction; it is, therefore, absolutely certain that fresh demands will be made upon us. The public have been treated most liberally by the directors of the company, and there have been very few complaints. The average dividend paid from the formation of the company I should put at 45 10s. or 45 15s. per cent. In order to produce the gas we have supplied, it has been necessary to use canal with ordinary coal, the proportion varying from 14 to 18 per cent. We have always endeavoured to give gas of great purity, and we have it constantly tested, day and night, so that we can easily detect the presence of sulphuretted hydrogen. I cannot give you the price for ordinary coal within a few pence, but it has cost us 22s. as nearly as possible, and the canal, I think, has been somewhere about 40s. per ton. Adding the 14 per cent. of canal coal, the total cost on the average of 1876 has been 23s. 4d. In the conduct of a gas company it is a cardinal principle that the works shall be kept in such a condition as continually to supply gas, and that necessitates an annual expenditure in order to keep up the works, which, of course, is largely varying. There is the expense for retorts, service-pipes, repairs of mains, painting, and repairs to the works, and, in fact, everything. "Wear and tear" really means the whole of the money expended on the works, except wages, and it comes out at 6 39d. per 1000 feet, which is a very moderate sum. I have endeavoured to keep the works in good condition, as being the most economical way of conducting such an undertaking. The average of the working expenses is 23 93d. The expense of coal is 33d., from which the residuals amount to 11 3d., leaving a net sum of 21 4d. as the cost for the coal, to be added to the working expenses, which makes a total cost of 3s. 9d. as nearly as possible. I think our working results will compare very favourably with those of any provincial company.

Cross-examined by Mr. CRIPPS: The capital account was kept in this way: The whole of the money subscribed by the shareholders was taken, and the profits were taken, and out of that they paid so much in the shape of dividends, and the surplus was carried on to meet the expenses of the company. The accounts were adjusted on a few occasions in order to ascertain exactly how much each share had contributed to the company's stock, and that having been struck, new shareholders were invited to take shares, but the amount which had been ascertained as their contribution per share was taken into account for the older shareholders. Those sums bore no dividend until the periodical adjustments to which I have referred. There was one adjustment in 1836; another in 1846, when a call of 42 per share was made; another in 1853, when 50 new shares were issued, each paying £22; another in 1860, when 130 new shares were issued, each paying £25; and another in 1864, when 420 new shares were issued, each paying £27 10s. The whole amount written off for depreciation is £3854, but very little of that amount was written off before 1863. Our capital has been taken at £36,000 for a long time, but it was first mentioned in any public document last September, when the company were registered.

Mr. CRIPPS: You then considered yourselves as a company with a capital of £36,000, composed, rightly or wrongly, of the sum which had been called up in shares, and the amount written up year by year, which you say you could have divided?

Witness: Yes; about one-third, I believe.

Mr. CRIPPS: You say that at the present time your works are sufficient.

With reference to your mains, are they not already laid in the new streets?

Witness: No; there are portions where not a pipe now exists. [Witness pointed out the various localities on the map.] We require also to make provision for the Waterside district, where the mains are all too small. An immediate outlay of £1000 is required for mains alone. The company now hold ground on lease, but they are taking powers to convert it into freehold. We are now paying 19s. 9d. or 20s. for gas coal, and for canal about 29s. or 30s. During the coal famine the highest price we charged for gas was 6s. 3d., which did not give a sufficient return to pay a dividend. During the years 1873 and 1874 we felt the worst effect of the coal famine, the average cost for that period being 32s. 4d. or 32s. 6d. We have been selling coke during the winter months at 10d. per cwt., which is a fair average; we have been as high as 1s., and sometimes as low as 4½d. The actual price of the coal *ex ship* was 17s. 6d. per ton, and the remainder of the 19s. 9d. was for the cost of cartage and so on.

Re-examined by Mr. LITTLE: Our leakage is remarkably low; last year it was only 7 85 per cent., while 15 per cent. is not uncommon. We have no local market for the disposal of our tar, and we are burdened with the carriage of it to Belfast. I should certainly not advise my company to go to the expense of something like one-sixth of the total capital without parliamentary powers, and if that amount is not expended, the people of Londonderry will suffer. There is no distinction between what are called original shares and the present shares; they are all mixed up. People have purchased at as high as £40 on the faith of direct assurances which have been made from time to time. We have always found outsiders willing to come in and take shares.

By the COMMITTEE: Our dividend was always declared at so much per share.

A MEMBER OF THE COMMITTEE: What, then, was done with respect to the £27 10s. shares and the £10 shares?

Witness: It sometimes was 22s. 6d. and 25s. per share; and 27s. 6d. and 32s. 6d. per share; and 35s. and 40s. per share. The reason why 27s. 6d. was fixed was simply because the accumulation of share capital made that amount. We received £2600 for the old works when we sold them, and that was written off from capital to make up for the depreciation of the works, and is included in the sum of £3800 as the loss by depreciation.

Mr. G. W. Stevenson, examined by Mr. M'CORKELL.

I have inspected the works belonging to the gas company at Londonderry, and have read the Bill which the promoters wish to pass, and also the petition against it. At present the gas company are not under any restrictions or obligations; they can supply gas or not as they please, of any degree of purity or impurity, and at any price they think fit, and either in sufficient or insufficient quantities. It is desirable that they should not remain in that condition, but that they should put themselves, as they are now seeking to do, under parliamentary control. I have made a structural valuation of the works, and should say, from my own knowledge, that £36,000 would not now suffice to construct them. Having relation to what many companies obtain as original capital, they might very fairly have asked for £40,000 original capital, bearing 10 per cent. I consider the additional capital asked for to be very reasonable, and with only £24,000 additional they will have to apply to Parliament again very shortly. That new capital, by the action of the auction clauses, will have to be offered to the public, who invest their money in gas-works, at something like 5 per cent., so that if the new capital is made to bear 10 per cent. upon the nominal value of the shares, a £10 share will sell for about £20, and £10 of that will bear dividend, and the other £10 will not; it will go into the concern, and serve to consolidate the undertaking, and bring the capital of the company down in regard to the amount of business done. In every way the auction clauses, with the sliding scale, are an advantage both to companies and to consumers. The operation of the sliding scale is simply this—that for every penny the company charge less than the standard price they get a quarter per cent. more dividend, and for every penny they charge more than the standard price they lose a quarter per cent. dividend, so that there is a direct inducement to the company to conduct their business with the utmost economy. I consider 5s. 9d. to be a proper standard price, as proved by the company's working of last year, when coal cost 33 19d. per 1000 feet, and the residuals realized 11 94d., so that the net cost of the coal was 21 4d. The working expenses were 23 93d. per 1000 feet, which, added to the net cost of coal, gave 45 18d. as the net prime cost of gas at the consumers' meters. Of course, to that has to be added the dividend, and 10 per cent. upon £36,000, spread over the whole gas sold, is 23 86d., making 5s. 9d. on the whole. With regard to the illuminating power, 14 candles is inserted in 99 out of every 100 Acts of Parliament just now, and it has been so for the last four or five sessions; but this company are proposing to insert 16 candles. That is a concession which has been made on the representation, I think, of members of the corporation and of some consumers, and it is a very great concession, because it means 16 candles minimum. It will be open to the local authority to appoint an official tester, and if he reports that the illuminating power falls below 16 candles the company become liable to heavy penalties. To produce 16-candle gas it would be necessary to manufacture gas equal to 17 candles, and, taking it at 2d. per candle, would make a difference in the cost of 4d., because to ensure against penalties, with 14-candle gas, they must make 15-candle gas. The works are the best that I have seen anywhere; they are admirably situated, admirably designed, and substantially constructed. I did not examine the books, but took the data furnished me by the manager as being correct. Assuming what he says as to the leakage is correct, it shows that the main-pipes are in a very good condition.

Cross-examined by Mr. HAMILTON: The supply of cheap gas mainly depends upon the cost of coal, the value of residual products, and so on, although, no doubt, a company who have suitable works will supply gas cheaper than a company with unsuitable works.

Mr. HAMILTON: The situation, for instance, down at the very lowest point, with the city ascending, would, of course, enable them to supply gas more easily and cheaply than if it were a dead level?

Witness: With a less initial pressure, no. I would prefer a dead level very much. I assume the same data as Mr. Spice does when I say that 5s. 9d. is a fair standard. I am aware that the company are registered under the Companies Act, but that does not prescribe the illuminating power, or purity, or pressure, or price. I am also aware that the Corporation of Londonderry may contract with any other company for the public lighting.

Mr. HAMILTON: Do you not think that the tendency of this Bill will be to put the company into the position of monopolists?

Witness: They are virtually monopolists now, and if they get their Act they will be monopolists controlled by Parliament, and directly responsible to Parliament. It will also give them an absolute right to open the streets for the necessary purposes of the company, and that I think they ought to have. They will be placed in such a position that no other company could practically compete with them, but even now it would be entirely impossible for another company to start in Londonderry with any chance of success. The present works of the company are perfect, so far as they go, but another gasholder is wanted, and that cannot be erected at a less cost than £5000. The largest daily make at the Leckey Road works

last winter was 206,000 feet, but they are capable of producing—allowing for a due reserve of retorts, which it is necessary to have—320,000 feet. At Waterside the largest daily make was 30,000 feet, and those works are capable of producing 56,000 feet, but the gasholder room at Waterside is very deficient, being only 18,000 feet. I valued the Belfast Gas-Works for the corporation just as the parties were on the point of agreeing, but I have not been consulted since. I think it very probable that the corporation there have reduced the price since, because they bought at a time when coal was dear. I should not be surprised to hear that I have stated that the average price of gas to private consumers in Belfast, after deducting discounts and all allowances, is about 3s. 5½d. per 1000 feet, but Belfast and Londonderry are two very different places. The works at Belfast have been constructed strictly out of capital, and they were managed by a very excellent English company. I think, however, that the corporation raised the price for one or two years, and then reduced it. I do not know of an instance in which 10 per cent. has been allowed on capitalized profits, except in cases where those capitalized profits have been reduced by Parliament. The case of the Isle of Thanet Gas Company is very different to that of Londonderry. This is a private trading concern, and stands on an entirely different footing. If a statutory company do not fulfil their obligations, and apply their surplus profits to the increase of their works, then they are doing wrong.

Re-examined by Mr. LITTLER: What the Thanet Gas Company did was to divide 10 per cent. on £16,000 which they subscribed, and to write up £4000 at one period and £4000 at another, to make up the whole £24,000 they were authorized to raise. They wrote that up out of profits, and divided 10 per cent. on the £24,000, which was monstrously wrong. They also asked for 10 per cent. on £48,000 additional, on profits which they said they had expended in extension of their works. They were really asking to put £56,000 of profits on £16,000, and to declare 10 per cent. dividend on that, which was not a just thing to do. In the present case the company are entitled to do what they please with their profits—to put them into their pockets or not. It does not make a pin's head difference, so long as they did not ask to have authorized an exaggerated capital they are justified in coming to Parliament and having their affairs put on a proper footing. With regard to the additional gasholders, there should be further accommodation provided, because a company cannot go to the extreme edge of their powers. They must take time by the forelock, and make provision for a consumption which is certain to come upon them, especially if they are going to be put under penalties as to quality and pressure.

Mr. W. F. Cotton, examined by Mr. LITTLER.

I am manager of the Alliance Gas Company in Dublin, who are the largest gas company in Ireland. I am well acquainted with the Londonderry Gas-Works, and in 1867 was called in to arbitrate in a dispute between some of the customers and the company. I made an award, which the company acted on directly in the fairest way. I agree with the general opinion of gas managers that it is necessary to be ahead of the consumption, not only in the interest of the company, but also of the consumers. The Londonderry Company were late in raising their price, and voluntary in reducing it. I consider the standard price proposed to be very fair, seeing that the residuals produce a very small amount—something like 35 per cent. In Cork they are charging 4s. 9d. for 14 candle gas within a very small area, and 5s. 3d. outside, and their residuals produce about 70 per cent. In the Londonderry Company the greatest economy has been used in the business; there is not the like of it in Ireland, Belfast being nearest to it. In Dublin the price is 5s.; at Kilkenny, 7s. 6d., which is an ordinary price in Ireland. At Limerick the price is 5s. for 12-candle gas, and the residuals there bear about the same proportion as at Cork—70 per cent. Taking the Londonderry works at the statutory value, I think £86,000 is a moderate sum to put down as their present value. I consider it would be quite fair to give them a maximum possible dividend of 10 per cent. Instead of putting the money into their pockets, they invested it in the works; and, therefore, taking the amount applied for, with the dividend, it would not amount to a larger sum. There is no pretence here of manufacturing capital for the purpose of coming to Parliament. They have kept their expenses as low as possible, and have offered outsiders the advantage of coming in on every occasion. I have never heard of the like before. The capital per ton of coal carbonized is £8 1s. 4d. In 1873 the capital of the Chartered Company was £8 6s. 5d.; Belfast Corporation, £9 8s.; and Cork, £9 2s. If the company keep up 16-candle gas, they will have to use 18 or 19 per cent. of cannel, the price of which is 34s. 6d. free on board at Glasgow. We bought at 35s. 6d., and one year we were obliged to pay 38s. for it. That is why I look upon it as a mistake to increase the illuminating power beyond 14 candles, which is the universal standard. It is probable that existing freights may increase three or four times during the next month. During the Crimean War rates were nearly doubled.

Cross-examined by Mr. HAMILTON: There is a large poor population in Derry from the various shirt factories and other places, but there is no doubt that applies to Dublin as well as to Derry. There are close on 7000 houses in Derry which ought to be lighted with gas. I account for the residuals fetching over 70 per cent. in Cork because coke commands a high price. We pay in Dublin for cannel and common coal together about 23s. at present. In Belfast they are reducing the price to 3s. 9d., but they do not test the gas beyond the test made for the engineer's information, and if you do away with testing the gas, you may sell at almost any price. I do not know anything about the northern towns in Ireland. In saying that 7s. was the average price in Ireland, I took inland towns as well as seaport towns—towns where coal is 30s. a ton as well as towns where it is 20s. a ton.

Mr. Alfred Penny, examined by Mr. LITTLER.

I have examined the Londonderry works and also the district. I have also heard the evidence given by Mr. Spice and Mr. Stevenson, and entirely concur in what they say. They are really the best works I ever saw, without any exception.

Mr. LITTLER: Judging from your experience, and also by precedents, and what Parliament has done, do you think there is anything unusual or improper in asking to capitalize the whole £36,000 at 10 per cent.?

Witness: I think not, for this reason—the absolute value of the bricks and mortar and iron is more than the £36,000 they actually ask to capitalize. It is not a mere assumed or written-up value, but is the absolute cost of construction.

Mr. LITTLER: Seeing these people have run the risk of having this concern without any statutory power for all these years, and never dividing more than 5 per cent., do you think it unreasonable to ask Parliament to allow them, if they can earn it, to have 10 per cent. on that capital?

Witness: They are asking what is usually asked, and what Parliament usually grants.

Mr. LITTLER: In the case of a company who have been without parliamentary powers?

Witness: Yes. With regard to the new capital, I do not consider £24,000 an unusual proportion. It will be some years, as a matter of course, before it can all be used up, but it is only a proper sum to ask, as there is no object in coming to Parliament so frequently, as that increases expense, which is borne by the consumers themselves.

Mr. LITTLER: I believe it is a maxim with gas engineers that companies ought not to come to Parliament more than once in 12 or 15 years?

Witness: I do not think it can be limited to that period. I think the company have asked for a moderate sum, having regard to the rapid growth and prosperity of Londonderry.

Mr. LITTLER: If your advice had been taken, they would have asked for more than £24,000?

Witness: Yes. They should have done so now that the auction clauses are about to be introduced, because there is no advantage the company can gain by issuing capital. The standard of 5s. 9d. we have arrived at by dealing with actual figures; it has not been jumped at. We have dealt with the figures in the same way that the standard price was arrived at in London. That standard will work down as well as up. If coals and other materials increase in value, it will be necessary to increase the price of gas, and that will diminish the dividend.

Mr. LITTLER: What do you say to it as a consumers question? In your judgment, is a 5s. 9d. standard in such a place as Londonderry better for the consumer than as the Bill was originally drawn with the 6s. maximum?

Witness: It cannot be worse. The company had the power to go up to 6s., but now they have only the power to go to 5s. 9d., unless they diminish the dividend. Every penny they advance above 5s. 9d. is a penalty on them, and they are not likely to do that if they can avoid it. Being allowed to divide a larger sum by going below the standard will induce economy in the majority of cases.

Mr. LITTLER: Having regard to the price of coal at Londonderry, and the residuals produced, do you think that lower than the 5s. 9d. standard would be fair and reasonable between the parties?

Witness: It would not be fair to put on the company a lower price. The question of residuals is a serious one. If the residuals fetched an average price—or, say, half as much again—the cost of gas would be reduced about 5d. per 1000; and if the usual standard of illuminating power—14 candles—had been adopted, that would reduce the cost of gas 4d. per 1000 more, so that 3s. 9d., the present cost of gas, would be reduced to about 3s., and the standard price of 5s. 9d. would be reduced to 5s. If the corporation were in possession of the works to-morrow, the price of residual products would not increase, because it is indigenous to the place; and as to the illuminating power, if that remains at 16 candles, it would cost just the same as it now costs the company.

There was no material cross-examination of this witness.

Mr. T. Chambers, examined by Mr. M'CORKELL.

I am solicitor to the gas company, and have lived in the neighbourhood for 30 years. When the corporation signified their intention of buying the works, I applied at the town-clerk's office for copies of the printed accounts of the corporation from the year 1859. I obtained those for 1860, 1861, 1862, 1863, 1865, and 1870, and was told those were the only published accounts. Up to Aug. 31, 1860, there was a balance due to the treasurer of £1886 17s. 4d.; Aug., 1862, £1738 2s. 6d.; Aug., 1863, £2469 12s. 2d.; Aug., 1865, £34 12s. 10d. In the previous year they had obtained power from Parliament to borrow £10,000 or £20,000, and they were in process of raising the loan in Aug., 1865. That was the only year they had a balance to their credit. The account for the year 1870 commences with a balance against the corporation of £4343 2s., and closes with a balance against them of £3420 8s. 8d. That does not include the £1000 owing by the corporation to the gas company. Under their Improvement Act the corporation can charge 4s. in the pound where there are lamps within 100 yards of the buildings; if not, half. Those rates have been charged ever since the Act passed, in 1848. They have very frequently talked of reducing it, but have never done so. They get a gratuitous grant of £1200 from the Irish Society, of which £500 goes to improvements, and £700 to pay the officers. By the last accounts of the corporation it appeared that they had borrowed £69,950, of which they had paid off something like £17,520, leaving a balance of £52,430. They are also about to borrow £15,000 more from the Government on the security of the rates.

Mr. M'CORKELL: Have the corporation any property on which they could secure the price of the gas-works?

Witness: I do not think they have any security to offer, except our own works. It is like taking a mortgage on your own property.

Cross-examined by Mr. HAMILTON: I do not wish to represent the corporation of Londonderry as being insolvent, but I say they are not able to make the two ends of the year meet. I believe their rates are collected as well as in any city in Ireland; there is only a small amount of arrears. I am not aware that the usual income of the corporation from all sources is £16,045 a year. The condition under which the corporation have borrowed money was that they should pay off 1-40th each year. I believe they can get money at 4 per cent., and I consider the reason to be that it is difficult to find any investment for money. They pay their interest punctually, and for that reason they are in fair credit with regard to borrowing money.

Re-examined by Mr. LITTLER: The rates are not sufficient to pay the annual expenses, and therefore, as solicitor for my clients, I should not advise a transfer of the works to the corporation. I do not know whether Londonderry is the highest taxed town in Ireland. The taxes come to 6s. or 6s. 8d. in the pound, including the grand jury cess and other rates.

Mr. LITTLER said that was the case on behalf of the promoters. Mr. HAMILTON said he would call his witnesses on behalf of the corporation before Mr. Cripps addressed the committee.

(To be continued.)

HOUSE OF COMMONS COMMITTEE.

MONDAY, APRIL 23.

(Before Mr. SANDFORD, Chairman; Mr. LAMBERT, Mr. HANBURY, and Sir HUGH CHOLMELEY; Mr. BONHAM-CARTER, Referee.)

ASHTON-UNDER-LYNE GAS BILL.

ASHTON-UNDER-LYNE IMPROVEMENT BILL.

(Continued from page 708.)

Mr. W. H. Hughes, examined by Sir E. BECKETT.

I am medical officer of the borough of Ashton. The gas-works are situated in the midst of a densely populated neighbourhood. The parts of the gas-works bounded by the north are the oldest portions of the borough. It is not a healthy district; the air is sensibly polluted with the gases from the gas-works, which exercise a deleterious influence upon people living in the neighbourhood. In St. Peter's Ward last year the death-rate per 1000 was 23; for Portland Place Ward 38; Market Ward, in which the gas-works are situated, 47; and St. Michael's Ward, 19. The death-rate for the radius of 300 yards round the gas-works was 5 per 1000. In 19 streets closely adjacent to the gas-works, with a population of 3739, 31 deaths occurred from zymotic diseases, giving a death-rate of 8.3. The density of the population and the character of the property may, to some extent, affect that death-rate, but not so much as the gas-works.

Cross-examined by Mr. CRIPPS: I made a report on the 24th of February, in which I pointed out various nuisances which were detrimental to health, but I did not make any allusion to the gas-works being one of those causes. [Witness pointed out the various spots where the nuisances occurred.] The property in Market Ward is very old and very bad, and the

death-rate is usually higher in places of that kind. St. Michael's Ward closely adjoins the gas-works, and that is the ward where the death-rate is very low. [Witness also pointed out the streets where zymotic diseases prevailed.]

The CHAIRMAN: I suppose your cross-examination means generally that the death-rate may be attributed to other causes than the gas-works.

Mr. CRIPPS: Yes; but I need not press the matter further.

Re-examined by Sir E. BECKETT: If the gas-works were purchased by the corporation, they would have to put increased works somewhere else.

By the REFEREE: The property in the neighbourhood of the gas-works is well drained.

Mr. J. Wilson, examined by Sir E. BECKETT.

I am a member of the Town Council and chairman of the Finance Committee. It is the unanimous wish of the Town Council that the gas-works should be the property of the corporation. We are willing to guarantee the company their dividend, and I cannot conceive what else they want. The benefit to the town would be that the corporation would have the sole management of the streets, and would disturb them only when most convenient to the public traffic. Some skilled workmen now employed by the corporation for paving, &c., would do the work of laying mains and connecting services, thereby saving expense, causing uniformity in work, and promoting public safety and convenience. The corporation can borrow money for extensions of the works at 4 per cent. All the benefit of the increase will go to the town at large, instead of to the people who buy the gas shares. I do not think the site selected for the extension of the works is a desirable one. It is situated in a very populous part of the borough, and is within about 320 yards of the town-hall, and I quite agree with the medical officer's statement, that the death-rate has been considerably increased by the gas-works being situated in that locality. The corporation have done all they can in respect of drainage in that district. I believe the prevalence of zymotic diseases to be entirely owing to the manufacture of gas. I do not know that there is anything unhealthy so far as foundries are concerned. The present works stand disadvantageously in this way, that they are much higher than the proposed site where the corporation, if they became possessed of the works, would have them placed. They are about 23 feet higher than No. 3 site, where the gasholder is. One of the objects of the corporation in trying to make this purchase, besides the financial ground, was to get rid of the works in an objectionable place, and to put them in a good place.

By the CHAIRMAN: It is the intention of the corporation to remove the works from the present site, not instantaneously, but by degrees, because if we were at once to set about removing a large plant like this, it would be exceedingly costly and disadvantageous to the consumers.

Examination resumed: We should do it as fast as we could; at any rate, we should spend no more in enlarging the present works, but as they wore out we should let them go. In 1857 the amount paid for the street-lamps was £792, and in 1876 £1151, but that is independent of the consumption in the town-hall and market-hall, which in 1876 was £1265. The company allow a large discount to millowners, amounting in 1875 to £1370, and on shops £1437. I have not the accounts for 1876, but in 1867 they had a balance available for dividend of £4163; 1868, £4213; 1869, £4276; 1870, £5068; 1871, £5455; 1872, £3104; 1873, £2414; 1874, £5389; 1875, £1425; and in 1876, £4820. I have taken these figures from the published accounts of the company. It would be our intention, if we became possessors of the gas-works, to pay off the whole capital in 60 years. We should place 1-60th part to the sinking-fund annually, and also a sum for contingencies, in order that the consumers should not be unfairly dealt with, as I think they have been in the past, through the extraordinary charges for repairs in one year. With regard to any further extension of capital, the corporation would borrow the money at 4 per cent., or probably at 3½, and consequently the difference would go to the benefit of the consumers of gas. Supposing gas shares are bought by auction to pay 5 per cent., there would be the difference between the 4 and the 5 per cent. If the sliding scale were fixed too high in the first instance, there would be a loss to the corporation and the town for ever. I am not able to form an opinion as to what the initial price should be, but for these works to be a positive benefit to the consumers it is really desirable they should get them as early as possible; the longer the purchase is delayed the more inferior would the advantage be.

Sir E. BECKETT: You propose to guarantee the company present dividends in perpetuity, and they propose to sell all new shares by auction; therefore, is there any conceivable loss they can suffer by the works passing into your hands?

Witness: We cannot see how it is possible they can suffer any loss. The highest auction price has been £75 for £30 shares, and the last offer the corporation made was £78 12s. 4d., which would be equal to £125,000 10s. for the works.

Cross-examined by Mr. CRIPPS: In the first instance we should endeavour to give the consumers of gas a more regular supply; then lower the price and give it to them as cheaply as we possibly could; and then any surplus that might occur after the working expenses were paid would go to the borough fund, but that is not the main thing we are looking to. Supposing the company remain, I do not know what the shareholders will do. In the past we did not find the management of the concern to be for the benefit of the consumers. When the last reduction was made, from 4s. 6d. to 4s. 2d., I believe that reduction was brought about through the corporation entering into negotiations for the purchase. A large sum of money has been put down every year for repairs, while the gas company were positively creating new plant, instead of reducing the price of gas to the consumers.

Mr. CRIPPS: Supposing the company were to remain so, and make a surplus over and above 10 per cent., the consumers would be benefited.

Witness: I say from the experience of the way in which they have managed their works up to the present time, I believe they might go on creating new plant.

Sir E. BECKETT inquired what the standard price was to be, as he could not go on further unless he knew.

Mr. CRIPPS said the sliding scale was to be from an initial price of 3s. 9d. per 1000. (To witness:) Supposing the works were transferred, the large consumers of gas, who might be benefited if the works remained with the company, would be deprived of that benefit, which would go to the borough fund?

Witness: It would be for arrangement afterwards. In Wigan, I believe, they have the sliding scale for charges, and I do not know why we should not be enabled to allow discounts in ratio to consumers.

Mr. CRIPPS: I am assuming you both carry on the business in the same way, but the ultimate profit would go, in your hands to the borough fund, and in the hands of the company to the consumers of gas?

Witness: The consumer would not lose the advantage, because we believe we shall be able to manage the works more cheaply.

Mr. CRIPPS: You spoke of the corporation having the sole control of the streets, and of alterations being made at particular times, but if there is any escape of gas you cannot wait for something else being done, but it must be remedied at once, must it not?

Witness: The corporation are continually repairing the streets, and they would be much more likely to find out the escapes than the gas company

would. From our experience in some parts of the borough, it is positively black with the gas which escapes. I am aware there are mines under some parts of the town. There is no proposal in the Bill of the corporation to acquire any land for the purpose of erecting new works, nor any resolution with reference to moving the works. Some portions of the borough of Ashton are certainly country, and the death-rate there would be just in ratio, excepting some influence which might alter it, such as the gas-works.

Cross-examined by Mr. BROADBENT: The interest upon £125,000 at 4 per cent. would amount to £5000, and the sinking-fund for 60 years would be £2000 a year, making £7000.

Mr. BROADBENT: The dividend payable by the gas company now is simply £4770; how do you propose to make up the difference unless you increase the price of gas?

Witness: If the corporation become possessors of the gas-works, I suppose it would be about six or seven years before they would have to pay to the sinking-fund, and at the end of that time the natural increase which would have taken place would enable the corporation to meet the amount required.

Mr. BROADBENT: Why do you propose to defer the sinking-fund for six or seven years when the works are in full operation now?

Witness: According to the account of the gas company, the works are not in full operation, for they are about to extend the concern, and make great improvements. It is only within a very short period that the company have been enabled to supply some portions of the borough. Ashton is already supplied with water by the corporation, and in 1878 the Hurst Local Board will join the Ashton Corporation in the water supply; but we have not considered whether they will join us in the gas. According to the Act of Parliament, if there is any surplus from the water-works it is paid into the borough fund, and from that transferred to the improvement account of the borough. I have been given to understand that the gas company would not supply Hurst.

Sir E. BECKETT (in re-examination): If the corporation get the works all the benefit that will arise from increase of population and improved manufacture will go to the town, but if the company keep the works, with the sliding scale, the profits will be divided between them and the town; and in the event of the price being reduced to 3s., as is probable, the company will get an additional 2 per cent. dividend?

Witness: That is so.

Sir E. BECKETT: Then you can now understand the sliding scale.

Re-examination continued: It would have been premature to pass any resolutions about removing the gas-works. The land where we should wish to put them is for sale. We can obtain power to borrow from the Local Government Board.

TUESDAY, APRIL 24.

Mr. Wilson said he should like to make a correction of his evidence on the previous day. He had stated that the sinking-fund for 60 years would be £2000 a year; but the way he would like to state it was as follows:—If the corporation became possessed of the gas-works, the amount of money they would have to put on one side would be about £1000 a year, not £2000, and consequently there would be a surplus instead of a deficiency.

Mr. T. Heginbotham, examined by Mr. BROWNE.

I am deputy-mayor of Ashton, and a member of the Town Council. I think it would be a great advantage for the gas-works to be transferred to the corporation. I believe the company seek for power to borrow money at 7 per cent., but we are now borrowing money without difficulty at 4 per cent.; we have other loans at a less rate than that. I believe the way in which the company have broken up the streets has been very unsatisfactory to the corporation; and on many occasions when our water-works inspector has opened various parts of the stench arising from the gas. I have heard it stated, but do not believe, that that is due to the settlement of the earth underneath the town. The town is only undermined on the north side [pointing it out]. Looking at the way the company have managed their mains, I think that is a case for transfer to the corporation. The proposed extension of the works is not at all satisfactory to me, because it is in a very undesirable part of the town. I should not like to pledge myself that the site marked No. 3 is more satisfactory for the extension of the gas-works than the plot marked No. 4, except that I believe it would be a very good place indeed for gasholders; but I am not prepared to say it is the best place for making gas, because I can point out a better. It is, however, close to the canal and railway, and those are great advantages for a company. Supposing these works passed into the hands of the corporation, there are many sites in the immediate vicinity of Ashton that could be selected for the extensions necessary in time to come. The wish of the corporation is that the auction clauses should be inserted without the sliding scale. I have obtained a good deal of information in reference to the price of gas at Ashton as compared with other towns, but of course a great deal depends on the quality of the gas, and how the works are managed. I am deeply interested in the question of cost, as I am a very large consumer. Last year my payment to the company was £234 14s. 7d., the price being 4s. 2d. per 1000, with a discount of 11d. From my knowledge of the subject, I consider gas could be produced at 3s. per 1000, including the dividend; but if the works were in the hands of the corporation there would be no dividends to provide, and no directors fees to pay. It has been stated that any complaints made would be more likely to be rectified if the gas supply were in the hands of a private company than if it belonged to the corporation, but that is the most unlikely thing I ever heard in my life, because the corporation meet monthly in their council chamber, and are subject to severe cross-examination for all their misdoings. The complaints against the company are very numerous—"their name is legion." Only the other morning two or three of our large mills at Guide Bridge had to close entirely until the light dawned upon them, because they had no gas to work by. The company's servants came to examine the mains, and they had to open the streets in three places before they could find the syphon to extract the water, and thereby let the gas go by. Complaints have been more or less continuous from various parts of the town throughout the years I have been connected with Ashton. They have been principally as to deficiency of pressure and illuminating power. I can testify to the former, because a short time since, in a large portion of our works, the gas was put out entirely by the slamming of a door, and we had to send up special messengers, one after the other, to get the matter remedied.

Mr. CRIPPS objected to the examination, as the manager had been asked no question on the subject.

The CHAIRMAN said the committee were of opinion that precise complaints could not be gone into unless they had been pointed at in cross-examination.

Examination resumed: I know the feeling of the town in reference to this matter, and it is very strong indeed in favour of the corporation possessing the gas-works, and has been so for a long time. Every town councillor, when he presented himself before the electors, was required to pledge himself to support the purchase of the gas-works.

Cross-examined by Mr. CRIPPS: A meeting was called in April for the purpose of obtaining an expression of opinion on the proposed acquisition

of the gas-works by the corporation, and the reason why it was an utter failure was because the question was considered such a foregone conclusion on the part of the ratepayers that they did not think it worth while to attend. The meeting was simply called because the town-clerk said it was necessary. I am not aware there has been any other meeting called.

Mr. MICHAEL: That was not the "borough funds meeting"?

Mr. CRIPPS: No; a meeting called by the mayor, in consequence of a requisition numerously signed. It was held in the town-hall, just before the 14th of April. The borough funds meeting must have been called long before that stage. (To witness:) You have said that gas can be sold at 8s. per 1000 feet; what would be the price of coal in Ashton?

Witness: I am not prepared to go into that. The Bill was considered by a committee of the council, and the discussion was upon the impolicy of extending the works in their present situation.

Mr. CRIPPS: You are one of those who are looking to make considerable profit out of these works for the purpose of laying out a park, and doing various other things in the borough?

Witness: I do not know about that. The first thing we shall look to is cheap gas; but we hope, in the course of years, to be able to do as other towns have done, and have a surplus. I believe, by our powers, the company are required to give us notice every time they break up a street, but in practice it is not done; the enforcement of things is sometimes more trouble than allowing them to go by.

Mr. BROADBENT was about to cross-examine, when

Witness said: Am I obliged to answer Mr. Broadbent? I think it very unfair that a few shareholders in Ashton should be allowed to appear here with such a minimum of expense—merely sending up a solicitor?

The CHAIRMAN said he assumed that Mr. Broadbent appeared as agent for persons petitioning against the Bill, and, therefore, he had a perfect right to cross-examine.

Cross-examined by Mr. BROADBENT: With respect to the site mentioned adjoining the railway, there is no siding-room there at present, but the company are making preparations for two additional lines, so that I think there will be no difficulty in getting siding accommodation. The corporation are the largest consumers of gas, but in the amount they pay for is reckoned that consumed in the market, and which is retailed to the persons who take stalls in that market. As regards the outside of the town, I should individually say they ought to pay more for gas than those in the borough, because of the expense of conveying the mains to a distance, and also because of the condensation and leakage from the pipes. If the borough of Ashton purchase this plant, they will be responsible for the profit and loss, and if, by any mischance, any great calamity occurs, and the town sustains considerable loss, that loss would have to devolve upon the rates of the town, and have to be paid for by the assessment of the town alone. The people outside would pay nothing. Moreover, they get the benefit of the market, which is a very large one, and is frequented by people from the districts all round, and they also get the benefit of the lamps on the way. I think there might be some amount of injustice in charging the lower portion of Hurst a higher price for gas than would be charged in the south-east portion of Ashton; but it would be very difficult to define any other plan of a varying scale than by the different districts. It has been mentioned that an imaginary circle should be drawn round the gas-works, and that all within the circle should be charged one price, and all without another, and I think that is quite fair and open for discussion.

Re-examined by Mr. MICHAEL: By our Act of Parliament the corporation of Ashton have power to make gas to supply the public lamps, the town-hall, and other establishments belonging to the borough, as well as the market, but we have chosen to let the power remain in abeyance, and have taken our supply from a private company. Our General Purposes Committee consist of the whole board, and therefore these various matters have been discussed by the entire corporation. The present extension which is proposed is merely a temporary alleviation of a difficulty which has arisen as to the supply. Eventually there must be a much larger extension than that now contemplated.

The CHAIRMAN: I should like to know upon what grounds you object to the sliding scale.

Mr. MICHAEL: Before the witness answers that, will you allow me to say that as yet we have not seen the sliding scale. We are arguing nearly in the dark, and do not know how it is to be proposed.

Mr. CRIPPS: We propose an initial price of 3s. 9d. from which the price shall slide either way, in those very short and emphatic words as described in the Acts of 1875 and 1876, and now placed in all new Bills. It is exactly the ordinary sliding scale, that 1d. per 1000 feet more or less charged to the consumers alters 5s. of the dividends to the shareholders.

Mr. MICHAEL: Are you going to take the mean price charged over the district with the discount already existing?

Mr. CRIPPS: Discounts do not apply to the case at all.

The CHAIRMAN (to Mr. Michael): We cannot begin discussing that now. You have extracted from your own witness the fact that he prefers the auction clauses without the sliding scale. He has given that opinion in equal ignorance with yourself as to what the sliding scale is, and, as he has given that opinion, I want to know the grounds for it?

Witness: The grounds are these, that the gas proprietorship can increase the rate of their dividend in proportion to the lowness of the price at which they sell their gas, and thereby put an amount of money in their pockets which would otherwise go into the hands of the corporation, and be applied to a reduction in the price of gas.

Mr. CRIPPS: If that is all you think it is I shall be content.

Mr. J. S. Stanley, examined by Mr. BROWNE.

I was a member of the Ashton Town Council for nine or ten years, but am not so now. I remember the works of the company being formed. They were small at the beginning, and have increased since. There were mills in existence before the gas-works were erected, but not many houses. I do not think the company ought to be allowed to increase their works on the site of the present undertaking. I am agent for a large property on the opposite side of the street to the gas-works, and there have been many complaints from the tenants respecting the great nuisance arising from the gas-works. The corporation say they will not erect additional works on that site, but remove them to No. 3. Our property is 20 yards distant, and the painting of the woodwork there is seriously affected. Looking at the whole question, I think it would be an advantage if the works were in the hands of the corporation; they would be fully competent to manage them quite as well as they are at present. For a great number of years there has been a strong feeling in the town that the works should not be allowed to remain in the hands of the company. I have noticed that the way in which the streets have been dealt with by the company has been unsatisfactory; but not being in the council now I do not take much interest in the matter.

Cross-examined by Mr. CRIPPS: I believe notice of the extension of the gas-works was served to every householder within 300 yards of the gas-works, and also that a very limited petition has been got up against the Bill, but I am not aware of its object.

Mr. CRIPPS: There is no proposal in either Bill to take any new site for gas-works; but do you not suppose that if there was any new site about to be acquired there would be no opposition to it?

Witness: It would depend upon where the site was located. I do not know whether the railway company would object to the land adjoining being taken?

Mr. CRIPPS: There must actually be some definite proposal before you could know whether there was any objection, and there is no such proposal?

Witness: Not that I am aware of.

Cross-examined by Mr. BROADBENT: I have not calculated the expense of removing the works to another site. Whether the effect would be to increase the price of gas would depend upon circumstances. In case of decay of works, or the works becoming too small from various reasons, they could then be removed hereafter, and under those circumstances the expense would not be so great.

Re-examined by Mr. BROWNE: If a new site were chosen by the corporation it would be where there was no population, provided it was as convenient; and I am sure a very good site might be obtained in the neighbourhood of Ashton. The corporation appear here to represent the strong feeling of the ratepayers that the works should not be extended on the present site.

Mr. G. Mellor, examined by Mr. BROWNE.

I am Mayor of the Borough of Ashton-under-Lyne, and brother of the member for the borough. I am not personally interested in the gas-works, but have family connexions who are. I agree with the other members of the corporation as to the advantage which would arise from the works being transferred to their hands. When we hear of a reduction in the price of gas by the company, we look upon it with horror. In 1872 the price of gas was 3s. 9d., and our gas bill was £490 18s. 6d.; in 1873 they advanced the price 3d. per 1000, and our bill was £382 17s. 10d.; or £108 less at 4s. than at 3s. 9d. In 1874 they advanced it to 4s. 6d., and our bill was £374 0s. 3d., or less again than at 4s. In 1875 it was 4s. 6d., and our gas bill was £392 16s. 5d. In 1876 they reduced the price to 4s. 2d., and our bill was £417 8s. 8d., or £25 more than when the price was 4s. 6d. The seeming boons given by the company have been expensive to us; we would rather have the gas at 5s., as we should pay less for it. The number of lights was exactly the same. We have actually put new burners throughout the whole establishment during the last two years, and still our gas bill keeps on increasing whenever there is a reduction in price. My works are within 150 feet of the gas-works, and in foggy weather the smell is very offensive. The company could not help it, and that is why we object to the extension, because the smell will be greater.

Cross-examined by Mr. CRIPPS: We burn by meter, and, therefore, expect to pay for what we consume.

Mr. CRIPPS: You pay each year by meter according to the quantity you consume; if the price per 1000 is more and you pay less, you must have consumed less that year?

Witness: No, we did not. We had a superior quality of gas, and we did not require so much; but when they reduced the price they sent an inferior article, which goes through the meter at such a speed that it registers frightfully. I expect it is forced through with extra pressure. I presided at a meeting, which was called by the requisition of about 150 persons, on the subject of these Bills, but there were only about 23 people present. I certainly expected the requisitionists would have been there; but there had been some sort of a *soirée* at a club in the town the night before, and, consequently, many of them were *non est*.

Re-examined by Mr. BROWNE: Even amongst that small assembly of 23 there was complete unanimity.

Mr. BROWNE: With regard to this consumption of gas, if the gas were made of an inferior quality you would have to burn more to get the same light?

Witness: Decidedly.

Mr. BROWNE: If the gas were of an inferior quality would the company be likely to increase the pressure?

Witness: There is no doubt about it.

Mr. BROWNE: And in that way drive not only gas but air through the meter, for which you would have to pay, although you would get no illumination thereby?

Witness: Yes.

Mr. J. Pollitt, examined by Mr. BROWNE.

I am a member of the town council, and am by business connected with the Manchester, Sheffield, and Lincolnshire Railway in Ashton. I agree with the previous witnesses as to the necessity for the transfer of these works to the corporation. In the neighbourhood where I live, up to two or three months ago the supply was very deficient; that is on the north side of the town. I have known times when the pressure has been so bad in that part that we have had to light candles to assist in reading. I believe it is the intention of the corporation, if they acquire the gas-works, to transfer them gradually to some other part of the town; and, if there were any necessity for it the corporation would apply for an enabling Bill in the ensuing session of Parliament.

Cross-examined by Mr. CRIPPS: We certainly could not apply for a Bill without obtaining the sanction of the ratepayers, which might, and probably would be, opposed by the inhabitants. I know the angle formed by the railways, but I should not like to say whether they would like the gas-works there. I am not here to speak for the railways. When I spoke about deficient supply, I only referred to the houses in the part in which I live. The street-lamps, I believe, were sufficiently supplied; but the district in which I live is just on the edge of the borough—something like 100 houses—and, through an insufficient main, I think we are badly supplied. I think it only fair to state that since the new gasholder has been erected on site No. 3, the pressure has been slightly improved, although the pipe has not been altered. I complained about the matter to a neighbour, Mr. Dalgleish, who was an officer of the company.

Cross-examined by Mr. BROADBENT: It has not come under my knowledge that the gas company have made compensation to the corporation for breaking up the streets, although I believe the corporation can compel them to do so.

Mr. J. Robinson, examined by Mr. BROWNE.

I have been borough surveyor of Ashton-under-Lyne for over 27 years, and have had control of all the streets and highways in the borough. The Improvement Act of 1849 vested in the corporation the property of the borough; but it had formerly been under the control of the Commissioners of Police. About 16½ miles of streets have been completed to the satisfaction of the council, and declared highways under the Act. Having had control of the streets, I have had frequent opportunities of examining the gas company's mains. In one case, the ground was impregnated with gas: it was black, quite a yard in depth, and has been in existence for over 20 years; but nothing has been done to remove that effect. There is another case in which if the cellaring were shut up an explosion would be caused, the leakage is so great. I ascribe that great escape of gas to the defective joints of the pipes. They were laid down long anterior to my engagement, and must be in a corroded condition. Our workmen have experienced difficulty in sewerage in the neighbourhood of some of these leakages, and I have complained to the gas company without obtaining any remedy. Complaints were made more than two years ago, which have not been attended to yet. The company are bound to give me notice whenever they intend to cut any trench or open any street, but they have

not done so since 1872. The company sometimes employ proper paviors for their work, but not always; but if the works passed into the hands of the corporation, that defect would be removed, because we have skilled workmen who do that work for the corporation. I have examined the paint in the neighbourhood of the gas-works, and will show the committee a specimen [producing same]. Whatever paint is put on is reduced to a lead colour in a very short time, which is due to the emanations from the gas-works. I have often found the sewers fouled by refuse from the gas-works, which is not a proper way for the business to be conducted.

Cross-examined by Mr. CRIPPS: I know the law to which all gas companies are subject with reference to breaking up the streets, but I have a decided objection to taking extreme measures. The company actually asked me at one time to take the breaking up of the streets into my own hands. I did, during Mr. Goodwin's time, undertake to repair for them, but they always gave me notice then. Mr. Clarke has not asked me during the last six months to do the same thing. I do not profess to know anything about the manufacture of gas, but I know the paint is fouled by the emanations from the gas-works. Every day I come across pipes being relaid somewhere or other; but the disturbance from the mining operations is only on the north side, where there is a very small population. No coal has been obtained under the main body of the town.

Cross-examined by Mr. BROADBENT: We have no control over the streets in the district of the Hurst Local Board, and therefore, supposing the corporation acquire these works, that board will meet with the same difficulties we now meet with, and so would the Audenshaw Local Board. Under the Hurst Local Board district there are more collieries than under Ashton; but I never heard any complaint from there, because I have never interested myself in the matter.

Re-examined by Mr. BROWNE: We should do our work in Hurst by skilled workmen, and not by ordinary labourers, as is the case with the gas company.

Mr. H. Lyon, examined by Mr. MICHAEL.

From 1861 to 1875 I was consulting engineer and manager of the Corporation Gas-Works in Rochdale Road, Manchester, and since that time I have been practising as a civil engineer. The works of the Ashton-under-Lyne Gas Company are objectionable on account of the site. I do not exactly know the level, but it is high, and I believe the coal and canal have to be carried into the works, which is objectionable, as raising the price at which gas can be produced. I think the site suggested by the corporation is a good one, on account of the convenience to water and rail, which would enable the materials to be brought in cheaper, and the residuals to be carted away at a less rate. It is close to where a gasholder is already erected, and where there is room for another, and that would be an additional advantage.

Mr. CRIPPS objected to the line of examination, as it was propounding an alternative scheme.

Mr. MICHAEL said, supposing the works were transferred to the corporation, they had the power to purchase that site and erect gas-works without coming to Parliament at all, whereas they could not acquire the present undertaking and erect fresh works without applying for a special Act.

The CHAIRMAN said that was suggesting an alternative scheme, whereas the proper course would be to put to the witness generally that there were sites which might be taken.

Examination resumed: There are many sites in Ashton which might be used for the purpose of erecting gas-works. I do not think there ought to be another foot of gas made at the present works. I do not disagree with discounts being allowed to large consumers, and I do not think the discounts allowed here are excessive. The average discount to large consumers for the last ten years was £18 9s., and to small consumers £11 4s.

Mr. MICHAEL: From those figures, what do you work out as the advantage which the large consumers have had?

Witness: Deducting the discount received by the small consumer from that received by the large, leaves a difference of £75 a year, which in ten years amounts to £750. The average cost of repairs and renewals from 1867 to 1872 is £13 5s. per million feet of gas, and for the next four years £32 9s.—a difference of nearly £20. In my opinion, the proper charge would be about 3-18d. per 1000, which would work out to £13 5s. per million; so that, during the last four years, the charge has been £20 per million more than it ought to have been.

Mr. MICHAEL: It is desirable, in conducting gas-works, that the plant generally should be kept in a proper condition, and there ought to be an amount annually spent on the works to keep them in that condition?

Witness: There ought to be, but not from revenue. In my opinion, the sum per 1000 feet should be about 4d.

Mr. MICHAEL: Then it follows that when Mr. Stevenson puts 8½d., that is double the sum that ought to be charged.

Witness: From the profit and loss account. If extensions are required they should be paid for out of capital. There must occur every year certain depreciations in the works of a company supplying gas, and thus an expenditure is required to prevent that depreciation and to keep the works in a proper condition, and I have taken that into account. Everything which appears in the profit and loss account as expenses for repairs and renewal, in the balance-sheet of 1876, is included in that 4d. per 1000. I consider the sum of 11-10d. for repairs given by Mr. Clarke to be most extortionate; it is money which ought to have been taken from capital to pay for the work done.

Mr. MICHAEL: Will you explain how that operates to the disadvantage of the gas consumer, in having an amount charged to revenue instead of to capital, as you say it ought to have been?

Witness: I look upon it in this way, that had the dividends been properly apportioned, and the renewal of apparatus paid out of capital account, a reduction in the price of gas might have been made earlier.

Cross-examined by Mr. CRIPPS: I have taken my 3-18d. as being the price per 1000 feet charged in the profit and loss account for repairs, maintenance of works, and renewals for the first six years out of the last ten. During the last four years those charges have been very excessive, and the company have been taking that money from revenue instead of from capital.

Mr. CRIPPS: The only difference between you and Mr. Stevenson applies to the last four years, in which we have charged to profit and loss account a large sum for renewals?

Witness: That is true.

Mr. CRIPPS: Are you aware that before that time we had a large reserve-fund, which was spent on these matters?

Witness: I was not aware that you had a reserve-fund before I came into this room.

Mr. CRIPPS: You did not make an average of the whole ten years, but stopped when you arrived at the last four; did it not occur to you that it might have been a low average one year, from the very cause that it was a large average the next?

Witness: It did, and that was the reason I took the six.

Mr. CRIPPS: If at the end of the first six years there was a very low average taken, would you not expect to have a higher average the following years?

Witness: No; I expect in those years to have a very good average.

Mr. CRIPPS: Would it not be the case in any works, that if for any reason

the improvements had been put off from time to time, and you found a very low sum charged for two or three years, you would expect to find it larger at the end to make it up?

Witness: No; I think the general thing is to have a separate fund for the purpose, termed a renewal-fund.

Cross-examined by Mr. BROADBENT: I have never heard of an appeal being made to the quarter sessions with reference to the Ashton Gas Company, either as regards price or the accounts not being properly kept.

Mr. H. Gartside, examined by Mr. MICHAEL.

The borough of Ashton obtained their charter of incorporation in 1847, and I was unanimously elected the first town-clerk. After holding that office for 16 years, I resigned my appointment, but was induced to resume the office about two years ago. I am well acquainted with the requirements of the borough, and marked out the districts for the various wards. I remember the gas company applying for their Act in 1874, shortly after which the question of the gas supply was discussed by the Town Council. Communications passed between the then chairman of the gas company and the corporation as to the purchase of the undertaking, and a deputation waited upon the gas company in consequence. The matter, however, dropped through at that time, but was taken up again about 12 years ago. It has been a test question with the ratepayers ever since 1847. The feeling of the ratepayers has been unanimous as to the acquisition of the gas-works. A portion of the northern end of the parish is supplied by the Oldham Corporation. The Ashton Gas Company have sold a portion of their undertaking to the Dukinfield Local Board, and there is nothing to prevent them from selling other portions of their district. All the gas-works round Ashton are in the possession of the local authorities, with the exception of Stalybridge, and the parties there are watching this Bill with a view to the acquirement of that property next year. If the Corporation of Ashton were the owners of the gas-works, they would be enabled to supply gas to the consumers at a more reasonable figure than the present company, because we should be able to borrow the money which we should pay for the works at a less rate than the 10 per cent. which is now paid by the company. If the gas-works belonged to the Corporation of Ashton, a certain sum would be set aside every year as a sinking-fund, and in the course of 60 years a very large portion of the value of the works would be free to the ratepayers, and consequently, they would be enabled in future times to sell gas at a less rate than they do at present, because the burden upon them would be lightened and eased every year, whereas, so long as it is held by the gas company, of course they have no incentive to pay off the capital. I think it is a fair principle which is followed out in Manchester and Stalybridge—and also, I think, in Rochdale—that the outlying districts should be charged a higher sum per 1000 feet than that within the borough. There is a borough rate made every year, and those parties who pay less rates than we do have the same advantages with respect to the town of Ashton as those within the borough. They make use of, perhaps, one of the best markets in Lancashire—the market-hall and the market-place—which is a great convenience to them. They can also make use of the town-hall on payment of a merely nominal price, and they have all the advantages of the town, and of the good streets, and, therefore, I think they ought to pay a little more than the people within the borough; that is supposing the works were transferred to the corporation. The outlying districts would also be under no obligation to provide any of the purchase-money. It is a very general opinion throughout the town that it is undesirable to have an extension of the present gas-works.

Cross-examined by Mr. GOULDTHORP: I do not think there would be any difficulty in obtaining another site. It is not always possible to take a town meeting as the test of the feeling of the borough.

Mr. GOULDTHORP: Mr. Mellor evidently expected a large number of people at the town meeting, but you were rather surprised to find only about thirty?

Witness: I was not, because I am accustomed to these things, and the people of Ashton know they are perfectly safe in the hands of the corporation. Ashton is considered to be the model town in Lancashire, so far as the streets are concerned. The whole town belongs to Lord Stamford, and he lays all the streets out at right angles. For the last 20 years, it has been considered that the Ashton Gas Company's shares have been possessed by one or two families, and they have been a little quiet, nice investment. The alteration of political parties sometimes alters the staff of a corporation, but not in a material thing like the gas-works.

In cross-examination by Mr. BROADBENT, witness said he thought it was quite right that the consumers outside the borough should assist in paying off the purchase-money, but he had made no calculations on the subject.

Mr. YATES said that on behalf of Lord Stamford he did not propose to call any witnesses, but would briefly state the position his lordship wished to occupy. Lord Stamford was the owner, not only of the borough of Ashton, but of a considerable district in the neighbourhood. He was laying out streets, and had others in contemplation, and it was therefore of the utmost importance to him that the gas supplied should be of the best quality, and sold at the cheapest rate possible. The opposition he (Mr. Yates) had offered to the preamble had been very slight, and more with the view of seeing whether gas could not be obtained cheaper than it was at that time, but he would undoubtedly prefer to see the works in the hands of the corporation, because of the advantages which would accrue to the ratepayers and inhabitants. It seemed as if those who were in favour of the Bill were large consumers, who lived outside the borough, and they did not want the corporation to have the gas-works, because the probability would be that the corporation would adopt a radius from the gas-works, and charge a higher price to the larger consumers than to the poorer inhabitants of the borough. At present those persons who lived round the borough got the whole advantage of the borough, without paying the borough rates, and therefore it was only reasonable that they should pay more than those who subscribed to the municipal rates.

Mr. BROADBENT said that he likewise did not propose to call any witnesses, but would simply deal with the fact that the corporation proposed a compulsory purchase of the gas-works, and the question was what effect that would have on the consumers whom he represented. It could not be supposed that the corporation could purchase at a less price by arbitration (which was the mode in which the Bill was framed) than what had been offered—£125,000. The committee had heard that the annual sum which would have to be paid by the corporation as interest and expenses connected therewith would be about £6000 or £6500 a year, while the company were only entitled to pay £4500, and any excess over that would have to go in reduction of price; and if any two consumers of gas were aggrieved, they could apply to the quarter sessions and have the accounts properly investigated. That being the case, it could not be supposed that the corporation, if they purchased the works, could supply gas at a lower rate than the company. He had nothing to do with the past. If it was found that the company had not conducted their business properly in the past, then the gas consumers would be alive to their interests, and would see that the accounts were henceforth properly kept in order, and the reserve-fund properly made. The corporation said they could sell gas at a less price than the company. They proposed a limit, but it was a limitation of area, so far as the lowest price was concerned. The corporation would have to charge more against the revenue account than the company had, so far as the sinking-fund was concerned, and the outlying

districts would have to pay every year towards that sinking-fund, and in 80 years from now the corporation would have their gas-works entirely free, at the expense partly of those persons outside the borough, which was an unfair thing.

Mr. MICHAEL, on behalf of the Ashton Corporation, said there was a very important sense in which the two Bills were not competing measures. The position of the corporation was as follows:—In the first place, they took precisely an analogous position in their opposition to the gas company's Bill to that which they would take if they had no Bill of their own. He wished strongly to impress upon the committee that, representing, as the corporation did, the sanitary condition of the district, they strongly objected to the extension of the works on their present site; and they ventured to say that no reason whatever had been adduced, except possibly an economical reason, for that extension. He would take as an illustration the 3½ acres of land adjoining the gasholder which had been erected by the company. It was quite clear that when the company selected that land as a site for the erection of gasholders they considered it the best for the purpose, taking into consideration the levels from which gas could be supplied. Therefore it left one other question to be considered—viz., what was the proper site upon which the manufacture of gas should be conducted. Mr. Stevenson said that if the gas-works were to be erected *de novo* he should never select that place. He also said it was an improper site, and could only be supported by the fact that there were gas-works existing on it. He (Mr. Michael) wished most strongly to impress upon the committee that the powers sought by the gas company should not be accorded, putting aside all question as to who should possess the undertaking. If the works passed into the hands of the corporation, they would never erect a single retort-house or anything else on that land. It must be obvious that it could not be proper, in the midst of a dense population, to allow what was acknowledged to be a nuisance to be enlarged. All that had been attempted to be said in answer to the complaints of the corporation was, "You do not, in your Bill, seek to take any powers for the acquirement of land for any other site;" but that was a very poor answer. It was quite sufficient for the corporation, in the first place, to address themselves to the acquirement of the works. But it was not necessary for the corporation to apply to Parliament in order to acquire fresh land. The only thing necessary for them to do, as an urban sanitary authority, charged, when they had the power to do so, to supply gas within their district, was to go to the Local Government Board to obtain permission to borrow the money necessary for the purchase of the land, and thus they would acquire all the powers necessary in order to set up another portion of the gas undertaking. The corporation based their opposition to the Bill of the gas company on the ground that the works ought to be removed from that densely populated district. They said to the company, "You ought not to come to Parliament to seek to increase that which has been for many years—even by your own acknowledgment—a nuisance. You cannot carry on your gas undertaking, from the very nature of things, without its being a nuisance, from the mode in which gas is purified—the drawing of these charges of hot coal, the evolution of sulphuretted hydrogen in the air, and the alleged suffering to public health in the immediate vicinity." It was, no doubt, necessary that the works should be extended. It had been shown that the company had been very remiss, and that they ought to have applied to Parliament long ago to acquire power to raise sufficient capital in order to give a proper amount of gas to their customers. He (Mr. Michael) did not complain of their coming to Parliament, nor did he complain of the auction clauses being introduced, nor of the amount of capital they sought to raise, but he confidently asked the committee not to allow the nuisance to be increased. Passing to the second point, a very important committee of that House had considered the whole question of the acquirement of gas undertakings by local bodies, and a very important report was issued by Lord—then Mr.—Cardwell, which had been uniformly followed by committees who had had to consider the question of the transfer of gas undertakings from companies to corporations. The principle laid down was that where a commercial company applied to Parliament for any further powers or privileges, it was competent for Parliament to consider the whole circumstances attaching to that company, and determine accordingly. A second principle laid down was that where a corporation sought to interfere with a gas or other company when that company were not themselves applying to Parliament, it was not competent for the Legislature to deal with a company who were not before them. Those were the two principles, and they had been uniformly followed; and if the company had not been present with their Bill, the committee ought not, and would not, consider any application for the compulsory purchase of the undertaking of the company.

Mr. CRIPPS: What Parliament laid down was this, that in order to enforce something compulsory upon a gas company coming before Parliament, and to put restrictions upon them, it was necessary to have the corporation, or some other company, also coming with a Bill before Parliament, to give them jurisdiction, so that they had, in fact, a sort of screw upon the company, saying, "If you do not do what we tell you, we shall pass the Bill of the other party;" but, unless somebody else came with that Bill, Parliament would not do it.

Mr. MICHAEL said that was precisely what the corporation were doing, and they were, therefore, entirely conforming to the conditions Lord Cardwell had laid down. There were a company, on the one hand, and a corporation on the other, and it was for the committee fairly to consider what was the balance of public interest. Was it best for the public interest that that undertaking should remain in the hands of a private company charged with public duties, or that it should be transferred to the corporation, taking care in the meantime that the whole of the interests of the private company were conserved by the committee in the transfer of the undertaking from a private company to a public authority? His friend had said that the corporation were not there with respect to compulsory powers of sale; but they were, and they were strictly within precedent in doing so, there being two cases which would show that they were entirely fulfilling the conditions. The first was the Rotherham case, in which the committee threw out the gas company's Bill, and indicated to the parties that they intended to pass the clauses enabling the corporation to acquire the undertaking, and then terms were arrived at between the company and the corporation, and clauses were inserted in the Bill, which became law. The other case was that of the Stockton and Middlesbrough Water Bill, where, against the opposition of the company, the undertaking was transferred upon terms which were incorporated in the Bill after a most protracted opposition in both Houses. It must be evident that, under the meaning of the Gas-Works Clauses Act, 1847, after payment of the maximum dividend a gas company became *quasi* trustees for the gas consumers. When 10 per cent. of the capital had been raised and put aside as a reserve-fund, it was to be invested in Government or other securities, to be kept for the purpose of meeting any extraordinary demands in the way of an accident at the works, and to make up a fund for the payment of back dividends when they had not arrived at the maximum amount, and after that time any surplus was to go towards a reduction in the price of gas. When, in fact, such a state of things occurred as in the last few years of the Ashton Company—when there was a surplus, if it had not been improperly distributed, of £5000, representing a sum of very nearly 1s. per

1000 in the price of gas—then what had been referred to by Mr. Broadbent would take place. If the gas company did not reduce the price by 1s. during the next year, it was in the power of the consumers to apply to the quarter sessions for an examination of the books, and to enforce the reduction in the price. Therefore, beyond the acquirement of the maximum dividend, the company had no interest in any profits they might have earned. Mr. Mellor had frankly said that the company had no interest whatever in carrying on the undertaking, and the attention of one of the witnesses had been called to the accounts for 1875, where the balance of profit brought down was £426. That was a sum very much less than was sufficient to pay their maximum dividend; and, therefore, the only way in which they could have paid that dividend, supposing the amount to be correct—which he very much questioned—was by going to the reserve-fund for something like £1600 in order to pay the 10 per cent. If they had gone on in that way for a few years the whole of their reserve-fund would have gone.

Mr. CRIPPS: We have no reserve-fund now, from Mr. Mellor's evidence. Mr. MICHAEL said the company had chosen to eat their bun, and yet they wished to have it still. There was nothing in the year 1875 which was exceptional, so far as the price of coal and other materials was concerned. It was an ordinary year—coal, iron, and labour were cheap—and yet they only earned 5 per cent. They therefore had to go to their reserve-fund to make up their dividend, and if they had continued doing so for only three years, it would have required £4500, or £500 more than their reserve-fund, in order to pay their dividends. Mr. Mellor had said it must be very much better for the company to have a permanent maximum dividend, secured on the whole of the property, instead of having to deal with all the fluctuations of the trade, and all the possible disadvantages of a rise in the raw material from which the gas was produced. The corporation, therefore, offered them something certain, as against that which was uncertain. Under the auction clauses 10 per cent. would not be paid; it was practically the value at which the public estimated the undertaking, and at which they purchased the shares in order to pay that amount. The amount of capital given in showed that £56,000 was paid for the raising of the Ashton Gas Company—£30,000 in capital and £26,000 in premiums, which latter sum received nothing in the way of dividend for its use. That practically reduced the dividend to 5 per cent., and as, according to the Standing Order, all further capital was to be raised in the same way, it was only 5 per cent. they could possibly have. His friend would agree with him on one point, if on no other, that the amount of capital mattered nothing at all, because the ratio would always be observed. No possible hardship could accrue to the gas shareholder by the transfer. He might say, "It is my property; I have a sentimental attachment to it;" although sentiment and gas-retorts and sulphuretted hydrogen seemed rather at variance with each other. If the company refused to part with their property on the terms offered by the corporation, there must be something behind, because monetary considerations usually governed matters in these cases. There must be some other source of profit which induced a gas company, under circumstances similar to the present, to hold back, and refuse that which was shown to be for their benefit. If by the transfer of the undertaking to the corporation any pecuniary damage would be caused to the shareholders, then his (Mr. Michael's) argument would fall to the ground; but he hoped he had shown to the committee, even by the evidence of the most adverse witness—the chairman of the company—and by the consideration of the facts, that if those accounts were to be taken as correct, he was proposing to confer a very large benefit on the shareholders, instead of any loss, by the transfer from the company to the corporation.

WEDNESDAY, APRIL 25.

Mr. CRIPPS having replied upon the whole case, The room was cleared for a short time. On the parties being called in, The CHAIRMAN said that the committee were of opinion that the preamble of the Ashton-under-Lyne Gas Bill was proved.

Mr. MICHAEL said he should take no part in the discussion on the clauses.

The various clauses were read and agreed to. On clause F the room was cleared. After some time parties were readmitted, and

The CHAIRMAN said the committee were of opinion that the initial price should be 3s. 8d.

The remaining clauses were agreed to, and the chairman was directed to report the Bill to the House.

Mr. YATES said he withdrew from any further opposition to the Ashton-under-Lyne Improvement Bill.

Some formal evidence having been given,

The CHAIRMAN declared the preamble of the Improvement Bill to be proved, striking out the recital that it was expedient to purchase the gas undertaking.

The consideration of the clauses was adjourned till Friday, April 27, when the Bill (the gas clauses being omitted) passed the committee, and the chairman was directed to report the Bill to the House.

Miscellaneous News.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Ordinary General Meeting of Shareholders was held at the London Office of the Company, 30, Gracechurch Street, on Tuesday last—THOS. HUGHES, Esq., Q.C., in the chair.

The SECRETARY (Mr. Alfred Lass), having read the advertisement convening the meeting, the following report and statements of account were presented:—

The directors have much pleasure in submitting to the shareholders the accounts of the company for the half year ending Dec. 31, 1876.

These, with the annexed report of the engineer, show the progress of the company. The directors have to state that the profit for the half year has amounted to £1042 3s. 9½d., and that after paying the interest on debentures there remains an available balance of £821 9s. 10½d., out of which the directors recommend the declaration of a dividend for the half year ending the 31st of December last, on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 4 per cent. per annum, leaving a sum of £119 1s. 10½d. to be carried forward to the next half year's account.

The directors have to report that they have reduced the price of gas to the general consumers to 3-60 dols. per 1000 cubic feet, as from the 1st of March last.

The directors retiring by rotation are Arthur Clarke, Captain Henry Thurnburn, and Joseph Quick, who, being eligible, offer themselves for re-election.

The retiring auditor is Robert King, who, being eligible, offers himself for re-election. The dividend will be payable on the 1st of June next.

Engineer's Report.

Gentlemen,—The usual half-yearly returns to Dec. 31, 1876, which have been forwarded, will, I trust, meet with the approbation of the board.

My report on the state of the working for the half year will, I hope, give satisfaction to the directors and shareholders of the company.

The two gasholders are in good working order, and the retort-house, governor-house, purifying-house, and all the buildings and machinery are in an efficient state of repair.

During the half year 6,035,800 cubic feet of gas have been made, and 5,860,500 feet have been accounted for, realizing 306'53 dols. more than during the half year ending December, 1875.

The number of consumers has slightly increased, although many small consumers

have discontinued the use of gas. I hope, however, to induce them to burn gas again, the price to that class of consumer having been reduced to 3'60 dols.

The sale of coke has increased. During the early part of the half year there was a considerable demand for it, but it has not been fully maintained. We, however, manage to keep down the stock, and hope to do so for some time to come.

The working expenses have been brought as low as possible compatible with efficiency. During the last half year ten houses have been fitted with 98 lights, and 83 lights added to old consumers, making an addition of 181 lights, to which may be added one stove, one contract lamp, and two public lamps.

In conclusion, I thank the board for sending the last stock of coals and bitumen, and for their consideration in endeavouring to get the indents for fittings quickly attended to, delay in the execution of orders being prejudicial to the interests of the company.

Trusting that the half year's working may be deemed satisfactory,
(Signed) THOS. B. YOUNGER, Engineer and Manager.

Dr.	Balance-Sheet, Dec. 31, 1876.	Cr.
Share capital—		
6200 ordinary shares, at £5, fully paid up	£31,000 0 0	
412 preference shares, at £5, fully paid up	2,060 0 0	
Debtenture bonds	6,400 0 0	
Retort renewal fund account	108 12 0	
Bad debt fund	50 15 0	
Bills payable	171 11 11	
Amounts owing to sundry persons	526 16 10	
Profit & loss account, net revenue	821 9 10½	
	£41,139 5 7½	£41,139 5 7½

Revenue Account.	
Coals and bitumen	£959 16 7
Purifying account	29 2 3
Wages account	374 16 8
Repair & maintenance of works and plant, &c.	197 8 10
Salaries	669 16 11
Rent, rates, and taxes	67 10 0
Directors and auditors fees	155 5 0
Trade and general charges	154 10 8½
Bad debts and allowances	88 15 6½
Law charges	12 7 10
Balance carried to profit and loss, net revenue	1,042 3 9½
	£3,751 14 1

Profit and Loss Account, Net Revenue.	
Interest on loans, debentures, &c., to Dec. 31, 1876	£230 15 6
Balance carried forward to the next half year's account	821 9 10½
	£1,052 5 4½

The CHAIRMAN, in moving the adoption of the report, referred to the unfortunate state of affairs in Georgetown, which the directors had to lay before the shareholders at their last meeting. He was happy now to be able to state that things were much more favourable than at one time he anticipated they would be, owing to the collapse of the late management. By comparing the present report with that for the corresponding period of last year, it would be seen that the company had entirely recovered themselves; for, although there was a small decrease in the profit, yet it was so small that they might practically be considered to have regained their former standing. At that time the profit amounted to £1155; at the present it was only about £100 less than at the most flourishing period of their previous existence. He was happy to add that the directors had received a most gratifying report about that portion of the works which had caused them the greatest anxiety. The new gasholder was in a satisfactory state, and the engineer reported that the retort-house, governor-house, purifying-house, and all the buildings and machinery, were in an efficient state of repair. Mr. Younger had also stated to the directors, in a letter received by them that day, that he had no doubt the new gasholder would remain in a satisfactory state, and that the board need have no anxiety about the foundations. He (the chairman) thought, therefore, that the directors were quite justified in stating to the meeting that the affairs of the company were really satisfactory. There was only one point which he felt he ought further to mention, because the policy of the board had been questioned at previous half-yearly meetings, and that was the reduction in the price of gas to small consumers, which the directors had thought it right, in the interests of the company, to make. The price previously stood at 4'50 dols., and the board had deemed it advisable to make a reduction to 3'60 dols. Their reason for that was founded upon the consumption, and he thought, when the shareholders heard what that was, they would admit that the policy of the board was wise and prudent. Taking the consumption at the maximum price of 4'50 dols. at Dec. 31, 1875—i.e., for the corresponding half year to that now under consideration—it amounted to 304,200 cubic feet. According to the present balance-sheet it was 270,000 cubic feet; therefore, there was here a great falling off. On the other hand, it would be found that the portion of gas which stood at 3'60 dols. showed a return as follows:—For the half year ending Dec. 31, 1875, the consumption was 1,812,000 cubic feet, and for the half year ending Dec. 31, 1876, it was 1,865,000 cubic feet. Taking these figures into consideration, he thought the evidence was overwhelming that the former high price of gas was actually reducing the number of small consumers. The directors felt, therefore, that a reduction was highly desirable, and they resolved to fix the price at 3'60 dols., which was the figure at which they had had the greatest increase of consumption. This was the principle upon which the board had acted, and he trusted they would have the assent of the proprietors to the course they had adopted. It would be seen that there had been a fair and satisfactory increase in the number of houses lighted, and in the actual number of lights during the half year. The only remaining question to touch upon was that of the dividend. The board might have recommended a dividend at the same rate as that fixed at the same time last year; yet, under all the circumstances, they thought it would not be perfectly prudent or right to do so; they therefore recommended a dividend at the rate of 4 per cent. per annum only, and in this matter also he hoped they would obtain the sanction of the shareholders. With these remarks he moved the adoption of the report.

Mr. ALFRED WILLIAMS seconded the motion.

Mr. STOKES congratulated the directors on having "turned the corner" of their difficulties, and he congratulated the shareholders generally upon the fact that, instead of going without a dividend as on the last occasion, the profits enabled them to provide one, albeit a small one. This showed that they were on the right tack. He was pleased to hear that the reduction in price was likely to result in an increase of consumption. The directors, in the course they adopted, had taken the right course, and one which he trusted would add materially to the prosperity of the company.

The motion was put and carried unanimously.

On the motion of the CHAIRMAN, a dividend for the half year ending the 31st of December last was declared at the rate of 8 per cent. per annum on the preference shares, and 4 per cent. per annum on the ordinary shares, free of income-tax, payable on the 1st proximo.

On the motion of Mr. WILLIAMS, seconded by Mr. BLYTH, the retiring

directors were re-elected, and on the motion of Mr. CLARKE, the retiring auditor, Mr. R. King, was also re-elected.

A cordial vote of thanks to the chairman and directors was acknowledged by the deputy-chairman, Mr. H. P. Stephenson.

Thanks were also voted to the secretary, who acknowledged the same, and the proceedings terminated.

BIRMINGHAM CORPORATION GAS SUPPLY.

At the Meeting of the Birmingham Town Council on the 1st inst.—the Mayor (Alderman Baker) presiding,

The Gas Committee presented their report, which stated that the hearing of the action of the *Corporation v. Allen and Holden*, for damage arising from mining operations at Swan Village, took place in the month of March, and in the result was dismissed with costs, the Master of the Rolls remarking that it was a case of great importance, and a very proper one to be brought before the Court. With regard to the motion in the action brought by the corporation against the Talbot Colliery Company, for an injunction to restrain the defendants from working their mines at Hill Top, in such a manner as to cause subsidence of the high road along which the gas-mains are laid, the committee reported that it was heard before the Master of the Rolls on the 9th of March, when his lordship was of opinion that on the evidence he ought to grant an interim injunction, and he ordered that a boundary line should be fixed by the engineers of the respective parties, beyond which the defendants should undertake not to work. The respective engineers not agreeing as to the lines of working, they have been fixed by the referee and marked on a map, one in the heathen coal and the other in the thick coal, to the west of which the defendants are not to work until the trial of the action or further order. On the 23rd of March the matter was again mentioned to the Court, when it was ordered that it should stand over to the trial of the action, on cross undertakings by the respective parties.

The Corporation of Walsall served the town-clerk, on the 19th of April, with notice under the provisions of the Walsall Gas Purchase and Borough Extension Act, 1876, signifying their option that the purchase from the Corporation of Birmingham of the Walsall portion of the gas undertaking, late of the Birmingham and Staffordshire Gaslight Company, shall take effect on the 1st of July next. This option is given to the Walsall Corporation by Art. 4 of the agreement of sale and purchase, dated April 23, 1875, scheduled to, and confirmed by, the Walsall Act. The property to be sold is defined in Art. 3 of the agreement, and the consideration (Art. 5) is the yearly sum of £1300, payable half yearly, on the 1st of January and the 1st of July, and the same is charged, by Art. 5 of the agreement and Sec. 32 of the Act, on the Walsall Gas Undertaking, and on the borough-fund and rate of the borough of Walsall. All that appears necessary is to execute the deed of conveyance, prescribed by the 7th Schedule to the Walsall Act, to clear away the books of the corporation, their office furniture and effects, stock in trade, and moveable chattels, which by Art. 3 of the agreement are not included in the sale. The town-clerk has been authorized to approve of the draft deed, and to affix the corporate seal thereto. On the 17th of March a formal meeting of the two arbitrators, Mr. Hawksley, C.E., on behalf of the corporation, and Mr. Bramwell, C.E., on behalf of the Smethwick, Oldbury, Tipton, and West Bromwich Local Authorities, was held in the Council Chamber, when the arbitrators proceeded to the appointment of Sir Henry Arthur Hunt, C.B., of Parliament Street, Westminster, as their umpire. It was suggested that the next meeting should be towards the latter end of July. Most of the future meetings will probably take place in London, and it has been considered advisable by both parties that the umpire should sit with the arbitrators, so as to avoid the necessity of going over the evidence a second time, if the arbitrators do not agree.

With a view of economizing the cost of shunting the coal waggons, your committee have purchased a locomotive engine from Messrs. Black, Hawthorn, and Co., for use at Saltley, which has been at work since the 22nd of March, with the most satisfactory results, no horses being now employed except for jobbing work in the yard. An entrance from the Birmingham and Warwick Junction Canal to the new basin recently constructed at Saltley has also been made, which will greatly facilitate the working of the new retort-houses, and also effect a considerable saving in the labour of loading coke, &c. The Gas Street storing station not being now required, it has been considered desirable to dispose of the old gasholders, and it is expected that in a short time this place can be entirely given up.

The work of rearrangement of mains is progressing. Icknield Street East is now clear of all mains except the 36 inch. A commencement has been made with a 12 inch in Broad Street, then along Ryland Street, and to be continued in course of time to meet the 18 inch in Icknield Street West, thus completing the circuit; while in a few weeks the entire length of Digbeth and Deritend will be clear of its superfluous mains, one of which, a 12 inch, is being relaid in the Green Lanes, in continuation of that which was commenced last summer. The 12 inch in New John Street is in course of removal to Lodge Road. All streets in which granite and other paving has been laid down have been previously cleared of surplus mains, and the services in them have undergone a thorough repair. It is anticipated that all heavy work, which it is now necessary to complete, will be finished in two or three months in the northern district.

With reference to the explosion of gas that took place on the premises of Mr. Westley, in Albion Street, in August last, your committee report that the arbitrator (Mr. G. J. Johnson) has made an award in respect of the damages and personal injuries sustained by Mr. Westley and his family, for the amount of £1644 12s. 6d., which amount has been paid to the solicitors acting for Mr. Westley.

The average quality of the gas, as certified by the official tester since the last report has been 17'30 candles.

The number of new services supplied during the quarter ending the 31st of March has been 867, as compared with 530 services for the corresponding quarter of 1876, being an increase of 337.

The report concluded by calling attention to some correspondence which had passed between a member of the council and the town-clerk, in reference to a speech delivered by the former at a recent political gathering, in which the proceedings of the Gas Committee were impugned.

Mr. MARRIS moved the adoption of the report, which was seconded by Mr. HADLEY.

An amendment, in the shape of a rider to the motion, was proposed and carried, as follows:—"That the report of the Gas Committee be approved, and that the correspondence embodied therein be forwarded by the town-clerk to the Lord Chancellor."

BANGOR GAS AND WATER WORKS.—At the meeting of the Bangor Local Board on the 3rd inst., a letter was read from Mr. White, secretary to the water and gas company, stating that the directors had decided that all negotiations for the transfer of the works to the board should cease, as far as they were concerned, as they were unwilling to sell. The clerk was instructed to bring the subject before the next board.

TRANSFER OF THE BLACKBURN GAS-WORKS TO THE CORPORATION.

The following is the report made by Mr. G. W. Stevenson, C.E., to the Parliamentary Committee of the Blackburn Corporation, in reference to the terms of purchase under the Bill which has recently passed through the House of Lords. The corporation have concluded the purchase, giving, however, £3 10s. bonus per share on the C shares, instead of £3, as recommended in Mr. Stevenson's report:—

To the Parliamentary Committee of the Blackburn Corporation.
4, Westminster Chambers, London, S.W.,
April 30, 1877.

Gentlemen,—In pursuance of your instructions I visited Blackburn on the 18th inst., and made a careful examination of the works of the gas company, being attended by a member of your committee and a director of the company, the town-clerk, the manager to the company, and the borough engineer.

Besides the information which I was able to gather from personal inspection, the company furnished me with answers to all inquiries, and I am therefore now in a position to advise you fully on the subject of the contemplated purchase of the undertaking.

When before Parliament with your Bill, the "Working Statement" for the year ending Dec. 31, 1876, had not been published. The details there given throw considerable light on the subject of the company's operations, and help to guide me in the advice I am about to offer.

The two points of most importance in the purchase of a gas undertaking are—firstly, whether the condition of the buildings, plant, and apparatus is such that they can continue to earn the profit at present realized; and, secondly, whether the business is likely to be stationary, or to decline, or to be progressive.

On the first of these two points I can speak positively; for it is rarely that I have been called upon to view works better designed and more substantially erected than those of the Blackburn Gas Company, and never have I seen works in which more ample provision has been made for the future. If there be a fault, it is in this direction; for the surplus retort, condensing, exhausting, and storage capacity of the works will suffice to carry on the business, at its past rate of increase, until 1883. About £50,000 has been thus expended in anticipation of future wants.

Then, as to the second of the two points, it is quite safe to estimate the future of a gas business from the experience of the past, provided always that a sufficiently long period be taken as the basis of calculation; for instance, it would lead to very erroneous conclusions if the increase of the company's business in 1876 were taken as the normal rate of increase, seeing that it amounted to 14·83 per cent. upon that of 1875; or if the business in 1875 were taken as a standard, which was 1·05 per cent. less than in 1874. I have gone back to 1866, when the sale of gas was 147,441,000 feet, and have averaged the rate of increase to 1876, when it amounted to 267,134,000* feet. The increase in the simple ratio averages 8·11 per cent., and in the compound ratio 6½ per cent. By compound ratio we mean, of course, the increase of next year over this year, and so on. During the period mentioned, the increase of one year over the next preceding year was as much as 19½ per cent., while in another year the decrease in consumption was 3½ per cent. Obviously, therefore, it is only by an extended experience that a safe average can be arrived at; but ten years is sufficient, and the probability is that the next ten years will show a higher average rate of increase than the last ten years.

Now let me apply these ascertained facts to the probable future of the undertaking. And in order to show how all the figures are arrived at, and to make the inspection easy and clear, I purpose to place them in a tabulated form—

265,422,000 feet of gas sold in 1876, produced a profit (together with meter-rents, &c.) of £18,216 18s. 6d., or 16·47d. per 1000 feet.

It is scarcely necessary for me to point out to you that, whilst the business increases year by year, the establishment expenses will remain nearly the same, and also that several items of expense which a company properly incur will not appear in the accounts if the undertaking should pass into the hands of the corporation. I would also draw attention here to the very large sum expended in 1876, for "Repair and Maintenance of Works," amounting to £5572, or 5d. per 1000 feet on all the gas sold. No doubt this expenditure was rendered necessary by the transition state of the company's works, but now that the new works are in operation, the debit under this head ought not to exceed 3d. to 3½d. per 1000 feet, and I feel sure the able manager of the company's works will endorse this statement.

But I do not purpose to take into account these items of reduced expenditure in the future, which will go to swell the profit of the 16·47d. obtained last year by the sale of each 1000 feet of gas and other things. Contenting myself with simply directing your attention to them, I proceed to state the figures, which are as follows:—

Year.	Sale of Gas. Feet.	Profit per 1000 Feet.	Aggregate Profit.
1876.	265,422,000	16·47d.	£18,216 18 6
Add 6½ per cent.	16,810,000	"	1,153 11 8
1877.	282,232,000	"	£19,370 10 2
Add 6½ per cent.	17,975,000	"	1,226 13 4
1878.	300,107,000	"	£20,597 3 6
Add 6½ per cent.	19,007,000	"	1,304 7 1
1879.	319,114,000	"	£21,901 10 7
Add 6½ per cent.	20,210,000	"	1,386 18 2
1880.	339,324,000	"	£23,288 8 9
Add 6½ per cent.	21,492,000	"	1,474 18 6
1881.	360,816,000	"	£24,763 7 3
Add 6½ per cent.	22,854,000	"	1,568 6 11
1882.	383,670,000	"	£26,331 14 2
Add 6½ per cent.	24,301,000	"	1,667 13 4
1883.	407,971,000	"	£27,999 7 6
Add 6½ per cent.	25,838,000	"	1,773 5 11
1884.	433,809,000	"	£29,772 13 5

These probably increasing profits are about as reliable as anything not previously ascertained and proved can be, and they enable me to advise

* 265,422,000 feet is the quantity appearing in the accounts as actually paid for, which does not, however, include the gas used in the works and offices of the company. The return of 147,441,000 feet in 1866, and 267,134,000 feet in 1876, is furnished to me by the company, and, I presume, is based upon the same relative data.

you upon the sum which you, as prudent men of business, may give for this valuable monopoly.

I believe you have agreed with the company on certain points—namely, to pay perpetual annuities equal to the statutory dividends on the subscribed capital, which will be £19,812 9s.; then to take upon yourselves the mortgage debt of the company, which requires an annual payment of £882; and, further, to pay a bonus of £2 per share on the A and B shares, the only unsettled point being as to the amount of bonus on the C shares, some of which are yet unissued, and upon the remainder of which only one-half has been called up.

No doubt the proprietors are entitled to full compensation for relinquishing the right to invest their money at 7 per cent., and I think they would not be more than fully compensated if, as you have agreed to £2 bonus in regard to the other two classes of shares, you were to give £3 bonus upon the C shares.

If you can agree with the company on these terms, my advice is that you should do so.

Your obligations would then, for the first five years, stand thus—

Annuities	£19,812 9 0
Interest on mortgages	882 0 0
Interest on bonus	2,817 2 5

Total £23,511 11 5

At the end of five years from the vesting period, which I will assume to be retrospective from Jan. 1, 1877, a further sum of £5886 1s. 10d. will have to be set aside annually as a sinking-fund to redeem the capital value of the annuities, mortgage debt, and bonus, at 25 years purchase; and this, added to the sum of £23,511 11s. 5d. previously stated, would make the obligations of the corporation amount to £29,377 13s. 3d. annually.

Now let us refer to the prospective annual profits of the undertaking, and see how these obligations can be met, and for this purpose I will repeat the statement of profits, and show alongside, year by year, the deficit or surplus.

Year.	Probable Profit.	Deficit.	Surplus.	Required Increase of Price per 1000 Feet.
1877.	£19,370 10 2	£4,141 1 3	.....	3½d.
1878.	20,597 3 6	2,914 7 11	.....	2½d.
1879.	21,901 10 7	1,610 0 10	.....	1½d.
1880.	23,288 8 9	223 2 8	.....	.....
1881.	24,763 7 3	.....	£1,251 15 10	.....
1882.	26,331 14 2	3,045 19 1	After allowing for surplus in 1881.	1½d.
1883.	27,999 7 6	1,378 5 9	.....	1d.
1884.	29,772 13 5	.....	395 0 2	.....
		£13,312 17 6	£1,646 16 0	
		1,646 16 0		
Total deficit.		£11,666 1 6		

It thus appears that by a temporary increase of 3½d. per 1000 feet in the price of gas this year, reducing gradually to 1d. per 1000 feet spread over five years only, your obligations in respect to the purchase on the terms mentioned will be fully met. I do not forget that the price of gas cannot now be increased for the first half of this year, but there are other ways of meeting the deficit for that period, which will, of course, suggest themselves to you.

Within three years after 1884, if the undertaking passes to the corporation, the deficit will be recouped; and, in each year afterwards, gradually increasing profits will be available for all the purposes to which they are usually applied when a gas undertaking is under the control of corporate authorities.

If I have failed to make myself understood in any particular, or if further information be desired which it is in my power to furnish, I shall be happy to add to this brief report, and I am, gentlemen, your faithful and obedient servant,

GEORGE WILSON STEVENSON, C.E., F.G.S.

HALIFAX CORPORATION GAS SUPPLY.

At the Meeting of the Halifax Town Council, on the 2nd inst.,—the Mayor (Alderman Whitley) presiding,

A report was presented from the Gas Committee which showed that the quantity of gas made during the past quarter was 90,591,000 cubic feet; for the corresponding quarter last year it was 92,776,000 cubic feet; decrease last quarter 2,185,000 cubic feet. The quantity of coal used last quarter was 1906 tons, compared with 2269 tons last year; decrease 363 tons. The quantity of coal used was 6967 tons, as compared with 6631 tons in similar quarter of 1876; increase 336 tons. Total coal and cannel used last quarter 8873 tons, as compared with 8900 in similar quarter last year; decrease 27 tons. Wages last quarter were £2125 8s. 6d., as against £2155 16s. 6d.; decrease, £30 8s. The illuminating power last quarter was 17·95, as against 17·71 corresponding quarter last year, average increase 0·24 sperm candles. The committee reported that they had sold the surplus tar on much more favourable terms than in any previous year, and in pursuance of a recommendation made by them at the last quarterly meeting, and resolutions passed thereon, they have instructed their engineer, along with the borough engineer, to prepare plans for carrying out the extension of the works. Some of the plans are already in a forward condition, the particulars of which will shortly be laid before the council.

Mr. BAIRSTOW called attention to the question of gas profits. He said that in 1874-5-6, no less a sum than £20,720 had been made as profit from the sale of gas. When the estimates were produced in 1873, it was shown that to keep the price at 3s. 8d. per 1000 feet, there would be a loss of £1280, and through the wisdom of the council the price was advanced to 4s. In spite of those estimates, they seemed to have made a profit of about £5459. When it was considered that the rates were 4s. 5d. in 1874, 5s. 6d. in 1875, and 5s. 2d. in 1876, and these large amounts had been appropriated in aid of rates, it appeared that the gas consumers had really had to pay 5s., about 6s. 1d., and 5s. 11d., as against 5s. for those who did not consume the article or who made their own. He asked whether the Gas Committee had considered that the time had arrived when a reduction in price should take place? He found a considerable reduction had taken place in other towns during the last twelve months, in Leeds from 3s. 9d. to 3s. 3d., in Bradford to 3s., with considerable discounts to large consumers—some of them getting it at about 2s. 8½d., and in Huddersfield at 3s. Since there was such an inequality between the direct and indirect ratepayer, he thought the time had arrived for a more equitable system being carried out. A profit of something like 6d. per 1000 feet was too much to expect on a large wholesale concern like the gas-works.

Mr. SCARBOROUGH said he had the figures before him making out the profits to be only £11,404 8s. 6½d., which had been taken from the gas in reduction of the rates. Mr. Bairstow did not tell how much had been

taken from the rates for Lister's fire—a very serious matter, far more than had been taken from the gas profits, the average of which for the past three years was 4½d. in the pound. Taking 1d. in the pound as producing £900, the amount from the rates towards Lister's fire had been 6d. in the pound, therefore the ratepayers had had to pay 1½d. towards the gas-works. It must be remembered that for some years to come there would be a very large outlay at the gas-works, on which interest would have to be paid, and there would be no return. Until they saw what the return would be, they ought to be very careful in lowering the price of gas.

Mr. BAIRSTOW said Mr. Scarborough was quite right in saying the net profit was £11,404, but there was also depreciation, £1362; sinking-fund corrections, £1952 17s. 9d.; and the renewal account of £6000; and he contended the actual amount of profit in three years was £20,720.

Alderman MIDGLEY said he could not understand why Mr. Bairstow brought forward his question now, seeing that this was the first quarterly meeting after the estimates for the year had commenced. He took it that both sets of figures were correct, the difference depending on the items included. He asked Mr. Bairstow if he had objected, when the estimates were under consideration, to the items he considered profits, or whether he had told the council which way he thought they should have been appropriated? He thought that ought to have been done at the time, or that Mr. Bairstow ought to wait until the estimates for another year were submitted. As near as his memory served, the net profits over the years referred to were about 4d. per 1000 cubic feet, and he thought that was a margin as narrow as was compatible with prudence. He ventured to say the council would rather see at the end of the year that there had been a profit higher than the estimate than less. The committee did take into consideration the price at which gas could be produced, and they reduced the price from 4s. to 3s. 8d. This year they considered it again, and reduced it to 3s. 4½d. They had not only considered the question, but had reduced the price. If the estimates for this year were realized, he should be thankful. They would find from the quarterly report that instead of the annual increase of about one million cubic feet per month, there was actually a decrease on the first quarter of this year of rather over two million cubic feet. That he found to have resulted almost entirely through trade not being brisk. Six of the largest consumers had burned 700,000 cubic feet less than in the corresponding quarter of last year. Taking all the circumstances into consideration, he thought the committee had gone as far as circumstances would warrant them in doing. The committee would be most happy to have the price as equitable in the direction Mr. Bairstow advocated as he could desire.

Mr. BAIRSTOW said it seemed from this statement, and the report by Mr. Hawksley, there was no need necessity for making further extensions likely to cost £40,000. He asked, seeing the demand had decreased, whether there was really a necessity to go to this large expenditure?

Alderman MIDGLEY replied that the increase in the last three months of 1876 was quite up to the average; and though there was a decrease in the last three months, they hoped that trade would not be permanently depressed. He did not think the committee would be justified in waiting until good trade came before they made the extensions. Last winter they had sometimes to put themselves very considerably about to keep the town from being in darkness.

The report of the committee was approved.

SHEFFIELD WATER-WORKS.

FAILURE OF THE NEGOTIATIONS FOR TRANSFER TO THE CORPORATION.

At the Meeting of the Sheffield Town Council on Wednesday last, the Water Committee brought up the following report:—

Your committee beg to report that, having been appointed to endeavour to negotiate with the directors of the Sheffield Water-Works Company for the purchase of their works and undertaking, the chairman (Mr. Councillor Mappin) placed himself in communication with the law-clerk to the company, and reported the result of an interview with him on the 6th inst. on the subject, and that he had since received from the law-clerk a letter, of which the following is a copy:—

"11, George Street, Sheffield, April 10, 1877.

"Dear Sir,—I brought your conversation with me before the directors of the water-works company, at their meeting yesterday, and I am desired to say that the directors are not aware of any circumstances now existing which make it desirable, either with reference to the benefit of the public or the advantage of the shareholders in the company, that the company's undertaking should be transferred to the corporation, and consequently the directors do not perceive any utility in the commencement of a negotiation with the committee represented by yourself.—Yours very truly,
"R. BLAKELOCK SMITH."
"To F. T. Mappin, Esq., Thornbury, Sheffield."

Your committee therefore beg to express their opinion that, for the present, it is not desirable that any further attempt should be made to negotiate with the Sheffield Water-Works Company for the purchase of their works and undertaking, and recommend the council to dissolve this committee.

Mr. MAPPIN, in moving that the report of the Water Committee on the proposed purchase of the works and undertakings of the water company be adopted and entered on the minutes, said: When I brought this matter before the council, and they were pleased to grant a committee to see if some negotiations could not be effected with the water company, I had hopes that we might have arrived at some conclusion. I felt certain that it would be an advantage to this town to possess the water-works. I felt pretty confident that it was for the interest of the shareholders to negotiate in a friendly manner with this council, and the condition of things on that occasion was such that I was warranted in having those hopes. A change took place in the directorate of the company; parties were elected on the board who appeared hostile to any purchase or intended negotiations that your committee might offer them. After calling upon the law-clerk, with whom I discussed matters for some time, we arrived at the conclusion that it was useless to proceed further in the matter; and to further settle the matter he sent me the letter which is published in the minutes of this committee. I am quite sure that this council have cause to regret the result of the short negotiations that were attempted, but I do think when we consider the large number of ladies who are shareholders in the company, and who are suffering at this time a loss of income from the money invested in the open stock, it does appear to me that the directors of the company and their adviser have not arrived at a sensible conclusion, but that they prefer to leave these ladies with limited incomes to suffer, as they are doing at the present time. I do not wish to say anything further on the matter, but I must express my regret that the negotiations have so failed.

The minutes and report of the committee were then adopted.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

The Fifth Yearly Meeting of this Association was held in the Council Chambers, Linlithgow, on Thursday, April 26—Mr. LEVI MONK (Lanark), President of the Association, in the chair.

Mr. JAMES M'GILCHRIST (secretary) read the minutes of last meeting, and of several committee meetings which had been held during the past six months, and these, on the motion of Mr. MITCHELL (Coatbridge), seconded by Mr. SCOTT (Musselburgh), were unanimously adopted.

The SECRETARY then read the report of the auditors, which the meeting unanimously approved.

ADMISSION OF MEMBERS.

The SECRETARY next moved that the following gentlemen be admitted ordinary members of the Association:—Messrs. Matthew Hamilton, May-

bole; Wm. M. Cheyne, Aberavon; David Mackay, Cupar Angus; J. R. Ambrose, Bo'ness; Joseph Fairley, Clydebank; Robert Tervet, Clippens; James Mackinlay, Auchinleck; Robert Nicoll, Lochgilphead; Wm. Tweedley, Greenock; John Reid, St. Margaret's, Edinburgh; and Alex. Bell, Gibraltar.

Mr. KIRKLAND (New Cumnock) seconded the motion, which was unanimously agreed to.

On the motion of Mr. LAWRENCE HISLOP, seconded by Mr. JEFFREY (Kirkintilloch), the following gentlemen were elected extraordinary members:—Messrs. Henry Aitken, Falkirk; John Robson, Glasgow; George M'Kenzie, Glasgow; and John Wilson, Pollokshields.

PRESIDENT'S VALEDICTORY ADDRESS.

The PRESIDENT then delivered a valedictory address. In his opening remarks he alluded to the operations of the benevolent-fund, the increase in the number of members of the Association, and the changes of location by members during the past year. He then referred to the recommendation made to the British Association for the Advancement of Science to form a "Special Gas Section," stating that it did not originate in a desire to break up or in any way interfere with the various associations of gas managers, but to enlist the co-operation of gentlemen having time, ability, energy, and wealth at their disposal, in the study of existing arrangements for the manufacture, distribution, and consumption of gas, with a view to suggest and recommend improvements which might with confidence be adopted by gas managers, and worked out in a practical form. He mentioned that a report would presently be brought up by a sub-committee, embodying the result of their investigation of Messrs. Aitken and Young's process, which had been for twelve months in operation at the Hamilton works, and he expressed his own opinion that that process secured the perfection of condensation of illuminating gas, with the addition of a good scrubber or washer. He had no doubt that other modes could be provided than the employment of steam for keeping up the temperature, where steam was not available, so that, in small works especially, the process could be used with much advantage. Having mentioned the titles of the papers which would be submitted for discussion, the President alluded to the "claptrap" on the subject of gas supply, which was to be found from time to time in the newspapers, remarking that it would be very amusing if it were not for the discontent it cherished in the public mind, and the annoyance it caused to gas managers. The extended use of gas for cooking and heating purposes seemed to him to be a good reason for endeavouring to adopt as a general standard 20-candle gas, and he was not prepared to agree with the writer of a long and ably-written article in the *Dundee Advertiser*, who advocated a reduction to 16 candles. He believed that, with a condenser such as would be reported on by the committee, there would be no difficulty in maintaining a 20-candle standard for an unlimited period. Even supposing all first-class coal to be exhausted, there was, as he was credibly informed, an abundant supply of splint and caking gas coals, inferior cannel, and rich shales in Scotland (if only such a price could be obtained as would pay to work them) sufficient to maintain a standard of 20-candle gas for centuries to come. Such being the case, the Scottish people should not accept a lower standard. For many reasons known to most of the members present, it was very evident that burners suitable for lighting, cooking, and heating with 20-candle gas were not suitable, either for 14 to 16-candle gas on the one hand, or 24 to 32-candle gas on the other, and it was equally certain that manufacturers had much difficulty in providing proper means of combustion for such varied qualities. The President then referred to the recent exhibition of gas apparatus at South Shields, expressing his regret at not having been able to accept an invitation to be present on that occasion. In the name of the Association, he thanked Mr. Warner for sending to this meeting a specimen of his market gas stand-pipe for inspection, and on their behalf also he wished every success to their youngest born brother, "The North of England Gas Managers Association." The President then briefly passed in review many of the subjects which have, during the past year, been brought forward in the columns of the JOURNAL OF GAS LIGHTING. He alluded to the working of the Burghs (Scotland) Gas Act, and the introduction of auction clauses, by Standing Order, into Gas Bills, and, in conclusion, referred to the arrangements made for the entertainment of the members in connexion with this meeting.

ELECTION OF OFFICE-BEARERS.

Mr. FAIRWEATHER (Barthead) next moved that the following gentlemen be elected office-bearers for the ensuing year:—

President—Mr. James M'Gilchrist, Dumbarton.

Vice-President—Mr. Duncan Jeffrey, Kirkintilloch.

Treasurer—Mr. W. Smith, Helensburgh.

Secretary—Mr. R. S. Carlow, Port Glasgow.

Auditors—Mr. John Walker, Ayr, and Mr. Lawrence Hislop, Uddingston.

Committee—Mr. Learmont, Milngavie; Mr. Young, Clippens; Mr. Renfrew, Langbank; Mr. Dunlop, Hamilton; Mr. George Niven, Airdrie; Mr. Mitchell, Coatbridge; Mr. Monk, Lanark; and Mr. Fairweather, Barthead.

Mr. NELSON seconded the motion, which was unanimously approved of.

Mr. M'GILCHRIST returned thanks for the high honour which the Association had conferred on him in thus electing him president. However much he felt his inability to tread in the footsteps of the gentlemen who had preceded him in the chair, he would yet do his utmost to forward the aims and interests of the Association.

Mr. FAIRWEATHER afterwards moved a vote of thanks to Mr. Levi Monk, who had, during the past year, so faithfully discharged the duties of president. If Mr. M'Gilchrist performed those duties as efficiently as Mr. Monk had done, the Association could not be otherwise than satisfied.

The motion was unanimously agreed to.

Mr. MONK returned thanks, and observed that if the president elect got through his duties as efficiently as he had got through those pertaining to his office of secretary, the Association would have no reason to complain.

THE AITKEN AND YOUNG PROCESS.

Mr. M'GILCHRIST then read the report of the sub-committee on Aitken and Young's patent, as follows:—

At a meeting of the committee, held at Glasgow on the 7th day of August, 1876, a sub-committee was appointed, consisting of the following gentlemen:—Mr. Wm. Smith, Helensburgh; Mr. Jas. M'Gilchrist, Dumbarton; Mr. R. S. Carlow, Port-Glasgow; and Mr. L. Monk, Lanark (convener), to investigate into the practical working of the Aitken and Young patent condensing process at Hamilton Gas-Works. It was also suggested that the sub-committee should endeavour to secure the practical and scientific assistance of their honorary member, Mr. Stewart, of Greenock. On application being made to that gentleman, he at once kindly agreed, if his spare time should admit, to give them all the assistance in his power.

A preliminary meeting of the sub-committee was held at Dumbarton, on the 29th day of August, 1876, at which Mr. Stewart was also present, when it was considered expedient that, before entering upon the regular trials, it would be advisable to visit the Hamilton works, and make themselves conversant with the whole arrangement, and also make such alterations and additions as would be necessary to have the trials made in the manner desired by them. In accordance with this resolution, the sub-

committee, along with Mr. Stewart, visited the Hamilton works on the 5th day of September, 1876, and made a preliminary inspection of the whole arrangement, which consisted of the following plant:—The retorts are of fire-clay of the ordinary D-shape, 26 inches by 15 inches by 7 feet 8 inches long, set three in an oven, the whole bench consisting of 27 retorts, 12 of which were in use at the date of the visit. The hydraulic main is D-shaped, 18 inches by 18 inches, placed on pillars alongside of the front wall. The stand-pipes are carried overhead to the hydraulic, and some of the stand-pipes (*i.e.*, from top of ascension-pipe to hydraulic) were covered with some non-conducting composition. The outlet from hydraulic main, 10 inches diameter, passes across the retort-house, 30 feet, and along the wall of purifying-house, 40 feet, to condensers, which are of the ordinary vertical pipe description, the pipes 12 inches diameter, and placed at the back of the retort-house, as is also the new analyzing condensing arrangement. This arrangement is similar in construction to the model shown at our Glasgow and Greenock meetings, and which is here again for the inspection of those members who had not the opportunity of seeing it before. The pipes leading from the hydraulic, and into the condensers and scrubber, are connected by branch pipes in such a manner that, by means of slide-valves, either the analyzing condensing or the ordinary condensing apparatus may be thrown into use. At the desire of the sub-committee this was done to show the working, when they were much surprised with the difference in the character of the gases condensed by the two processes. When the ordinary process was thrown into action, the gases, as they issued from a $\frac{3}{4}$ -inch stopcock placed on the inlet to the scrubber, had a brown, smoky appearance, and when allowed to blow on a piece of paper, gave a black, tarry stain. On the other hand, when the analyzing condensing arrangement was thrown into action, the issuing gases were comparatively colourless, and gave only a slight brown stain to paper, which rapidly dried up on exposure to the air.

As already stated, the gases pass from either of the condensing arrangements to the ordinary square perforated plate scrubber, and when the analyzing condensing arrangement is in use, the mixed tars and weak liquors are run from the bottom of the analyzer into the cooling-tank, where they are cooled and separated, the weak liquor being pumped into the scrubber, and the tars run off to the tar-well. From the scrubber the

gases pass to the exhauster, which is of the kind known as "Anderson's;" thence to four purifiers, lime being the sole purifying agent employed. The station-meter is very small for the quantity of gas it has to register, but the sub-committee considered that, as the tests were to be *comparative*, and the measure of the gas made with the same instrument, any error made would affect both processes alike. The gasholders are three in number, the one nearest the testing-station having a capacity of 36,000 cubic feet. From the manner in which it was connected with the mains leading to the town and inlet-main from works, it was selected by the sub-committee as the one best suited to be connected to the testing apparatus in the laboratory to be employed during the trials. At the request of the sub-committee, a $\frac{3}{4}$ -inch pipe was carried from the inlet of the gasholder into the testing-room, that experiments might be made with the gas just as it was newly made, and also after having been stored for some time; and, further, to test the gas after being passed through a long length of main underground, a testing-station was prepared about 2000 yards from the works. The testing apparatus at both stations were as far as possible duplicates of each other, and the same candles and burner were used at both stations.

The nature of the processes to be tested necessitated that the same gas-producing material should be used for a considerable time, and, as the season was far advanced, and the consumption great, and also as the capacity of the works was not sufficient to make and store two qualities of gas, it was seen by the sub-committee to be impossible to use a coal giving any other than a gas somewhat near what the consumers had been receiving. They, therefore, decided just to employ the usual materials used in the works for the trials. This was a mixture of Camp parrot and Westwood shale.

After having made these preliminary arrangements, the sub-committee again met at Hamilton Gas-Works on the 20th of October, 1876; Mr. Monk having visited and remained over from the previous day, to see that the same descriptions of coal and shale were used, and that the analyzer should contain only tars and naphthas resulting from such proportions of shale and coal as were to be used in the trials. After a careful testing, with 36 hours working of each process, the following average results were obtained:—

TABLE No. 1.

Average Results of Preliminary Experimental Tests made for 36 hours, to test the Aitken and Young Analyzing Condensing Process at the Hamilton Corporation Gas-Works, by a Sub-Committee of the West of Scotland Association of Gas Managers. Table corrected for Temperature to 60° Fahr., and for Barometrical Pressure to 30 inches.

Test No. 1.	No. of Retorts working.	Camp Parrot Coal used. Cwt.	West-wood Shale used. Cwt.	Total Cwt.	Index of Meter.		Gas Made. Feet.	Gas per Ton of Mixture.	Durability of 5-in. Flame.		Condensation by Bromine.	Illuminating Power. Stand. Candle.	Specific Gravity of Ammoniacal Liquor.		Specific Gravity of Tars (Water, 1000.)	Pr. Centage of Naphtha when Tars distilled to a Temperature of 320° Fahr.	Pounds of Sperm per Ton.	
					Com-mencing.	Ending.			Min.	Sec.			From Analyzer or Con-denser.	From Scrubber.				
Analyzing Process— Oct. 20, 1876, 3 p.m., to Oct. 22, 3 a.m. . . .	15	269½	40½	310	5,995,750	6,127,250	131,500	8483	59	00	9·50	28·26	Twad. 1·5	Twad. 6·0	1158	Traces.	821·64	
Ordinary Process— Oct. 22, 1876, 3 a.m., to Oct. 23, 3 p.m. . . .	15	289	44	333	6,127,250	6,267,000	139,750	8393	52	00	8·50	21·96	3·0	4·0	1146	2·00	631·92	
Difference for or against analyzing process .									+90	+7	00	+1·00	+6·30	—1·5	+2·0	+12	—2·00	+189·72

The temperature of the tars in the hydraulic ranged during the experiments from 180° to 190° Fahr., and the temperature of the tars as they issued from the analyzer ranged from 220° to 230° Fahr.

The results obtained from testing the gas as it was newly manufactured, after it had stood for twelve hours in the gasholder, and after it had travelled to the distant testing-station, were substantially the same by both methods of manufacture (*i.e.*, for permanency of hydrocarbons), no material deterioration of the illuminating power having taken place in either gas.

As indicated by the above table, samples of the tars from either process showed, on being carefully distilled, that the analyzer tar contained about 2 per cent. less naphtha than the ordinary tar. The ammoniacal liquor, as it flowed from the analyzer, had a specific gravity of only 1½ Twaddel, and had a very feeble smell of ammonia, but, after it was cooled and passed through the scrubber, it acquired a specific gravity of 6° Twaddel. The ammoniacal liquor, as it flowed from the ordinary condensers, had a specific gravity of 3° Twaddel; that from the scrubber, 4° Twaddel. By the ordinary process, water was in part used in the scrubber.

An examination of the gases, as they entered the purifiers, showed that the gases from the analyzer process were almost perfectly denuded of suspended tarry matter—indeed, they were almost colourless—whereas, the gases condensed by the ordinary method had a slight smoky appearance, and contained a considerable quantity of suspended tarry matter.

The quantities of gaseous impurities, sulphuretted hydrogen, and carbonic acid, as ascertained (comparatively) from a number of experiments, by using a "Cooper's tube," and employing acetate of lead and caustic potash as absorbents, showed a decided advantage in favour of the analyzer process. We believe this to result from the more perfect action of the cooled water from the analyzer absorbing the ammonia in combina-

tion with the gaseous impurities, or as the salts, carbonate, and hydro-sulphate of ammonia. The time over which the experiments extended was far too short to make any practical test as to the relative quantity of lime used to purify the gases resulting from the different methods of condensation; but, looking to the freeness of the analyzed gas from suspended tarry matters, and the comparatively smaller quantity of gaseous impurities, the sub-committee are of opinion that there will be a very considerable saving in the lime employed for purification.

So soon as these experiments had been corrected and drawn up in the form of an interim report, they were placed before the committee at a meeting held in Glasgow. It was proposed to have those reports published for the benefit of the Association; but Mr. Young, who was present, asked as a favour that the committee would defer publishing their report until it had either been verified or disproved, because he considered the results considerably too high, and much better than he had ever got whilst experimenting with the process on a comparatively small scale. This the committee at once granted, seeing that their sub-committee proposed making experiments for permanency of hydrocarbons during the winter, and a final trial similar to the one just made, early in the spring, in order to have the report drawn up for this meeting. The limited time at the disposal of the sub-committee prevented them from making the proposed experiments during the cold weather in winter; but they again met at Hamilton on the 12th of March, when fortunately there was a severe frost, snow, and wintry weather as at any time during the winter.

The sub-committee commenced by making a trial extending over 42 hours, with a mixture of eight of Camp parrot coal and one of Westwood shale, that being the mixture which had been employed for some days prior to the visit of the sub-committee. The following table gives the average result of the testings:—

TABLE No. 2.

Average Results of Final Experiments made to test the Aitken and Young Analyzing Condensing Process at the Hamilton Corporation Gas-Works, by a Sub-Committee of the West of Scotland Association of Gas Managers. Table corrected for Temperature to 60° Fahr., and for Barometrical Pressure to 30 inches.

Tests.	No. of Retorts working.	Camp Parrot Coal used. Cwt.	West-wood Shale used. Cwt.	Total Cwts.	Index of Meter.		Gas Made. Feet.	Gas per Ton of Mix-ture.	Durability of 5-in. Flame.		Conden-sation by Bro-mine.	Illumi-nating Power. Stand. Candle.	Specific Gravity of Ammoniacal Liquor.		Specific Gravity of Tars. (Water, 1000°.)	Pr. Centage of Naphtha when Tars distilled to a Tempe-rature of 320° Fahr.	Pounds of Sperm per Ton	
					Com-mencing.	Ending.			Min.	Sec.			From Analyzer or Con-denser.	From Scrubber.				
No. 2 Test (42 hours). Analyzing Process— March 12, 1877, 12 p.m., to March 14, 6 p.m.	15	286	36	322	862,910	1,003,500	140,590	8732	53	22	9·13	26·47	..	..	..	..	..
No. 3 Test (48 hours). Analyzing Process— March 14, 1877, 6 p.m., to March 16, 6 p.m.	15	288	72	360	995,500	1,151,900	156,400	8688	53	24	9·50	27·54	Twad. 2·5	Twad. 5·5	1162	0·50	820·85	
Ordinary Process— March 19, 1877, 6 p.m., to March 21, 6 p.m.	15	288	72	360	1,372,300	1,530,300	158,000	8777	49	02	8·80	23·30	3·0	4·5	1154	2·62	701·15	
Difference for or against analyzing process .									— 89	+ 4	22	+ ·70	+ 4·24	— ·5	+ 1·0	+ 8	— 2·12	+ 119·20

As in October last, during the time the trials were being made with the ordinary process, numerous complaints were made by the consumers throughout the town about the low illuminating power, it was suggested by Mr. M'Gilchrist, and agreed to by Mr. Dunlop and the sub-committee, to use a rich mixture of gas-making materials, so that the consumers could not have such cause of complaint; and it was decided to use a mixture of one part of Westwood shale to four of Camp parrot coal.

The final trial of the analyzer condensing process commenced on Wednesday, March 14, at 6 p.m., and continued till March 16, at 6 p.m. The analyzing process was continued in use over the Saturday, but it was thrown out of use on the Sabbath, and the ordinary condenser brought into action. The sub-committee again met on Monday, and commenced a trial by the ordinary process at 6 p.m., and continued for 48 hours, till 6 p.m. on Wednesday evening.

During the final trials, the results of which are recorded in the above table, much higher heats were employed than in the first trials, and smaller charges put into retorts. This, as shown by the table, has resulted in a considerably increased yield of gas, and by the ordinary process a slight increased gross sperm value over the previous experiment, but as the high heats would leave a smaller quantity of naphthas undecomposed, the analyzing condensing process, although giving a very substantial increase in the gross sperm value, does not show an increase in proportion to the shale used. This proves that beyond a certain temperature it becomes unprofitable to carbonize coal for a high illuminating power, and that in order to carbonize coal economically it is essential to employ such a temperature as shall produce the proper proportion of gases and volatile hydrocarbons to carburet those gases. Another cause for the low illuminating power of the gas being produced at this time was the comparatively lower atmospheric temperature (from 15° to 20° Fahr.) compared with that when the previous experiments were made. Or it may be that as during the first trials the 15 retorts employed were all placed together, and at the end nearest to the outlet from the hydraulic to the condenser, and the temperature of the gas kept up to 180° or 190° Fahr. in the hydraulic and 220° to 230° Fahr. in the analyzer, and during the final experiments the retorts worked were at each end of the hydraulic, and consequently, the whole length of the hydraulic was cooling the gases produced from the retorts at the end farthest from the outlet, the consequence being that the gases in the hydraulic were only 160° to 170° Fahr., and the gases and tars in the analyzer 214° to 224° Fahr., this lowness in the temperature is the most probable cause, as in the latter experiments 0.5 per cent. of naphtha was left in the analyzer tar, whereas in the former experiments there were only traces of naphtha left.

As in the case of purification, the time over which the trials extended was too limited to ascertain the exact quantities of tars produced to each process, as the trays of the analyzer are always left full, but it may be approximately stated at about 18 gallons of tar per ton of the mixture of coal and shale employed; and as all that the analyzer does to the tar is simply to separate the naphthas and diffuse them through the gas, the analyzed tars will amount to the 18 gallons, *minus* the naphthas diffused through the gas. This, as shown by the table, amounts to respectively 2 and 2.12 per cent., or equal to about one-third of a gallon per ton of the gas material employed. This would indicate that about 2½ grains weight of naphthas were diffused through each foot of gas made by the analyzing process, and that a little over one-third of a gallon of naphtha diffused through the gas from a ton of mixture gave an increase of sperm equal, in the first trial, to 189.72 lbs., and in the latter trial to 119.20 lbs. respectively, per ton of mixture distilled.

In concluding this report, the sub-committee would add that it is obvious that the net gain of working this process will be affected by many circumstances which can easily be worked out by practical minds. The chief recommendation in working this patent process evidently is the fact that an expensive first-class coal in large quantities is not required to produce a gas of high illuminating power; and, further, that the only expense or trouble connected therewith is the providing of steam to keep up the temperature in the analyzer. The sub-committee desire to tender their very best thanks to Mr. Dunlop for the very courteous and hospitable manner in which he entertained them while the experiments were being made in Hamilton, and for the promptitude with which he acceded to their requests in every way; and they desire to add that it reflects the greatest credit upon his committee and himself in acknowledging the value of the patent, and in getting apparatus erected so soon after it was brought under the notice of the Association.

(Signed)

WILLIAM SMITH, Helensburgh.
JAS. M'GILCHRIST, Dumbarton.
S. STEWART, Greenock.
ROBT. S. CARLOW, Port Glasgow.
L. MONK (Convener), Lanark.

The discussion which followed the reading of the above report will be given in next JOURNAL.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been a very quiet feeling in the local iron trade during the week, owing to the war panic and the general depression of all branches of manufacturing industry. In respect of ordinary brands of pig iron, the number and size of current transactions are not large, few consumers being willing to overstock themselves with this class of raw materials, whilst the demand for merchant and other finished iron holds so slack. In the Leeds district the well-known Airedale Hematite Iron Company have arrived at the determination to blow out both their blast furnaces, owing to the accumulation of stock and the comparatively small demand. At other works in the same district large numbers of men are being discharged from similar causes.

There has been very little alteration in the general condition of things at the principal foundries in South Yorkshire and North Derbyshire, most of those which are attached to concerns having their own blast furnaces, collieries, and ore deposits, being still fairly well engaged. At the Thorncliffe, Staveley, Claycross, and Butterley establishments the production of the foundry shops is to a great extent gas and water pipes, together with tubing for colliery shafts. The Sheffield Water Company, amongst others, are taking large lots of mains, and are, I hear, not unlikely to be good customers for a long time henceforward, in furtherance of their extensive relaying and extension schemes in the town.

There is just now rather more business doing at some of the collieries, both as regards gas and steam coal. Several of the Midland, Lancashire, Derbyshire, and Yorkshire Gas Companies are at present either renewing or making fresh contracts—most of which are in favour of buyers.

The steam coal demand has revived somewhat since the opening of the Baltic, but it is not yet up to a good average in any respect.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Inquiries for gas coal continue to be made in this district, but, as yet, they are in most cases put forward more with the view of feeling the market than for any actual business, at present, and I have not heard of any quota-

tions being out, upon which to form any reliable judgment as to the future. The nominal prices are much the same as they have been for many months past, averaging about 8s. to 9s. per ton for screened gas coal at the pit, but consumers are apparently looking forward to placing their contracts on favourable terms. A somewhat disturbing element has, however, been introduced by the threatened strike in West Lancashire, and, should it be of a protracted character, colliery proprietors, although some of the large firms have considerable stocks on hand, would not be too keen in entering into forward engagements. In one or two districts the masters are holding back from the struggle, and in a few cases where notices have been given it is doubtful whether they will go the length of closing their pits, but the colliery proprietors generally seem determined to enforce the reduction. In the general classes of coal there is no material change to notice. For house pit classes of coal the season is now closing, and no serious inconvenience will be experienced in this direction by the strike; whilst with regard to common coal, supplies are so abundant in other districts that consumers will have no difficulty in covering their requirements. Slack, however, is scarce, and burgy of the better class is not plentiful, so that an upward movement in the price of these will not be improbable. So far as the average pit quotations are concerned, there is no material change to notice upon those last given.

If the miners persist in their arbitrary attempts to regulate the hours of work, such as the adoption of the eight hours movement, which it was decided to put in force after the 1st of May, the masters will in all probability close the pits at noon, thus running them only six hours, and pay the top men for half a day.

The iron trade of this district has again relapsed into a depressed condition, and prices have lost the little extra firmness which they exhibited a week ago; they, however, are not materially lower, as makers are not in a position to take less money, and local producers, although they are almost altogether out of the market, are still quoting, for delivery into the Manchester district, 56s. to 57s. per ton for No. 3 foundry, and 54s. to 55s. for No. 4 forge, less 2½ per cent. Finished iron makers are very short of work, and prices continue low; bars delivered here being quoted at from £6 12s. 6d. to £6 15s. for Middlesbrough, and £6 15s. to £6 17s. 6d. for Staffordshire qualities.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The shipments of coals continue upon a large scale; 64,000 chaldrons have been shipped from the Tyne Dock alone within the past fortnight. The demand for best gas coals does not show any material falling off; the price is about 8s. 6d. per ton. Second-class gas coals continue in fair average demand at from 6s. 6s. to 7s. 6d. per ton. House coals are selling at 11s. per ton. Affairs are in a very disturbed condition in the Northumberland coal-field. Notices were last week served upon the men employed in all the collieries, of the termination of their engagements at the end of a fortnight. This looks very like a lock-out, and a stoppage of all the pits in the county of Northumberland. As already reported, the masters gave the men notice of a proposed reduction of 10 per cent. upon wages in the steam coal district, and 15 per cent. upon soft coals. This could easily have been arranged by arbitration, but along with the notice they also intimated their intention to terminate their agreement with the men, by which the latter were supplied with coal and occupied their cottages free of charge. The men have refused point-blank to deal with the question of the cottages and fuel, though the masters were disposed, upon second consideration, to allow this subject to go to arbitration too. Of course, if there is a strike over so large a section of the coal-field as Northumberland, it will materially affect the price of coals in the adjacent county of Durham. In anticipation of a strike of this description the factories are laying in stocks of small and manufacturing coals, and this increased local demand is likely to produce a hardening effect upon second-class gas coals sold in the open market. The strike, if it should occur, will happen awkwardly for the coalowners, as from the war and other circumstances the Northumberland steam coal trade was slowly recovering from the depression which had prevailed in the trade for nine or ten months.

The coal ports are somewhat scarce of tonnage, but the only place from whence there have been numerous small orders for coals has been France. Small ships have been taken up for the northern ports of France at somewhat increased rates of freight. The English ports in the British Channel and the east coast seem tolerably well supplied with coals for the present. A quiet business is doing, but as small sailing vessels have been scarce, something like a rise of 6d. to 9d. per ton has had to be paid for small sailing vessels to load coals for the wharves in London river. There is little or no home business with the Black Sea or Mediterranean. Outward coal freights thence are steady at about £18 per keel. The Baltic appears to be very well supplied with steam and sailing tonnage, and outward and home rates are not quite so good.

The iron trade of the district is a little firmer and better. Some branches of it, such as engine-building and iron ship-building, are really in active employment.

The chemical market is extremely depressed. Prices have not been so low for a lengthened period. There is no great demand for fire-clay goods or cement, and the timber trade is very quiet.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a recent meeting of the Glasgow Corporation Gas Committee, there was submitted a report from the Works Sub-committee, as to the loss of gas through leakage. It stated that the committee had, along with Mr. Foulis, visited the Tradeston works, and found that the experiment made in the Pollokshields district with the new governor had been successful in diminishing the pressure, and consequently the leakage, of gas within the district. The report was approved, and, on the recommendation of the sub-committee, it was resolved that a similar experiment should be made in other two districts. The Sub-committee on Works recently had under consideration a letter from the town-clerk, stating that he had been instructed again to communicate with the Gas Committee with reference to Dr. Wallace's reports on the illuminating power and purity of the gas supplied to the city, and to express the surprise and regret of the magistrates in finding the gas was still sometimes below the statutory minimum illuminating power. In reply to the communication, the clerk was instructed to intimate that the Gas Committee were using every means in their power to maintain the illuminating power, at least up to the statutory minimum.

Dr. Wallace's report on Glasgow gas for the week ending the 5th of May gives the minimum illuminating power of the gas tested at St. George's Cross Station (for Dawsholm works, I believe), at 25.01 standard candles. The lowest minimum at West Street testing-station (for the Tradeston works) was 26.71 candles, and the maximum was 28.24 candles. The average illuminating power over the four testing-stations ranged from 25.47 candles to 27.68 candles.

An ambitious cry, raised by the people of Crossgates, one of the mining villages in the west of Fife, for "more light," has issued basely in the mere consumption of more drink. It was resolved in that village to attempt to raise funds for lighting the public thoroughfares during next winter

by holding a series of entertainments of a light and agreeable character. Nine such entertainments were held, it seems, with the net result of creating a fund of £1 3s. 4d., available for the purpose of street lighting. The whole income derived from them amounted to £21 1s. 1d., and the expenditure to £19 17s. 9d. The first item on the expenditure side of the account was the tell-tale return—For drink, £4 12s. 6d.

The Lighting Committee of the Ayr Police Commission have at present in hand a new plan of lighting the Steeple and Wallace Tower clocks, a plan whereby two-thirds of the gas will be saved, while there will be a much better light. On the recommendation of the committee it has been resolved to keep the lamps at the street corners lighted every night throughout the year.

The gas supply of Inverness has passed into the hands of the civic authorities, but that fact does not prevent the local newspapers from expressing dissatisfaction with the price and the quality of the gas supplied to the town. One of the newspapers says: "The quality of the gas supplied in Inverness is not published, and can only be guessed at by consumers. The price is, unfortunately, well known to be 8s. 4d. An inspector is appointed by the Town Council of Perth, whose reports are steadily communicated to the public." After quoting the returns of the illuminating quality of Perth gas during a recent week, the paper goes on to say: "The price of this illuminating gas of nearly 28 candles in Perth is 4s. 7d. per 1000 feet, with 10 per cent. off to consumers of 100,000 cubic feet per annum."

Another pipe burst on Sunday, the 6th inst., in the line conveying the water from the Loch of Lintrathen to Dundee. On examination it was found to be 12 feet long and 1½ inch thick. No explanation of the accident can be given, as the water has been running for some months at a pressure of 300 feet per square inch at the place where this burst occurred.

Great inconvenience has again arisen from the deficient water supply at Burntisland, and the authorities are actively negotiating for a provisional addition from the Grange Distillery Pond. The new water-works are advancing rapidly, but it will be another year before the Dour scheme is available for practical purposes.

A memorial to the Board of Supervision has lately been signed very extensively by the inhabitants of Kilmaccolm, craving that the introduction of an additional supply of water be forwarded with all due speed.

Owing to the position in which the Perth Water Bill now stands, the Police Commissioners of the "Fair City" are all at sixes and sevens as to the question of giving any further opposition to the progress of the measure through Parliament.

The Glasgow pig iron market closed on Friday afternoon with sellers at 55s. 1½d., and buyers at 55s. cash, or 3d. under the closing quotations of the previous Friday.

A somewhat quieter feeling is now showing itself in the local coal trade. Shipping orders are again scarcer, but the local demand is about the average. Prices are unchanged.

WESTON-SUPER-MARE PUBLIC LIGHTING.—At the meeting of the Town Commissioners, on the 9th inst., a report was brought up from the sub-committee appointed to confer with the gas company with reference to the proposed new agreement for the supply of gas for lighting the public lamps for the term of five years. It stated that the committee had met a deputation, who had offered a reduction of 5s. per lamp per annum, which they calculated would be at the rate of 3s. 6d. per 1000 feet, or less than the price charged to private consumers. The company had also offered to reduce the charge for the ten private lamps on the Esplanade from £25 to £22 10s. per annum. This offer the committee now recommended the board to accept. The chairman having congratulated the board on the liberal

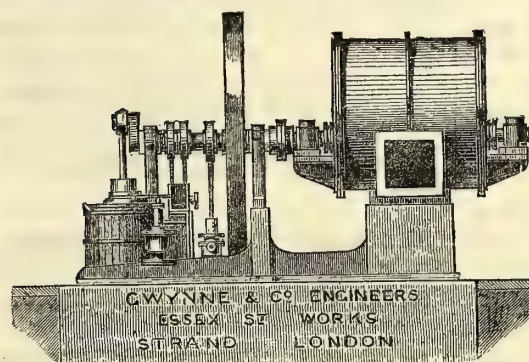
terms offered by the gas company, Mr. Matthews took exception to the recommendation of the committee, on the ground that the reduction offered by the gas company was not sufficient as compared with what was paid by the public bodies of other towns. He had made inquiries from five different towns, and had received that day telegrams which set forth that Bath, where the public lamps were lighted 3650 hours per year, the charge was £3 per lamp; at Oxford, £3 3s.; at Cardiff (lamps lighted from sunset to sunrise), £3 5s.; Bristol (average ten hours light, and burning 5 feet per hour), £3 14s.; Cheltenham, £2 10s. per lamp. The average price paid by these five towns was £3 2s. 6d. per 1000 feet, as compared with £3 13s. for Weston-super-Mare, which town until now had been paying £3 18s. per lamp per annum. After quoting these statistics, he said that if the public lamps of Weston-super-Mare were lighted nine hours every day, and consumed 5 feet of gas each per hour, it would be equal to 16,425 feet in the year, which, at 3s. 6d. per 1000, would amount to £2 17s. 6d.; then allowing 12s. 6d. for the hire of the lamp-posts, cleaning, and repair of lanterns, would make the amount £3 10s., which, he contended, was quite sufficient, considering the facilities that there existed for obtaining coal. He added, that to reduce the cost of the Esplanade lamps from £25 to £22 10s. was making a reduction of 10 per cent., whereas the other lamps were only to be reduced from £3 18s. to £3 13s., or a reduction of only 6½ per cent. If the cost per lamp was reduced in proportion to those on the Esplanade, the cost would be £3 10s. per annum, which would be in fair proportion to what was paid in other towns. He concluded by moving that the question should be reconsidered between the gas company and the sub-committee, which, after some debate, was unanimously carried, although some expressed as their opinion that more favourable terms would not be procured.

MACCLESFIELD CORPORATION GAS SUPPLY.—At the quarterly meeting of the Macclesfield Town Council on Wednesday, the 5th inst., Alderman Stancliffe read the Gas Committee's minutes, one of the most important items in which was the investigation into the failure in the supply of gas on the 27th ult., by which the town was placed in darkness for some time and the public greatly inconvenienced. The explanation given by the gas manager was considered insufficient, and the committee resolved that he be discharged after two months notice had expired. They further stated that "it was resolved that an offer be made to the Local Board of Health to light and maintain the public lamps of the borough for a period of one year, commencing on the 1st of July next, for the amount realized by a threepenny lighting rate, the hours of lighting to be according to the scale now in operation, or such other scale as may be agreed upon, provided that this committee shall have the power of deciding as to the erection of all additional lamps." The Chairman, in moving the adoption of the report as read, said he had been requested by the manager to correct an impression which he understood some people had derived from the reading of the minutes—that he had left the works knowing that air was getting into the pipes. He (the chairman) did not consider the resolution bore that construction; he fancied it was worded clearly enough; at the same time he might state that the committee did not consider that at the time he left the works he was acquainted with the fact that the pipes were open. With reference to what the committee were doing at present, they were making a few improvements at the work—or necessary alterations, which would be improvements eventually. As to the resolution providing for taking a rate of 3d. in the pound for the lighting of the town, it would be much more convenient if they received it in one sum at a given time, so that they could rely exactly on what they had to receive, instead of so much per lamp as they had had before. At the same time he was glad to hold out some hopes that if their profits continued to be as great as last year, they would be able to reduce the price of gas to the public, perhaps something like 2d. per 1000 feet. Mr. Lovatt seconded the motion, and the minutes were approved.

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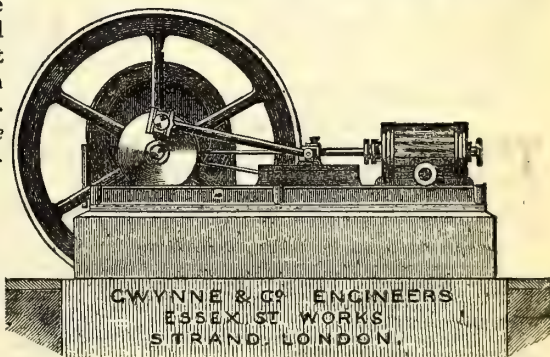
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FOR SALE.

A Set of 8-in. Vertical Condensers, with tar-box and all connexions complete, containing about 180 ft. of pipes.
Also a SCRUBBER, 12 ft. high, 5 ft. diameter, with reversing valve.
The above are nearly new (only been in work six years), and are now removed to make room for larger.
May be seen and price obtained on application to H. and F. BAILLY, Engineers, EAST RETFORD.

GASHOLDER FOR SALE.

ONE Telescopic Gasholder, 70 feet by 20 feet, complete, with cast-iron tank, columns, girders, and inlet and outlet pipes, valves, &c., of modern construction. In first-class condition, and made by Messrs. Pigott and Co., of Birmingham.
To be seen at work at the Gas-Works, Birkenhead.
Cause of removal to make room for extensions.
To be sold a bargain, taken down, and re-erected ready for work.

For particulars, apply to Messrs. ASHMORE AND WHITE, STOCKTON-ON-TREES, or to view to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

TO TAR DISTILLERS AND OTHERS.

TO BE LET ON LEASE, or the Interest SOLD, a very handy TAR-WORKS in London. In good order, and capable of working nearly a million gallons per year. Water frontage.
Address No. 362, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOROUGH OF DARLINGTON.

THE Gas-Works Committee invite TENDERS for the supply of COAL suitable for Gas purposes.

Tenders to state the price per Ton for the supply of 10,000 Tons, the whole quantity required, commencing the 1st of July next; also, the price per Ton for 5000 Tons, to be delivered during the six months commencing the 1st of July next. The Coals to be delivered at the Stockton and Darlington Railway Depot, Darlington.

Further particulars as to time and rate of delivery may be obtained from Mr. William Smith, Gas-Works Manager, Darlington.

Tenders, endorsed "Tender for Gas Coal," to be sent to me on or before Monday, the 28th inst.

No pledge is given that the lowest or any tender will be accepted.

By order,
HUGH DUNK, Town-Clerk.
Darlington, May 7, 1877.

THE MEXBRO' & DISTRICT WATER-WORKS COMPANY, LIMITED.

To be Incorporated under the Companies Acts, 1862-7.
CAPITAL £10,000, IN 1000 SHARES OF £10 EACH.
Provisional Directors.

PETER WADDINGTON, Chairman of the Local Board, Mexbro'.

J. P. MAKIN, Member of the Local Board, Mexbro'.

WM. BEEVERS, Member of the Local Board, Mexbro'.

A. M. BOLSOVER, Brewer, Mexbro'.

JOHN DICKINSON, Farmer, Mexbro'.

C. H. VERITY, Waggon Works, Mexbro'.

JAMES WHITE, Member of the Local Board, Mexbro'.

WM. ROEBUCK, Gentleman, Mexbro'.

Bankers,

THE SHEFFIELD BANKING COMPANY, Mexbro'.

Solicitors,

Messrs. NICHOLSON, SAUNDERS, AND NICHOLSON, Wath, near Rotherham.

Engineer and Manager,

CHARLES TOMLISON, Rotherham.

Secretary (pro tem.),

F. H. GOLDSMITH, Wath, near Rotherham.

Office,

This Company is formed to supply the Town of Mexbro' and district with Water.

The Town is situate near Rotherham, Yorkshire, and the present population is about 5000, and it is intended to provide Works capable of supplying a population of 10,000 with 200,000 gallons, or 20 gallons per head per day.

Part of the Town is at present without any sufficient supply, in consequence of mining and other operations; the other part has a supply from deep wells, which are difficult to work by hand, and will soon be superseded by the Company's supply, which it is proposed to give under the constant high pressure system at a reasonable rate.

There are several sources available for the supply, and the first that will be utilized is from a well on the east side of the Town, where numerous deep wells have for years furnished a plentiful quantity of satisfactory and moderately soft Water (so soft that rain water is not generally stored). If at any future time this source is insufficient in quantity or quality, there are springs near the town which yield about 250,000 gallons per day in the driest seasons, without any attempt to increase their yield; the principal owner has offered them to the Town on conditions which will ensure a supply of 20 gallons per head per day for double the present population. The Water from these springs is hard, but exceptionally wholesome, and particularly suitable for brewing. There are several other sources of supply available.

If the east end well proves sufficient, about £4000 will be the cost of the Works; and if the springs are added, the cost of the Works will be increased about £2000. Land and other contingencies are computed to cost less than £1000. Under these favourable circumstances of small outlay and immediate demand, an early and good dividend is anticipated.

Holders of 20 shares of £10 each are eligible as directors.

The Company have the sanction of the Local Board to open the street, and secure parliamentary power for the supply.

Applications for Shares to be sent to Mr. CHARLES TOMLISON, Hadley House, ROTHERHAM, or to the Bankers.

Calls.

£1 per share on application, to be returned in full if no allotment made.

£2 per share during month of May or June.

£2 per share during month of June or July.

Making £5 per share in all, which it is confidently expected will be all that need be called up.

THE Farnworth and Kearsley Gas Com-

pany are prepared to receive Plans and Specifications and Tenders for the supply and fixing complete of Two PURIFIERS, 20 ft. by 18 ft., also 24 ft. by 18 ft., and 5 ft. deep, with all necessary valves and connexions.

Also for a cast-iron CISTERN, 22 ft. 9 in. by 30 ft., and 4 ft. 6 in. deep.

Contractors to state the time in which they will undertake to complete the respective works.

No allowance for plans, &c., nor will the Directors pledge themselves to accept the lowest or any tender.

Tenders to be sent in on or before Wednesday, the 23rd inst.

Any further information may be obtained by making application at the Works, Middle Street, Farnworth, near BOLTON.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Bangor Water and Gas Company, Carnarvonshire, are prepared to receive TENDERS for their surplus TAR and AMMONIACAL LIQUOR, for One, Two, or Three years, from the 1st of June next.

The Company will deliver the Tar and Liquor at the Bangor Railway Station, in iron tanks to be provided by the contractor.

The Company do not bind themselves to accept the highest or any tender.

Particulars may be obtained of the undersigned, and the tenders must be sent to me not later than the 22nd of May next.

DAVID WHITE, Secretary and Manager.

CARDIFF GASLIGHT AND COKE COMPANY.

AMMONIACAL LIQUOR.

THE Directors of this Company are pre- pared to receive TENDERS for the AMMONIACAL LIQUOR produced at their Works in Cardiff, for One, Two, or Three years, from June 30, 1877.

Sealed tenders, endorsed "Tender for Ammoniacal Liquor," to be forwarded to the undersigned, on or before the 6th day of June next.

Any further particulars may be obtained upon application at the Company's Offices.

HENRY BOWEN, Engineer.

Gas Offices, Cardiff, May 12, 1877.

PAMPHLET ON GAS.

COOKING AND HEATING.

HINTS ON GAS-BURNERS, &c.

For GAS COMPANIES to distribute to their Gas Consumers.

Specimen Copy by post Threepence, from the Author,
MAGNUS OHREN, Gas-Works, Sydenham, S.E.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 22, 1877.

Circular to Gas Companies.

THE "sulphur fight" has been, as we anticipated it would be, adjourned over the holidays, and the decision of the Committee will not be given until after another fortnight. In the meantime, we have certain utterances of the Chairman which, while giving us no hint from which we might infer the probable fate of the Chartered Company's Bill, show the points which have caught the attention of the Committee. They appear to think that, while the damage alleged to be done by the sulphuric acid produced by the combustion of the sulphur compounds in gas is hypothetical, problematical, or exaggerated, the nuisance occasioned by the use of lime is positive, real, and substantial. At the same time, they seem to recognize the fact that the abolition of purification by means of lime will result in a considerable saving to the Gas Company, and the idea has been expressed that the public should have the benefit of this economy. It will be seen at once that the question of price not being raised by the Bill now before the Committee, the introduction of a clause to alter the existing law in this respect would involve a fundamental change in the nature of the measure, which, promoted with one object, would thus become the instrument of effecting a second. How far parliamentary usages will

justify the course which it is pretty clearly intimated may be taken, we are unable to say. The Committee have a Bill before them which they may pass or reject after having weighed the evidence adduced for and against. For any alteration or addition to the measure the consent of both parties is necessary, and we think we may take it that the alternative proposition of the Committee will be obnoxious to both. The Company could hardly assent to a reduction of the initial price, which is already low enough, and which was settled after a very full inquiry last year; and the opposing authorities would stultify themselves if they accepted such a reduction in price as compensation for the damage they allege, and for nuisances they contend ought not to exist.

There is a further suggestion, that the Committee should pass the Bill with a clause, or clauses, fixing a new maximum of thirty-five or forty grains of sulphur per 100 feet, and giving the Board of Trade power to order the Companies to make experiments, under superintendence, with a view to ascertain whether the above-mentioned maximum may not, in course of time, be reduced without any nuisance being occasioned. A good deal might be said in favour of this proposal, which would leave the Referees pretty much in the position they now stand. We must not, however, discuss the suggestions made to the Committee, nor the opinions expressed by themselves. The decision of the Committee will be anxiously waited for, and, whatever it may be, we expect it will involve another contest in the Upper House.

The same reasons which compel us to abstain from any comment on the position taken up by Mr. Plunket's Committee, of course, preclude us from making any remarks on the extract from the Report of the Metropolitan Board of Works, which we publish to-day. It is, however, open to us to call attention to the fact that, while the Board strongly object to the removal of all restrictions on the quantity of sulphur to be allowed in metropolitan gas, their statement in this report seems to leave the way open to compromise, the design of which has been clearly indicated in the evidence given, but which the Committee appear not to have approved. It seems with them, as we said before, to be a question of giving the Company the relaxation they ask, accompanied by a reduction of the initial price, or of continuing the conditions from which the Company seek to be relieved.

We have received, from an intelligent informant, some particulars respecting the "electric candles," as recently exhibited in Paris, which we give, without guaranteeing their strict accuracy. We are told, then, that the machine used by M. Jablchskoff was one of Gramme's (the inventor whose name escaped our memory), which, driven by a two-horse power engine, and supplying electricity to one lamp, gives a light equal to six hundred candles. The Russian inventor has succeeded in dividing the current produced by this machine, so as to supply two "electric candles." That, we are told, is all, and by those competent to form an opinion, the candle is not as yet considered a success. It is not to be disputed, however, that the invention is a great step in advance. If an electric current can be divided into two, there would appear no reason why it should not be subdivided into twenty; but even if that were done, Gas Companies would not be in the least prejudiced. While writing on this matter, we may remark that some activity is being displayed in England with respect to illumination by electricity, and we read in a contemporary that the Messrs. Siemens, who may well be supposed to take an interest in the question, have lighted up the shops at their telegraph works at Woolwich with three machines, driven by about six-horse power, and the effect is said to have been good.

Mr. Raikes had a little difficulty before him the other day. The Lowestoft Water, Gas, and Markets Company had a Bill in the Commons, by which they proposed to raise additional capital to the amount of £80,000, but they did not apportion their capital among the several undertakings, and the Company seems to be one and indivisible. It seems, moreover, to be in a bad way, paying only two and a half per cent., and the shares selling at a heavy discount. Thus the insertion of auction clauses in the Bill promised no good to anybody, and they were left out.

Our readers have been informed that, subsequent to the fire at the landing-stage, the Liverpool United Gas Company dissociated the business of gas-fitting, &c., from the general concern, and a separate Company, with a paid-up capital of £10,000, was formed to take over this branch of the undertaking. That Company held their first annual meeting on the 15th inst., and the accounts presented showed that the profits of the year amounted to £1636. A dividend of ten per cent. was declared, and the balance was carried over to the next year. We hope the fitting

business will continue to prosper. When the Gas Company are compelled to go to Parliament they will have auction clauses inflicted on them. The Liverpool Gas-Fitting Company will never go to Parliament. Might not several Gas Companies split up their business in a similar way?

A suggestion is made by a correspondent this week, in support of which we may, very properly, say a few words. It is, that the Directors of Gas Companies should give some pecuniary contribution towards the expenses of their officers who attend the meetings of the British Association of Gas Managers. Everybody knows—that is, everybody who has any knowledge of the matter—that gas managers, as a rule, have very small salaries. Even with a house, and coal and gas free, some of them find it hard enough to make both ends meet, even at home. We regard, however, the advantage of these annual gatherings as so great, that we have always advised managers to be members of the Association, and to attend the meetings. But the benefits are mainly conferred on the Company the manager represents. He is, of course, personally instructed, and the knowledge he gains is always at the service of his employers, who may be considered to reap the pecuniary advantage of his communications with his brother managers. We hope Gas Directors will take the matter into consideration in the course of the next week or two. The meeting of the Association, which will shortly take place at Bristol, promises, we are told, to be a very useful one, and we hope there will be a full attendance of members, whether aided or not.

A report in another column shows that the Corporation of Blackburn have ratified the agreement made by a Committee with the Company for the purchase of the gas undertaking. The terms are said to be higher than any yet paid by a Corporation for a gas undertaking, but this we believe to be a mistake. It may, however, be admitted that the terms are liberal. The holders of A shares, of £15 each, fully paid, and entitled to ten per cent., obtain a perpetual annuity equal to maximum dividends, and a bonus of £2 per share; the holders of B shares, of £15 each, fully paid, and entitled to seven and a half per cent., also receive annuities equal to maximum dividends, and a bonus of £2 per share. The bonuses, it must be understood, are to compensate for back dividends, which the Company are now in a position to make up. The owners of C shares, nominally of £10, on which only £5 have been paid, are compensated for their uncalled-up capital by a bonus of £3 10s. per share, with annuities of 7 per cent. on the capital paid up. There is no denying that those terms are very fair, but the Gas Company were in a position to go on making their maximum dividends, so far as can be seen at present, for all time to come. They had, therefore, a perfect right to stand out for the highest terms they could get. They had nothing to fear from either auction clauses or sliding scale if imposed at some remote date. The Corporation have now a fair start. If the consumption of gas continues to increase as it hitherto has done, at the rate of six and a quarter per cent. per annum, the undertaking will, in the course of a few years, become very profitable. The only people, we imagine, who are to be pitied, are the gas consumers, who are not likely to get cheaper gas in consequence of the transfer. Everybody in Blackburn, however, seems to be perfectly satisfied.

The Corporation of Neath have decided on erecting new gas-works at an estimated cost of £10,000, those they took over from the Gas Company two or three years ago, having been allowed, perhaps intentionally, to fall into a state of dilapidation. It is said that the new works are to be placed on a more eligible site than that occupied by those taken over from the Company. It may be presumed that the purchase of the undertaking has been profitable to the Corporation, or they would not so soon have resolved on so heavy an expenditure in connexion with it.

Some alterations, not of great moment, have been made in the agreement entered into between the Town Commissioners of Mansfield and the Directors of the Gas Company, for the transfer of the gas undertaking. According to the agreement now signed and sealed, the Directors will continue from the 30th of June next to carry on the concern until the Commissioners acquire the necessary powers, paying to the shareholders a dividend of ten per cent., free of income-tax, and £6 per share in satisfaction of arrears of dividends. Then it is agreed that the shareholders shall receive for every £50 share, debenture stock of the nominal value of £150, on which stock the Commissioners guarantee interest at the rate of four per cent. per annum, free of income-tax. These are the most important stipulations, but there are others to which we may have occasion to refer when we come presently to notice the Provisional Order which the Company have now before the Board of Trade.

The Corporation of Hull are not making progress with their negotiations for the purchase of the gas-works supplying their

limits. To an application from the Town-Clerk, the Secretary of the Kingston-upon-Hull Company politely replies that his Directors are not disposed to part with the undertaking; whereupon the Town-Clerk, on his own responsibility, threatens the Company with a Bill to effect a compulsory purchase next session. At menaces of this kind the Company can well afford to laugh. Compulsory purchases are not now favoured by Parliament—they never have been, in fact—and the Corporation of Hull would have no chance of success with any one of the Companies within their limits. They have invited the British Company to contract for the supply of the public lamps in the old town, they (the Corporation) proposing to obtain a Provisional Order to secure the necessary powers. We shall be surprised if the British Company for a moment entertain the proposal.

Water and Sanitary Notes.

THE Kent Water-Works Company have issued the statutory notice to the Metropolitan Board of Works, that they intend, on certain dates within the next twelve months, to place five additional districts, within their limits, under a constant supply. The efforts made by this Company, to carry out expeditiously the provisions of the Act of 1871, are, to our mind, highly commendable; but, unfortunately, they do not meet with the approval of the Metropolitan Board. Anxious as that body appeared to be, and, no doubt were, to obtain for London the benefit of a constant supply, they have lent no assistance to, but have rather obstructed, the two Water Companies who are doing their utmost to confer the blessing. In their annual report, just issued, they seem to complain of the conduct of the Kent Company in fixing hydrants, and compelling the Board to pay for them. The fact is that the Board are desirous of getting the water supply into their own hands. They insist that hydrants will be of no value so long as the supply remains in the hands of the Companies. "The water supply," they say, "is not in the hands of the Local Authorities; the pressure is by no means so great or so certain [as in Manchester and Liverpool], being derived, not from gravitation from a high source of supply, but, generally speaking, from being forced through the pipes by pumping." This is quite true; but what can the Companies do? What would be said if they went to Parliament for power to construct a large reservoir on every height around London? But this, it seems, is what the Board would do if they got the supply into their hands. We need not speculate as to what this would cost the Metropolis, nor inquire what advantages would be gained by an excessively high pressure service. We might have hydrants from which a jet of water could be thrown as high as the fountain at Chatsworth; but what would be the good of them? The great recommendation of a hydrant is, that it can be seen, and is constantly charged with water. The firemen have not to lose time in searching for a plug concealed by mud in the roadway, nor to wait for the turncock, who has to look for a valve similarly circumstanced. Water can be obtained from a hydrant in less than a minute, and this consideration alone should have induced the Metropolitan Board to place them wherever there is a water-main constantly charged.

The boring at Messrs. Meux's brewery has passed through a thin stratum of lower greensand, and entered the Palæozoic rocks, and the expected inexhaustible supply of water has not been discovered. This is, on many grounds, to be regretted, but we were prepared for the disappointment. Mr. Prestwich had expressed his opinion that the greater formation of sandstone would be found south of the river, and the truth of this opinion is now being tested by the boring at Crossness. The bore there is now in red clay, which sometimes overlies the lower greensand. We shall wait with much interest for the result of this experiment, in which we hope the Metropolitan Board will persevere. No one will reproach them for the money spent in the enterprise, even if it should in the end prove abortive. In the meantime it is suggested that the boring at Tottenham Court Road should be continued in that hopeful search for coal under the Metropolis. As a scientific fact, it would be interesting to know that coal exists at a depth of two or three thousand feet under London, but it would remain simply an interesting fact for centuries. While coal sufficient, it is said, for two hundred years, is to be easily won within a short distance of the Metropolis, this generation need not trouble itself about what lies half or three-quarters of a mile below us.

The Corporation of Glasgow appear to be setting resolutely to work to stop the enormous waste of water which goes on in their city. They have now dropped upon defective fittings, by which, of course, the greatest waste is caused. They have an Act which gives them the most ample control, but it seems

to have partly fallen into abeyance. It is now, however, to be revived and strenuously enforced. Cheap taps which eternally dribble will henceforth be rejected in Glasgow, as they would be in London, if the Metropolitan Board owned the water-works.

When we say that the discovery of Professor Barff* is not new, we do not in the least intend to detract from his merits as an original inventor and observer. He has rediscovered the fact that, when iron is exposed to the action of steam at a high temperature, it becomes coated with a continuous adherent layer of magnetic oxide, which absolutely resists the action of moisture, and practically renders iron indestructible. The fact is of great importance to Water Companies, and also to Gas Companies, who suffer much from the decay of pipes in moist ground. We know nothing of the cost of the process, but we imagine it can add very little to the expense of pipes.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXXVI.

SUBWAYS.

Although subways are intended for, and do actually accommodate, not only the gas-pipes of a city, but also the water-pipes, telegraph and other tubes, and therefore cannot be considered as a special adjunct of gas supply only, yet a treatise of this character could not, in these days, be considered complete without containing a detailed description of these subways, underground passages, or tunnels, that are, we believe, destined, sooner or later, to be constructed beneath the busy thoroughfares of all populous cities.

Subways were an institution of ancient Rome, and such portions of them as remain to the present day are not the least interesting and important of the many surviving monuments of the enterprise and genius of the people of that empire in bygone times.

The subways of Rome, however—amongst which the Cloaca Maxima, or great water-way, “through which a waggon loaded with hay might pass,” was the principal—differ from the subways (properly so called) of London of the present day. The former were vast aqueducts to convey all the waters of the city, pure and foul, into the Tiber, and bore a resemblance to the large sewers of London and Paris of modern times; whereas the subways proper, are dry tunnels, constructed for the reception of the various water, gas, telegraph, and other pipes and tubes permeating the streets in all directions.

Surprise is sometimes expressed that the obvious advantages accruing from the use of subways in London and other great cities for the purposes mentioned, should only have been recognized of recent years. The wonder, however, is misplaced. It is only of comparatively recent years that the necessity for subways for the reception of pipes has arisen.

Although water-pipes have been in use for many years, their dimensions were, until recently, but small, and the number of them not great. The traffic, also, in the streets, even of the Metropolis, prior to the beginning of the present century, gave little indication of reaching the enormous magnitude it has since assumed; and the materials composing the streets themselves were not generally such as, in the breaking or opening of them up, to entail anything like the present heavy expense and difficulty of reinstatement.

It will be interesting to our readers, and not out of place here, in dealing with the subject of subways, if we briefly relate when main-pipes for the conveyance of water were first used in the Metropolis, and the circumstances that led to their introduction.

The first instance on record of water being conveyed to the City of London by means of pipes is in the year 1236. Before this time, according to Maitland, the city and places adjacent were supplied by the “river of wells,” in the west part; whose decay was owing to certain mills erected on the banks thereof by the Knights of St. John, which obstructed its navigation, and by degrees gave it the name of Turnmill Brook, a name which is still preserved in Turnmill Street, through part of which this water took its course towards the bottom of Holborn Hill, and thence into the Thames between the Fleet and St. Bride’s. In process of time, Turnmill Brook was lost in the name of Fleet Ditch, or Fleet Dyke.

The other waters were Olborn or Holborn, Wall Brook, and Langbourn. Besides these bourns or brooks were several springs which supplied the City, as Holywell, a fine spring famed for its miraculous virtues in superstitious times; Clerk’s or Clerkenwell, Skinner’s Well, Fogg’s Well, Tod’s Well, Loder’s Well, Crowder’s Well, and Rad-Well, and the Horsepool or Horsepond in Smithfield. These several springs, or most of them, united their streams, and formed the “river of wells” before mentioned.

In the year 1236, in consequence of a great want of water prevailing in London, occasioned principally by the encroachment of buildings and the mills of the Knights of St. John, before referred to, on the fresh-water canals about the outskirts of the City, many opulent citizens contributed liberally to the inauguration of a scheme for bringing water by means of main-pipes from six fountains in the neighbouring town of Tyburn, and this project was eventually carried into execution.

Conduits for the reception of this water were accordingly erected in

various parts, the first of which was built in the year 1285, at the west end of Cheapside, then called West Cheap, and these were found so convenient, that they were shortly increased to nineteen in number, being supplied with water by pipes from the different wells or fountains in the neighbouring districts. The method of conveying water from the Thames and New River rendered these constructions useless, and they were totally removed after doing good service for many years. Though named conduits, they were, in reality, reservoirs or cisterns of stone, lined with lead.

Stowe informs us that when the conduits were in use, it was customary for the Lord Mayor, Aldermen, and other principal citizens, to repair on horseback annually, on the 18th of September, to the heads from whence they were supplied, “but particularly on the 18th of September, 1562, the Lord Mayor Harper, Aldermen, and many worshipful persons, and divers masters and wardens of the twelve companies, rid to the conduits’ head, for to see them after the old custom. And afore dinner they hunted the hare and killed her, and hence to dinner at the head of the conduit. There was a good number entertained with good cheer by the chamberlain; and after dinner they went to hunting the fox. There was a great cry for a mile, and at length the hounds killed him at the end of St. Giles’s. Great hallowing at his death, and blowing of horns, and thence the Lord Mayor, with all his company, rode through London, to his place in Lombard Street.”

In this way the water supply of London was obtained, with the exception of a portion pumped from the river Thames by Peter Morrys, an ingenious Dutchman, until the time of Hugh Myddelton, a worthy and enterprising citizen, carrying on the business of a goldsmith, who, after several others had attempted it without success, put into execution the design of supplying London with water for domestic use, by means of a river cut through the country from Chadwell and Amwell, near Ware, in Hertfordshire, to a basin or reservoir near Islington, on the north side of London.

This work was begun on Feb. 20, 1608, “and with great difficulty, art, and industry, and a prodigious expense,” with the assistance of King James I., was completed, and the water let into it, on Michaelmas-day, 1613; when Sir Thomas Myddelton, Lord Mayor elect, and brother to the author of the scheme, accompanied by Sir John Swinerton, Lord Mayor, the Aldermen, the Recorder, and many other citizens and gentlemen, repaired to the place called New River Head, in solemn cavalcade. On their arrival, sixty labourers, handsomely dressed and wearing green caps, marched with pickaxes, shovels, and spades, thrice round the basin, preceded by drummers and trumpeters discoursing loud music, and stopping before the Mayor and the others, seated upon an eminence, one of them addressed the assembled company in a copy of verses:—

“Long have we labor’d, long desired, and pray’d
For this great work’s perfection, and by th’ ayd
Of heaven, and good men’s wishes, ’tis at length
Happily conquer’d, by cost, art, and strength,
And after five years deare expense in dayes,
Travaile, and payne, besyde the infinite wayes,
Of malice, envy, false suggestions,
Able to daunt the spirits of mighty ones
In wealth and courage. This, a work so rare,
Onely by one man’s industry, cost, and care,
Is brought to blest effect, so much withstood,
His only ayne the cities general good.”

This recital being ended, the sluices were opened, and the stream gushed plentifully into the canal, under the sound of drums and trumpets, the discharge of cannon, and the loud acclamations of the spectators.

The source of the New River is twenty miles from London, but the measurement of the original stream, followed throughout its devious windings, necessary to preserve its level, and to some extent, also, owing to the stubborn opposition of certain of the landed proprietors, was 48 miles, 3 quarters, and 16 poles. Its length has been reduced, at different times, to about 28 miles, by cutting off the loops.

On the completion of the work, Mr. Middleton was knighted, and afterwards created a baronet. The stupendous undertaking eventually produced immense profits to the fortunate proprietors of its shares, but the original projector was all but ruined by the expenses he incurred in carrying it to a conclusion.

The successful completion of the New River marked an era in the history of the science of engineering in this country, and the abundant supply of one of the chief necessities of life, which it afforded to the population of the Metropolis, led to the development of the method of conveying water by means of pipes to the doors and into the dwellings of the inhabitants.

The main-pipes used at that early day were sheet lead, turned on a mandril and soldered at the edges, and the trunks of elm trees, bored with augers, and left in their natural undressed condition outside.

Other water companies were established in the course of time, till at the present day there are eight of these supplying the Metropolis from various sources.

Gas, as we have seen, began to be supplied through pipes in 1807, and telegraph-pipes and the pneumatic despatch tube are of still more recent introduction.

(To be continued.)

NEATH CORPORATION GAS-WORKS.—The Neath Town Council decided, at their meeting on Tuesday last, to expend the sum of £10,000 in the construction of new gas-works at Millands. The engineering part of the undertaking was given by tender to Willey and Company, of Exeter, for £4480. Mr. John Thomas, of Neath, obtained the contract for masonry and excavating for £4090. The council decided to give Mr. Ellery, the gas manager, £200 for superintending the erection of the works.

* “The Treatment of Iron for the Prevention of Corrosion.” By Professor Barff, M.A., &c., &c.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

STILL'S REGISTERED GAS-PURIFIER.

SIR,—I have this week had my attention called, for the first time, to a letter which appeared in your JOURNAL of the 12th of December last, in which "G. I. P." gives a sectional view of "Still's Registered Gas-Purifier" from the *Mechanics Magazine* for June 17, 1848, and states that it is in most respects similar to the scrubber recently patented by me, which, he writes, proves the familiar adage, that "there is nothing new under the sun."

Will you permit me to state that at the time the above letter appeared I was distant a thousand miles from England; had I been at home I would at once have written, as I do now, that I knew of, and had seen, years ago, Still's scrubber, that I consider it was an advance of things for the purpose in 1848, but that in no way in which I can view it does it resemble my machine, nor is it possible to make it effective as we now require those things to be.

I feel that I should not make your JOURNAL a medium for crying down one machine and up another; therefore I will abstain from making those comparisons which, in my opinion, prove the two things totally dissimilar; but as my long silence may be mistaken for consent to the views of "G. I. P.," and that, consequently, I have been knowingly appropriating the design of another man, I trust to your permitting me to make this explanation in an early number of the JOURNAL.

35A, Great George Street, May 15, 1877.

GEORGE ANDERSON.

SALE OF THE BLACKBURN GAS-WORKS.

SIR,—The long-continued negotiations for the transfer of the ownership of this undertaking, from the hands of those by whose public spirit, courage, and enterprise it has been created, to the ratepayers, for whom it will, in future, be conducted by officers responsible to the corporation, have at last been brought to a conclusion upon terms satisfactory to both parties.

I send you a report,* as given in a local newspaper, of a meeting of the Town Council, at which the agreement for the purchase was confirmed, and invite the attention of your readers to it, as a favourable and very satisfactory specimen of the way in which such changes should be effected.

In this instance there has been no attempt on the part of anybody to depreciate the value of the property with the view of lessening the price to be paid. The tone and spirit throughout has been good-natured, sound, and healthy, and I would fain hope that the example will be borne in mind, and serve as a model for proceedings in future cases of the kind.

The works will long endure, as evidence of the sound sense which prevailed among the directors of the company, for whom they were erected, and of the skill and judgment of their engineer and manager, Mr. Ogden, in regard to the arrangement and adaptability of the several parts making up the harmony of the whole, which it will always be a pleasure to see.

21, Parliament Street, Westminster, S.W.,
May 19, 1877.

R. P. SPICE.

A SUGGESTION TO THE DIRECTORS OF GAS COMPANIES.

SIR,—I presume that the advantages which result, not only to the individuals immediately concerned, but to the world at large, from the proceedings of associations and societies, in connexion with the various branches of science, engineering, and manufacture, are so fully realized by every intelligent and thoughtful individual of mature age in this country, that I need use no argument in advocacy or in vindication of such associations. They are, in fact, a necessity in this age of mental activity and progress, and by their agency many a valuable discovery, many a valuable experience, many a fact, many a conviction, has been brought to light, while many an error or false theory has been exploded.

Valuable as are the published transactions of such societies, there can be no question that those members who actually attend the meetings, hear the papers read, and also hear, and, it may be, take part in the after-discussion, reap the greater benefit; for no reports of discussions can produce so vivid an impression on the mind as verbal and spontaneous expression, any more than reported evidence can, on all occasions, convey its full value and weight. Besides the fact just stated, there is another well worth regarding; it is that, by intercommunication among members in friendly conversation, after the formal meeting, many doubtful points are cleared up, and much information mutually furnished.

If such be, as they are, the advantages arising from personal attendance at the meetings of most societies, I feel assured that they are specially great in respect to the meetings of gas managers associations, which have broken down the antiquated notions which caused gas-makers in the past to be reticent in respect to constructive details, as well as in respect to the processes pursued in the production of gas, &c. Of all those in existence, the largest and most important undoubtedly is the British Association of Gas Managers, and of that Association I am most decidedly of opinion that every gas manager in the United Kingdom should be a member, and not only so, but that, when practicable, each manager should attend its meetings, as I am sure that, by so doing, he may obtain from, and probably give to, his brethren information which would be of practical value to companies and to the public. It is impossible to estimate the money saving in capital expenditure and in working expenses which have been effected by knowledge gained at these meetings; but I have no hesitation in saying that the saving must be enormous, and that very many companies, as well as thousands of the public, are now reaping a large crop of profit from the seed sown by the agency of the Association.

It unfortunately happens that attendance at the meetings necessitates expenditure of money for railway fares and other matters, and I fear that there are many managers who stay at home because financial considerations restrain them. Such must be the case with many who have charge of comparatively small works.

* See page 784.

Now, as the actual and absolute object of the meetings is to extend knowledge, to improve the character of the plant used, to improve the processes of manufacture, distribution, &c.—in short, to promote the interests of gas companies, and, through them, the interests of the public generally, it seems to me that directors should regard the membership and attendance of their managers as a necessity; but, in order not to impose a tax on the resources of the manager, should, when such course is agreeable to him, gracefully present him with the needful sum, and send him, in a certain sense, as their representative, thereby marking their sense of the value of the Association, and evincing their own desire to keep up with the march of improvement. The course suggested has been already adopted by many directors, and I have no doubt that many more, if not most, only require their attention drawn to the matter in order to follow the same path.

I have ventured to write this letter in consequence of having had conversations with a number of gas proprietors at various times, very nearly all of whom were in favour of a presentation being made to the manager, to cover the expenses of his attendance at the Association meetings, and they were quite satisfied, as I am, that if this were done in such a way as to make it an evidence of respect and consideration for the manager, a good service would be rendered to the company by whom he might be employed.

The next meeting of the British Association of Gas Managers is to be held at Bristol, on the 12th of the coming month of June, and I trust that, at that meeting, many a manager will be in attendance, at the instigation, and by the aid of his directors.

F. W. HARTLEY.

55, Millbank Street, May 15, 1877.

AITKEN AND YOUNG'S PROCESS OF GAS MANUFACTURE.

SIR,—In your notice of this invention in last week's JOURNAL, you have done me the honour of mentioning my name in connexion with the subject; but while I thank you for the meed of praise thus accorded, I must complain of your diminishing its value by the intimation of my having failed "from attempting too much," and I am sure you will, with your usual courtesy, allow me to state my own case.

I attempted to solve the difficulty of decomposing steam, on a manufacturing scale, and converting it into a useful gas, in such a way as to render it not only convenient to the gas manufacturer, but at such a cost as to make it a commercial success, and entirely succeeded; and, on my system, the production of hydrogen and carbonic oxide gas, containing 4 per cent. of carbonic acid, is within the reach of everybody.

This is the great point gained; and, as to rendering this gas luminiferous, it may be done in a variety of ways, and by any kind of oil, whether from shales, or the wells of Petrolia, or similar products which may be found in any region on the face of the earth.

I do not admit failure; indeed, I do not believe in the word, and did not cease from my laborious researches for the solution of all the problems involved, until I had overcome all the difficulties as they cropped up.

The active pursuit of the duties of my profession has hitherto prevented my taking any steps to introduce the process to gas companies, and has, indeed, obliged me to defer attending to two applications for its introduction into two gas-works abroad; but let another coal famine come, and gas companies at home will soon make themselves acquainted with the value of the invention.

I have not had time to make myself acquainted with Messrs. Aitken and Young's process; but from your notice of it I imagine that theirs and my own are not distantly related, and that a closer bond of union may be established advantageously.

21, Parliament Street, Westminster, S.W.,
May 19, 1877.

R. P. SPICE.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

WEDNESDAY, MAY 9.

(Before the MASTER OF THE ROLLS, and Lords Justices JAMES and BAGGALLAY.)

In re THE NEW GAS COMPANY.

This was a shareholders petition to wind up the company. Vice-Chancellor Bacon dismissed the petition. The petitioner appealed.

Mr. KAY, Q.C., Sir H. JACKSON, Q.C., and Mr. W. LATHAM were for the appellant; Mr. HEMMING, Q.C., and Mr. MACNAGHTEN WOODS for the company; Mr. GROSVENOR WOODS appeared for some creditors who opposed the petition.

Their LORDSHIPS dismissed the appeal, with costs, including one set of costs for the creditors who appeared. The creditors were not, however, to have their costs of the hearing before the Vice-Chancellor, inasmuch as they had not appealed from his refusal to allow them their costs.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

MONDAY, MAY 7, AND TUESDAY, MAY 8.

(Before Vice-Chancellor MALINS.)

BEALE v. GWYNNE.

This was an action in which the plaintiff, a civil engineer, who for 45 years had, in conjunction with his brother, carried on business at East Greenwich, sought to obtain, under the construction of an agreement entered into between him and Messrs. Gwynne, engineers, of Essex Street, Strand, certain royalties or profits on oil-pumps in connexion with gas-exhausting machinery they might supply to gas companies and gas-works.

Mr. LOCOCK WEBB, Q.C. (with whom was Mr. CHADWICK HEALY), on behalf of the plaintiff, said the business which he had carried on with his brother consisted mainly in the manufacture of certain machinery connected with gas-works, and he had, in fact, obtained some celebrity, even beyond England, for the excellence of his manufacture. After his brother's death some nine years ago, the plaintiff had, for a short time, continued to carry on the business. The defendant's business had been, at all events before he entered into the agreement with the plaintiff, that of a hydraulic engineer; and the short history of the case was that Mr. Beale applied to the defendant in December, 1869, to know whether he was prepared to undertake the manufacture of machinery such as his brother had made under his superintendence; that led to an interview and an agreement between the parties. Letters had passed between them previously, which it would be necessary to read to show exactly the position of the matter.

Mr. GLASSE, Q.C. (with whom was Mr. PHEAR), for the defendant, said time might be saved by stating that the matter had already come before the Court in February, 1876, when his lordship settled two issues for trial, excluding all these letters. The fact was the plaintiff had got into such a muddle with his voluminous statement of claim and enormous reply, that he hardly knew what to go upon.

The VICE-CHANCELLOR read the issues, as follows:—"Whether the defendant has ever, and, if ever, when and under what circumstances, refused or neglected to buy from the plaintiff the oil-pumps named in the agreement of Jan. 1, 1872; secondly, whether the defendant ever, and, if ever, when and under what circumstances, made default in rendering to the plaintiff proper accounts showing the moneys payable to him, or in rendering proper information in reference to such accounts."

Mr. WEBB, resuming, said that one particular piece of machinery made by the plaintiff was called a gas-exhauster, which was not complete unless it had attached to it an oil-pump—a beautiful little piece of mechanism, so fitted as to constantly lubricate the exhauster in working, and save the expense of employing men to continually oil the machinery. It was, in fact, a necessary adjunct to the machinery which the defendant was to make. That statement would better convey to the Court the full meaning of the important article of the agreement, the fourth, on which one of the principal contests in the case arose, and that question, in fact, was whether the defendant was obliged to buy the oil-pumps required for his gas machinery from the plaintiff, or whether he was at liberty either to obtain them elsewhere or make them himself; the plaintiff contending he was bound to take them from him. Having previously been a hydraulic engineer, when he entered into agreement with Mr. Beale, defendant commenced to make gas machinery also, under that gentleman's superintendence, and in some of the exhausters as many as four or five oil-pumps or lubricators were fixed. Consequently, it was an important part of the case to show that the oil-pump was a necessary part of the machinery. [A brass model was produced to the Court.]

Mr. GLASSE pointed out that it was nothing more than an adaptation of the familiar salmon-wheel, with which those acquainted with fly-rods were familiar.

The VICE-CHANCELLOR, having examined the pleadings, said that the dispute ought certainly to be settled.

Mr. WEBB said that the defendant was liable to pay commission to the plaintiff had been fully admitted, as he had, in fact, offered to compromise by paying him 20 per cent. of the profits on the gas-exhausting machinery he supplied to gas-works. That offer had, of course, been declined.

Mr. Beale, the plaintiff, was then called to prove formally the negotiations which had resulted in the agreement, under one of the provisions of which he was to have 3½ per cent. on the nett price received by the defendant for gas-exhausters, steam-engines, boilers, and bye-passes supplied by him to gas companies and gas-works. A previous agreement had been made between them (dated Jan. 20, 1870), by which defendant was to pay 10 per cent. upon exhausters, 5 per cent. upon other classes of machinery, and a different per centage on another class, and it had been replaced by the agreement of 1872, under which witness was to be paid 3½ per cent. on all machinery included in the agreement of 1870.

Mr. Allen (Messrs. Gwynne's manager) was then called to prove that the agreement was confined simply to the gas exhausters supplied directly by the defendant to gas companies and gas-works.

During the examination and cross-examination of the witness on the transactions of the firm, several attempts were made, at the instance of the Vice-Chancellor, to settle the case.

Mr. GLASSE said all defendant asked was to be allowed to buy the oil-pumps where he pleased. There never had been a patent, and as plaintiff had no special right in them he was receiving a very good offer in the proposal to pay him 20 per cent.

The VICE-CHANCELLOR said perhaps at another time the parties would conquer their repugnance to employ solicitors in drawing such an agreement. He could see that if they would only settle the matter, the result would be, having told the world (which might very well be the case) that Mr. Beale was the most skilful oil-pump maker known, they would still avail themselves of his skill, and although nominally at liberty to go elsewhere, they really would not.

Mr. WEBB offered to divide the profit on this machinery half and half.

Mr. GLASSE said defendant must have the opportunity of ascertaining the current market prices. He could not allow the plaintiff's nominees to name any price they pleased; they might fix £5 for these articles, or any other ridiculous sum, at which the defendant would be obliged to take them.

Mr. WEBB said the prices charged to Mr. Beale himself were 31s. 6d. and 21s. for the horizontal and vertical apparatus respectively.

Mr. GLASSE said the fact was contracts had already been lost by defendant, on account of the plaintiff having put too high a price upon them. He would offer to pay 20 per cent. on any amount the defendant might be able to buy them at, and no more.

Mr. WEBB said defendant charged, as appeared by his own books, £2 1s. 9d. for vertical pumps.

Witness (Mr. Allen) said that was not the case. They charged 25s. for the vertical, and 35s. for the horizontal pumps.

The VICE-CHANCELLOR suggested that as between plaintiff and defendant the prices should be taken at 20s. and 30s.

Mr. GLASSE refused.

The VICE-CHANCELLOR then said that, instead of going into these questions of detail, the parties should at once take the opinion of the Court on the construction of the agreement.

Mr. Gwynne (the defendant) was called, and stated that the clause in the agreement, providing for the payment to the plaintiff of 3½ per cent. on the items of machinery mentioned, had been expressly agreed between them to be confined to those items, as being connected with exhausting machinery supplied to gas companies and gas-works. He had considerable business before he heard of plaintiff, principally in hydraulic machinery, machinery for artesian wells, and so on, besides apparatus for gas-works. It was distinctly understood by plaintiff that he was not to have a commission on any exhausters which were not supplied directly to gas-works or gas companies. In fact, in their negotiations, he said that was all he wanted, as his connexion lay altogether with gas-works.

Cross-examined by Mr. WEBB: Had supplied machinery for the use of gas-works before his connexion with plaintiff, but since he had known that gentleman he had supplied gas machinery to the extent of upwards of £50,000. He had indeed devoted much time and attention to the subject. An agreement had no doubt been come to in 1870 with regard to the commissions to be payable to plaintiff; but the agreement of 1872, the construction of which was now in question, was not come to with the view of fixing one uniform commission on all machinery. Their first disagreement occurred in consequence of plaintiff threatening to make application to the gas companies and other customers to whom machinery had been supplied for the purpose of ascertaining the state of his accounts with them, and the prices at which the articles were supplied. This appeared so shocking a thing, conveying, as it did, an imputation upon him, that he felt he could not for a moment longer submit to the plaintiff's proceedings.

Mr. GLASSE then addressed the Court on behalf of the defendant, and said

that the plaintiff's contention which he had to meet was that the article of agreement, providing for the payment of the commission, extended to every description of machinery supplied to gas-works, whether connected with exhausters or not—a contention which was nothing less than absurd. Would he maintain that, if defendant supplied machinery for sinking an artesian well on the premises of a gas company, he would be entitled to commission on that? Simply stated, the result of the action had been to show that he had no ground whatever for his contention; he had received considerable sums, and if the operation of the agreement was to be confined to the exhausting machinery, he had been overpaid. If it was not, but was allowed to extend to all machinery supplied by defendant to gas-works, more would be due to him on the accounts.

The VICE-CHANCELLOR, without calling for a reply, said he was sorry that so much time had been occupied in such a case. It appeared that the plaintiff had been engaged for many years by his brother at East Greenwich, who had acquired great reputation as a manufacturer of engineering apparatus; and that the defendant, who had made a speciality of supplying gas companies with exhausting apparatus, conceived it worth his while to have plaintiff associated with him, as well for his knowledge as his name. He, therefore, entered into a contract with him, in 1872, by which he was to receive 3½ per cent. upon all exhausting machinery supplied to gas companies. He (the Vice-Chancellor) was of opinion that the plaintiff had made out his title to this commission; but it would not be paid on machinery *bona fide* sold to a purchaser, although it might afterwards reach a gas company. But if it were supplied with the knowledge of the defendant that it was for a gas company, the plaintiff was entitled to his commission. He, therefore, directed an account to be taken upon that footing. The defendant to pay the costs.

THURSDAY, MAY 17.

SIMMONS v. THE VESTRY OF RICHMOND.

Mr. PEARSON, Q.C., said he moved, on behalf of the plaintiff, for an injunction to restrain the defendants working a steam-engine and pumps erected by them near Monmouth House, Lower Road, Richmond, in the occupation of the plaintiff, in such a manner as to occasion a nuisance, disturbance, or annoyance to the plaintiff, or any other persons residing in the house, and from causing to be thereon or deposited on the plaintiff's premises any cinders, ashes, or dust, from the steam-engine, or otherwise. The plaintiff was the occupier of Monmouth House, a large house containing 35 rooms, which she had rented in order that she might take in ladies and gentlemen to board. She had a large connexion, and was, of course, desirous to keep that connexion. The vestry, who wished to supply Richmond with water, having, in spite of his (Mr. Pearson's) efforts in that Court, got rid of the Southwark Company, had put up an enormous engine within 30 feet of the plaintiff's house, with a large boiler, and a steam funnel 18 feet, and a Blake's steam-pump, making 60 double strokes a minute. This was going on Sundays as well as week days; it filled the house with smoke, and made the place vibrate.

The VICE-CHANCELLOR asked if this was part of the temporary or the permanent works.

Mr. GLASSE (who appeared for the vestry): The temporary works.

The VICE-CHANCELLOR: How long will it last?

Mr. GLASSE: It ends next month. Besides, plaintiff is 60 feet off, and people living within 15 feet do not complain. It is the greatest farce out.

The VICE-CHANCELLOR: It is important whether it is a temporary or a permanent work.

Mr. GLASSE: The contract for the artesian well will be completed on the 30th of June. Nobody, except those under the influence of the Southwark Company, of which the plaintiff is one, makes any objection.

In reply to the VICE-CHANCELLOR, Mr. GLASSE said the engine was used for pumping water to the top of the hill. None of the residents in the other houses near the works complained.

Mr. PEARSON: Because they are all occupied by vestrymen. This, he added, was to go on until the mythical artesian well was sunk and was successful. He wanted to know how long that would be. The plaintiff swore positively in her affidavit that it was a loss to her of something like £30 a week. It was a most serious matter to her, especially as the season was just coming on. She had already received notice from two persons.

Mr. GLASSE said there had been many affidavits filed which there was no time to answer. The Vestry were using the engines on a piece of land, the lease of which expired on the 30th of June. They had been working since the 1st of January, and they had never been complained of till now. If they were stopped, the supply to Richmond Hill would cease. He had a right to answer the affidavits.

Mr. SENIOR (the vestry-clerk) pointed out the position of the works on a plan. The pumps were on the opposite side of the road, but the engine was the same side as the plaintiff's house, the skating rink intervening.

The VICE-CHANCELLOR said the Vestry were entitled to have time to answer the affidavits, and he would adjourn the further hearing of the application till next motion day.

QUEEN'S BENCH DIVISION.

THURSDAY, MAY 17.

(Before Justices MELLOR and FIELD.)

REGINA v. THE COLNE VALLEY GAS COMPANY.

In this case a rule *nisi* was obtained on the 17th ult. for a new trial, and Mr. DIGBY SEYMOUR, Q.C., and Mr. CAVE, Q.C., now showed cause against it.

This was an indictment for the obstruction of a highway, and was tried before Lord Coleridge at the last Spring Assizes at Leeds, when it appeared that the defendants, who are a gas company in Yorkshire, had on two or three occasions dug trenches across a highway, near Huddersfield, for the purpose of laying down or repairing their mains. The highway in question was 8 yards wide, and it was proved that on one occasion they had dug trenches in three places, two of which were across the highway, and the third parallel to it. The trenches were 3 yards long, and were opened at night and closed at three in the morning. On another occasion some more trenches were dug, so that it was impossible to drive past along the highway, and these were kept open from eleven at night until two o'clock in the following afternoon. The case of *Regina v. The Longton Gas Company* was cited at the trial, the circumstances of which were very similar to those of the present case, and where eminent judges had held that the defendants had been properly convicted. Lord Coleridge, in summing up, directed the jury that if they thought the facts were proved they should pronounce a verdict of guilty, and he afterwards added that having told them the proper verdict to find—indeed, the only verdict they could find—on the authority of the case which had been cited, which bound them as much as it bound him, they must tell him whether they thought there was a sensible and appreciable obstruction of the highway. The jury at once found that there was, and returned a verdict of guilty.

Justice FIELD asked on what grounds the rule had been granted. Mr. WILLS, Q.C., who supported the rule, said on the ground of misdirection. Whilst the judge stated he would leave the points raised to the jury, yet in reality he left them no liberty in the matter, and they found a verdict of guilty.

Mr. SEYMOUR contended that whilst every one could use the public roads to a certain extent, no one could legally cause such an obstruction as to be a nuisance. The learned judge had adopted the only course open to him. The indictment charged the defendants with digging several trenches across the road at Milnsbridge, near Huddersfield, to the obstruction of the public thoroughfare. The trenches were about 3 yards long and half a yard in depth, and in such a way as to prevent vehicles from passing. A funeral was actually so obstructed, and the decent burial of the dead interfered with.

Mr. CAVE followed on the same side, and maintained that Lord Coleridge had left the matter to the jury properly and fairly, being controlled to a certain extent by former decisions. He said, in his summing up, if the facts laid before the jury were true, he should, as a matter of fact, direct a verdict of guilty, assuming that the acts complained of were committed by the defendant company.

Justice FIELD: Had I been on the jury I would have found a verdict against the defendant company at once. The only question is, whether it was proper for the judge to have directed the jury in the finding of their verdict.

Mr. CAVE, in concluding his argument, said the question to be decided was one of the very highest importance. Upon the decision would depend the existence of one or other of the companies. One or other of them should die; it was impossible for them to live together. This being a criminal case, the question was entirely one for the jury. The surrounding observations, therefore, amounted to misdirection, and the verdict should be set aside.

Mr. WILLS, in supporting the rule, observed that not only was the case important to the parties, but a most important constitutional principle was at stake—namely, that a defendant cannot be convicted of a criminal offence unless a jury are allowed to use their own judgment in saying whether he is guilty or not. Lord Coleridge had acted improperly in telling the jury that the case of *Reg. v. Longton* bound them as well as it did him. All the jury had to do was to say whether what the defendants had done was bad enough to render them criminally responsible. In the case of *Reg. v. Morris*, where the defendants were indicted for obstructing the public highway by the erection and maintenance of a private railway, Baron Vaughan left it for the jury to say whether the effect was to obstruct, hinder, or inconvenience the public. Lord Tenterden concurred with this, and the question of obstruction was left to the jury to decide. When addressing the jury for the defendants, he (counsel) asked them to look to the fact that what was done was done in the night time, when no one was about except policemen, and also that the trenches only existed for a short period.

Justice MELLOR agreed that there should be a real obstruction to the public convenience before an indictment would lie.

Mr. WILLS said that although there might have been a sensible and appreciable obstruction of the highway, yet, even admitting that, he would contend there was no nuisance, and upon that question alone the jury had to decide. The jury were not lawyers, they could not understand what was even a difficult matter for experts, and, listening to the latter part of Lord Coleridge's summing up, they could not come to any other conclusion but that they would be violating their oaths if they did not find the defendants guilty.

The arguments were continued on the following day. At their close, Justice MELLOR delivered judgment. He said the Court were of opinion, after the most careful consideration, and after reading the whole summing up of the learned judge, that there ought to be a new trial. They thus decided mainly on the ground that from the mode in which the case had been left to the jury, the latter may possibly have misunderstood the case of *Reg. v. The London Gas Company*, which the learned judge had told them bound them and him. When that case was examined, it appeared possible that the jury might have been misled, for the facts in that and in the present case were not the same. The judgment in *Reg. v. The Longton Gas Company* was not grounded upon the facts only, but also upon admissions which were made on both sides. It was not there disputed that the highway was obstructed, but it was contended that the defendants had a right to obstruct as they did. The learned judge told the jury in this case that he should ask them whether they thought that there was a sensible and appreciable obstruction by the defendants in the sense he had explained to them, which he had explained with reference to the Longton case. They thought, indeed, that the whole course of the case showed that the jury were so tied up with the Longton decision, which was not necessarily applicable, that the verdict was not satisfactory, and the rule would, therefore, be made absolute for a new trial.

COMBIMARTIN PETTY SESSIONS.—MONDAY, MAY 7. (Before Mr. TOMS, Chairman, and Messrs. BASSETT and NYE.)

ALLEGED NUISANCE AT THE ILFRACOMBE GAS-WORKS.

At a Special Sessions at Ilfracombe, on the 20th of March, in the case of a summons by the Ilfracombe Local Board against the gas company for causing a nuisance, a decision was arrived at that, unless certain recommendations were adopted, a fine would be inflicted at the May Combimartin Sessions.

A letter was now read from Mr. T. A. Thorne, on behalf of the local board, stating that they had withdrawn the summons, the gas company having completed the improvements at their establishment; and having in other respects complied with the requirements of the local board as to the settlement of the case, the complainants had thought it right to consent to the discontinuance of the proceedings—a course which he trusted the magistrates would not disapprove.

In answer to the BENCH, Mr. FFENCH said Mr. Thorne had seen his clients (the gas company) behind his back, and had informed them that the summons was withdrawn, and the case was, of course, in the hands of the Bench.

The MAGISTRATES concurred with the request of withdrawal.—No application was made as to costs.

CENTRAL CRIMINAL COURT.—WEDNESDAY, MAY 9. (Before the COMMON SERJEANT.)

EMBEZZLEMENT BY THE ASSISTANT SECRETARY OF THE COLNEY HATCH GAS COMPANY.

William Henry Wood, clerk, aged 23, pleaded "Guilty" to embezzling £1100, the money of the Colney Hatch Gas Company, of which he was under-secretary. He was further indicted for obtaining £463 by false pretences from Mr. Robert Higdon, but this case was not proceeded with.

Mr. POLAND prosecuted, and Mr. GRAIN conducted the defence.

The prisoner, who, before his defalcations became known, absconded to New Zealand, was sentenced to five years penal servitude.

AUDLEY GAS-WORKS.—At the last meeting of the Audley Local Board, held on the 2nd inst., plans of the proposed new gas-works at Audley were presented by Mr. Davies, gas engineer, Kidsgrove, together with specifications. These plans were considered by the board as highly satisfactory, and were adopted.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

[Extract from the Annual Report for 1876 of the Metropolitan Board of Works.]

The Board, acting in conjunction with the Corporation of London, laid before Parliament again this year [1876] the Bill for the regulation of the metropolitan gas supply, which was approved by a Select Committee of the House of Commons last year [1875], but which was prevented by the pressure of public business and the late period of the session from passing through the other stages necessary to complete legislative sanction. The Bill provided for placing all the metropolitan gas companies under uniform conditions, and it regulated the price, illuminating power, purity, and pressure of the gas to be supplied. The principal feature of the Bill, and that by which it differed from all preceding gas legislation in the Metropolis, was the provision that the profits to be divided among the shareholders should depend upon and vary inversely with the price at which gas was supplied. The rate of dividend taken as the standard was 10 per cent., hitherto the maximum rate, and the standard or initial price to be charged for gas was fixed at 3s. 9d. per 1000 cubic feet. For every penny per 1000 feet charged in excess of this price, the dividend was to be diminished by a quarter per cent., and conversely, for every penny by which the price was reduced, the company was to be allowed to divide an additional quarter per cent.

The provisions of this Bill, though opposed last year by nearly all the metropolitan gas companies, were adopted by the Commercial Company, and embodied in an Act of Parliament which that company obtained. This year the South Metropolitan Company introduced a Bill, containing substantially the same provisions, and The Gaslight and Coke Company also deposited a Bill by which it was proposed to adopt, with some limitation, the sliding scale of price and dividend; the limitation being that there should be no diminution of dividend unless the price of gas was above 4s. per 1000 feet, and no increase of dividend unless the price fell below 3s. 6d.

At the same time as the Bill of The Gaslight and Coke Company was prepared, a scheme was submitted to the Board of Trade for the amalgamation of the undertakings of the Imperial and Independent Gas Companies with that of The Gaslight and Coke Company, and, in accordance with the requirements of the Act of Parliament, a copy of the scheme was sent to the Board in order that it might express its views on the subject. The question of the expediency of the proposed amalgamation was considered by the Board from the point of view of the consumers, and the conclusion came to was that it would be inexpedient to agree to the amalgamation, unless the companies concerned should consent to be subjected to the conditions which Parliament might think right for the protection of the consumers interests. The Board of Trade having suggested that an arrangement might be come to between the companies and the representatives of the consumers, and thus the expense of another long parliamentary contest avoided, and the companies having expressed their willingness to discuss terms, a conference took place at the office of the Board of Trade, at which this Board, the Corporation of London, and the three companies seeking to amalgamate, were represented. The companies then conditionally agreed to accept all the main provisions of the Metropolitan Gas Bill approved by the Select Committee of the House of Commons last year, and the only important question left open was, upon what terms the united company should in future raise such additional capital as might be required. This question, which was not dealt with in the Metropolitan Gas Bill, and upon which, therefore, the Board and the Corporation were not at once prepared to express an opinion, was subsequently considered, and the conclusion arrived at, after conference with the Chancellor of the Exchequer and the President of the Board of Trade, was, that the new capital should be raised one-half by the issue of shares, and one-half by borrowing, and that the new shares should be sold by auction, or that tenders for the same should be invited from the public, and the shares allotted to the highest bidders.

This mode of issuing new shares had been lately adopted in the case of several provincial gas companies, and had been found to work satisfactorily. It was considered to be the best for the consumers interests, inasmuch as whatever the new shares might be worth above their nominal value would be received as premium, and applied to the purposes of the company's undertaking, and would not be treated as part of the capital entitled to dividend. The proposal of the Board and the Corporation with respect to the mode of raising capital was accepted by the companies, and it was agreed that this and the other conditions to which the united company was in future to be subject should be incorporated in the special Bill of The Gaslight and Coke Company, and that no opposition should be offered by the Board and the Corporation to the amalgamation of the Imperial and Independent Gas Companies with The Gaslight and Coke Company. The amalgamation was accordingly sanctioned by an Order in Council on March 24 last.

The Gaslight and Coke Company's Bill passed through both Houses of Parliament, and received the Royal Assent on the 11th of August. The amount of new share capital which the Act authorizes the company to create is £1,000,000. This will raise its total stock and share capital to £8,265,000. The Act also gives the company power to borrow £1,000,000 in addition to the loans already existing.

The Bill of the South Metropolitan Gas Company was referred by the House of Commons to a Select Committee, before which the Board appeared by counsel, as did also the local authorities of some of the districts supplied by the company. The provisions of the Bill were in effect the same as those of the Bill of the Board and the Corporation of London, including the sliding scale of price and dividend, with 3s. 9d. per 1000 cubic feet as the standard or initial price, and 16 candles as the illuminating power. The Select Committee, after hearing counsel and evidence, decided that, inasmuch as the company was favourably circumstanced, and was able to supply gas of 14-candle power for 3s. per 1000 cubic feet, the initial price to be charged by it for 16-candle gas should be 3s. 6d. instead of 3s. 9d. The company sought power to raise additional share capital to the amount of £250,000, and in addition to that to borrow £250,000, and, in default of any provision to the contrary, the new shares carrying with them, like the other shares of the company, the right to a standard dividend of 10 per cent., would have been allotted to the existing shareholders, and have been equivalent to the granting to them of a large money premium, as the shares could be sold for nearly double their nominal value. The Board therefore asked that the creation of the new shares should be subject to the same conditions as those agreed upon, with the approval of the Chancellor of the Exchequer and the Board of Trade, for The Gaslight and Coke Company; that is to say, that they should be offered to the public by auction or advertisement, and allotted to the highest bidders, the amount received by way of premiums being applied to the purposes of the undertaking, and not considered as capital entitled to dividend. The Select Committee decided that this course should be adopted, and clauses were inserted in the Bill accordingly. The company also obtained power to amalgamate with any other metropolitan gas company on the south side of the Thames, subject to an Order in Council being obtained in each case.

Valley, and Tottenham waters were clear and colourless; the New River and East London, clear and nearly colourless; the West Middlesex, clear and slightly yellow; Grand Junction, slightly turbid and brownish yellow; Chelsea, slightly turbid and brownish; Lambeth, slightly turbid and slightly yellow; and the Southwark, very turbid and dark brown.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Mat- ters.	Or- ganic Car- bon.	Or- ganic Nitro- gen.	Am- monia.	Nitrogen, as Ni- trates and Nitrites.	Total combined Nitro- gen.	Chlo- rine.	Total Hard- ness.
Inner Circle.								
Thames—								
Chelsea	28.20	.331	.026	0	.171	.197	1.50	18.6
West Middlesex	28.06	.289	.021	0	.207	.228	1.50	18.6
Southwark and Vauxhall	28.34	.415	.047	.001	.169	.217	1.43	18.0
Grand Junction	27.90	.309	.028	0	.192	.220	1.42	18.3
Lambeth	30.63	.255	.025	0	.263	.293	1.70	19.1
Other Sources—								
New River	27.60	.175	.010	0	.242	.252	1.52	19.1
East London	29.20	.193	.017	0	.259	.276	1.70	19.7
Kent	39.90	.054	.007	0	.392	.399	2.45	25.4
Outer Circle.								
Colne Valley	13.46	.051	.003	0	.343	.346	1.35	4.9
Tottenham Board of Health	49.34	.023	.006	.003	.598	.606	3.35	27.1
Corporation of Birming- ham *	24.60	.203	.025	.002	.237	.243	1.90	16.4
Corporation of Glasgow †	2.70	.131	.000	.000	.003	.003	.70	1.1

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of the Andersonian University, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

Major Bolton reports that the state of the water in the Thames and Lea was bad during the first half, but fairly good during the latter part of the month of April. The water in the river Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was bad during the first half of the month. The highest flood state of the river was 3 feet above the (6 feet) summer level, and the lowest was 5 inches above summer level. The highest temperature of the water taken at Seething Wells was 52°, and the lowest 44°, while the highest temperature of the air at the same place was 56°, and the lowest 42°. The condition of the water in this part of the river was indifferent on 12 days, and bad on 18 days during the month. The highest flood state was 4 feet 8 inches above, and the lowest 1 foot 6 inches above summer level. These observations were made daily at 9 a.m. The rainfall for the month was 3.0 inches.

Dr. Whitmore's report on the composition of the Thames companies and other waters supplied to Marylebone during April:—

	In Grains, per Gallon.			In Parts, per Million.		In Degrees.	
	Total Solid Matter.	Loss by Incine- ration.*	Chlo- rine.	Free Am- monia.	Albu- minoid Am- monia.	Hard- ness.	Hardness after boil- ing Fifteen Minutes.
West Middlesex	19.34	0.80	1.16	0.10	0.076	13.6	2.8
Grand Junction	20.34	0.88	1.08	0.00	0.80	14.1	3.0

* The loss by incineration represents the amount of organic and other volatile matters contained in the Imperial gallon (70,000 grains) of water; the total solid matter, minus such loss, consisted chiefly of carbonate of lime, with small quantities of equally harmless salts.

The water of both companies, as seen through a glass tube 2 feet in length, was clear and well filtered.

KENT WATER-WORKS COMPANY.—The directors of this company have given statutory notice to the Metropolitan Board of Works of their intention to bring further large portions of their district in the parish of St. Giles, Camberwell, under the constant supply system.

DEATH FROM INHALING COAL GAS.

On Monday, May 7, an inquest was held at the Essex County Gaol, Springfield, Chelmsford, before Mr. C. C. Lewis, coroner, and a jury, touching the death of a prisoner, named Charles Wright, alias William Wallman, aged 25, who died on the previous Friday in the infirmary of the gaol.

Captain M'Gorvery said: I am the governor of the gaol. The deceased was a prisoner, having been committed from Billericay, in April, for trial at the adjourned sessions, on the charge of stealing half-a-crown. He appeared to be in good health on Tuesday, the 1st inst. On the following morning, about seven o'clock, my attention was drawn to him. I went to him directly, and found he had been carried out of his cell, and was lying insensible and speechless on the deck or gallery just outside. Mr. E. Hunt Carter, the gaol surgeon, had been sent for, and came shortly afterwards. The deceased was by his orders removed to the infirmary, and he was under his care until he died, at three o'clock on the morning of the 4th inst. I saw the deceased several times after his removal to the infirmary. Each time he was unable to speak. At the time I went to his cell, on the morning of the 2nd inst., it smelt strongly of gas, although the door had then been open for some time. There is a burner in each cell. I believe the gas was lighted about eight o'clock on the evening of the 1st inst., and it should have been extinguished at nine, by being turned off outside the cell. Any prisoner can blow out the gas, but he has no tap to turn it off with. I have known several cases of prisoners blowing the gas out. When detected they are punished for it. The burner is about two feet from the floor. I have known prisoners put out the gas all along the deck by blowing down the pipe.

F. W. Butcher: I am principal warder at the gaol. It was my duty to turn on the gas on Tuesday evening, May 1, and I did so about 7.30. The process is for the warder to turn the gas on outside each cell, and pass a candle to the prisoner through the trap-door of the cell with which to light it. I saw the deceased light his gas on the evening in question, and he then handed me back the candle through the trap-door. The gas should have been turned off at nine o'clock. The prisoner could have blown it out at any time. At ten minutes past six on Wednesday morning, the warder on the deck drew my attention to the deceased. He was lying insensible, on his back, undressed. I spoke to him, but received no answer. He breathed heavily. I threw the door wide open, and ordered the ventila- tor to be opened also, as the cell smelt very strongly of gas. About three

minutes afterwards the deceased was carried out of the cell in his hammock, and laid upon the deck, and when he had been seen by the surgeon he was taken to the infirmary. It was Hill's duty to turn off the gas on Tuesday night. A warder on the deck could not smell an escape of gas in a cell if the trap-door was let down.

Alfred Hill: I am a warder at the gaol. I went on duty on the deck where the deceased's cell was at eight o'clock on Tuesday night. The gas had been previously turned on. It was my duty to turn off the gas, and to receive through the trap-doors of the cells the clothes of each prisoner. I undid the trap-door of the deceased's cell, and he put his clothes out about seven or eight minutes to nine. There was at that time a light in the cell, which was at one end of the deck. I then went to the other end of the deck, and began to turn out the gas of each cell. I cannot say whether I turned the deceased's gas out. When I came to his cell the light was out and I shut the trap-door. I did not smell any gas. On Wednesday morning, about seven or eight minutes past six, I unlocked the cell door to put the deceased's clothes in, when I found him lying on his hammock in a state of unconsciousness, and there was a strong smell of gas. I looked at the gas-tap directly, and I then found the gas turned on slightly. I believe now that I had not turned it off over night. I turned all the gas off at the main at three o'clock on Wednesday morning.

George Edwards: I am a prisoner in the gaol, and have been acting as nurse in the infirmary. The deceased was brought there on Wednesday morning, just before eight o'clock, in a state of insensibility. He was under my care till he died at three o'clock on Friday morning. He took a little strong tea and brandy as ordered by the doctor, and had every care and attention he required.

Mr. E. Hunt Carter: I am surgeon to the gaol, and was called to the deceased about half-past six on Wednesday morning, and I saw him about seven. I found him outside his cell lying in his hammock. There was a very strong odour of gas in his cell. He was perfectly insensible, and his mouth was covered with frothy matter. The respirations were 56 to 58; the skin cold, and the jaw firmly closed. He had already had some brandy. I caused him to be removed to the infirmary. I saw him several times during the day. On my second visit I noticed a large quantity of bloody frothy matter about the mouth, and the last witness told me he had bitten his tongue nearly through. I could not open his mouth. His unconsciousness remained. I last saw him about half-past six on Thurs- day evening. He was then pulseless. In my judgment the cause of death was coma arising from inhalation of gas. In a small cell like that a man would soon become giddy and insensible if the gas were on.

The CORONER said he had himself known the deceased a long time, and had always thought he was a fitting subject for an asylum.

Mr. Carter: He was certainly a man of a low type of intellect.

The CORONER said he had no doubt the opinion formed by Mr. Carter was the correct one, but from the fact that particular attention had lately been paid to inquests at gaols in the House of Commons, he would advise the jury to have a post-mortem examination made of deceased by the gaol surgeon, in the presence of an independent medical witness, in order to prevent the possibility of fault being found afterwards.

The inquest was then adjourned.

On Wednesday, May 9, the inquiry was resumed.

Dr. Carter said: I made the post-mortem examination of the body yesterday afternoon at three o'clock, assisted by Dr. Nicholls and the Messrs. Wheeler. I opened the head and chest, but found nothing unusual. The body seemed to be well nourished, but the lungs presented a very dark appearance, and were entirely congested, being gorged with blood. They were otherwise healthy. The right side of the heart was distended with partly coagulated blood, but the heart itself was healthy in structure. The stomach contained about two ounces of yellow matter, but was otherwise healthy, while the liver showed symptoms of fatty degenera- tion; the spleen was somewhat enlarged, but soft and pliable; the brain was small and healthy; one of the ventricles of the brain contained a small quantity of serum. The cause of death, in my belief, was coma, produced by the non-aëration of blood, which, after hearing the evidence, was to my mind, produced by the inhalation of coal gas.

Mr. D. Wheeler corroborated the evidence of the last witness, and stated that he entirely agreed with him.

The CORONER summed up the case to the jury, pointing it out as very remarkable that the turnkey, on passing the door of the deceased's cell after the gas was out, should not have smelt it, and that no sound should have been heard to proceed from deceased, as the frothy matter round his mouth showed that he must have died a "hard death."

The JURY returned a verdict in accordance with the medical evidence— namely, that the cause of death was the accidental inhalation of coal gas; and appended a rider to the effect that the gas-burners were not under proper control, they being unprovided with stops.

TRANSFER OF THE BLACKBURN GAS-WORKS TO THE CORPORATION.

A Special Meeting of the Blackburn Town Council was held on Satur- day, May 12—the MAYOR (Mr. W. H. Hornby) in the chair—for the purpose of considering the desirability of purchasing the works of the Blackburn Gas Company.

The TOWN-CLERK, at the request of the Mayor, explained the terms on which the Parliamentary Committee proposed to take over the gas-works. He said the members of the corporation who were present at the meeting of the council when they went into committee, would, no doubt, remember the terms which the Parliamentary Committee had then offered the gas company for the purchase of their works. At that meeting a resolution was passed that they should not go beyond the offer which they had then made, the point in difference between the corporation and the company being in respect of the C shares. The difference between them was £1, the company asking £4 on these shares, and the corporation offering £3. The Parliamentary Committee, acting upon the resolution passed by the council, did not feel in a position to make any further advance, but they wisely considered that they should be properly and well advised by some one who was well versed in matters of this nature. They accordingly consulted Mr. G. W. Stevenson, who, having inspected the works, reported very favourably upon them. The committee renewed negotiations with the directors of the company, and the following terms had been come to:—The share capital of the company consists of 6000 A shares of £15 each, fully paid up; 6000 B shares of £15 each, fully paid up; and 11,607 C shares of £10 each, but only £5 per share called up. The terms of purchase agreed upon were the payment of a bonus of £2 per share and 10 per cent. in perpetuity on A stock; a bonus of £2 per share and 7½ per cent. in per- petuity on B stock; and a bonus of £3 10s. per share and 7 per cent. in perpetuity on C stock; the remaining share capital uncalled up not to be called up. No further capital was to be called up, and the corporation had not to take over the works until the 1st of January next, but the com- pany had to work the concern for the whole of this year for the benefit of the corporation. Whatever reserve-fund there might be at the end of this year, when the balance-sheet was drawn up, would be equally divided between the corporation and the company. The Parliamentary Committee now asked them to confirm their offer. In answer to an inquiry,

the Town-Clerk said the reserve-fund, when the balance-sheet was made up last year, was £6000, but out of this amount some works which were now being carried on would have to be paid for, and the reserve-fund would then amount to about £5000. The reserve-fund had to be divided. The report of Mr. Stevenson, which we published in our last, was then read.

Mr. PARKER asked the Mayor if the Parliamentary Committee were unanimous in recommending the purchase of the gas-works.

The Mayor said there was only one man on the committee who had a doubt. He really did not see what the town had to lose by the purchase. As far as regarded the bonus of £2 per share on the A and B shares, it would, in fact, be no bonus at all. The bonuses on these shares would amount to £24,000, but the directors of the gas company said that there were back dividends due on these shares to the amount of £25,000, which they could call up from the public and pay. The corporation, therefore, were in reality not giving any bonus, because the gas company could charge the public with back dividends to the extent of £25,000. Then they were only paying a bonus of £3 10s. on the C shares, and that was in lieu of interest on money. In reality they were paying the shareholders for the prospective advantages of their shares. Of these shares there were 11,607, and £5 per share had been called up. In time to come the company would have to call up the remaining £5 per share, and they would have power to charge 7 per cent. on the whole. Instead of calling up the remaining £5 per share and paying 7 per cent., the corporation proposed to give a bonus of £3 10s. per share, and to borrow any capital that might be wanted at 4 per cent. There would therefore be no great loss to the town. The whole matter really lay in a nut-shell. If the company continued the works they would have power to pay back dividends; and it just came to this—whether it would be more advantageous to have the works in the hands of the corporation or in the hands of the company? He did not suppose that in the long run it would make very much difference; but one advantage in the corporation possessing the works would be, that the streets would not always be liable to be pulled up at a moment's notice, just at the bidding of the directors of the gas company. He therefore moved that the corporate seal be affixed to an agreement for the purchase of the gas-works by the corporation from the gas company.

Mr. BEADS, in seconding the resolution, said there was no doubt but they were proposing to purchase the gas-works at a very high price—the highest that had been paid by any corporation in the kingdom. But they were purchasing probably the most complete works ever transferred by a company to a corporation. They were proposing to pay bonuses amounting to £64,264 10s., in addition to maximum dividends on all share capital called up. They must bear in mind that there were 11,607 £10 shares, with only £5 paid, and the company had thus power to call up £58,035, on which the holders of the stock were entitled to a dividend of 7 per cent. when called up. Under the committee's agreement with the directors of the gas company, this capital would not be called up, but when money was needed the corporation would borrow at 4 per cent. Now, the difference between 4 per cent. and 7 per cent. on £58,035 amounted to £1741 per annum, which at 25 years purchase amounted to £43,525. The committee had done the best they could with the directors, who, no doubt, feeling they had a valuable monopoly, had done the best they could for their shareholders. No doubt there would be some loss during the first few years. He did not mean absolute loss. At the end of five years from the corporation taking possession of the works a sum of £5944 2s. would have to be invested annually, so that in 100 years the works would stand free of charge. Now, if the rate of gas consumption continued to increase during the next twelve years at the same rate as it had increased during the last ten years—namely 6½ per cent. per annum—the gas-works would have been self-sustaining in addition to creating a fund for their redemption amounting to over £35,600. In his opinion, nothing could prevent the gas-works being a profit to the corporation, except continuous bad trade—a calamity which would arrest the progress of the town. So far as he knew, they had no reason to apprehend this, but they might expect a steady growth of the town for many years to come. If this should be so, it was a prudent thing to purchase these works, and the generations following would be greatly benefited by what they were proposing to do that day.

The TOWN-CLERK, in answer to an inquiry, said the bonuses would be paid on the 1st of January next.

Mr. SMITH said the best thing the corporation could do was to purchase the gas-works, for there were no more substantial or better works in this country, and they would last for many generations to come. Better works could not be put together, and they had been constructed regardless of cost.

The motion was then put to the vote, and carried unanimously.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

After the reading of the report on the Aitken and Young Process, as given in last JOURNAL, page 752 *et seq.*

Mr. DUNLOP said: Gentlemen, the report which has just been read to you on this new process of Messrs. Aitken and Young is so full and complete that it leaves me, indeed, very little to say. At the outset I may incidentally mention that, for my own personal satisfaction, I took tests immediately after those taken by your committee, and my results correspond exactly with those which have just been submitted to you. However, as has been stated in that report, there are certain things connected with this new process which can only be satisfactorily tested by trials extended over considerable periods of time; as, for instance, as to whether the prolonged heat to which the tars are subjected has a tendency to cause them to pitchify, or be deposited as a char on the heated surfaces to which they are exposed; the relative quantity and quality of the tar and ammoniacal liquor from the old and this new process; the relative purity of the gases from each process, with the quantity of purifying material required, and as to whether the hydrocarbons suspended by this new process are permanently suspended in the gases and conveyed to the consumers, or whether they are in part deposited. I think the best way for me to place this matter before you is just to give you a note of my experience of the process since it was introduced into the works at Hamilton. First, then, gentlemen, so far as my experience has gone, I am perfectly satisfied that the high heat to which the tars are subjected—from 212° to 224° Fahr.—has no other effect upon them than to prevent them absorbing illuminants from the gas, and to distil from them the naphthas which they may have absorbed before reaching the analyzer. My reason for believing this will be gathered from the following facts. The bottom casing of the analyzer, from the time it was fitted up, was never perfectly tight, but as it was expected it would take up after working for some time, it was kept at work for upwards of three months; at the end of that time, seeing it was hopeless to expect it ever to be tight, I had it thrown out of action for repairs. I then carefully examined the contents of each tray and the surfaces of the heated casing-plates, and found the plates were as clean as the day they were erected, not a single particle of scale or pitch being upon them. The three lower trays contained tar, and each successive tray contained lighter and lighter tars, till, on reaching the two uppermost, only naphtha was found. With reference to the quantity of tar, I regret to say I cannot speak very

definitely, as during the period prior to the introduction of the analyzer the tar and ammoniacal liquor were sold in a mixed state, and, therefore, I am unable to state the quantities of tar and ammoniacal liquor per ton distilled; but on comparing the gross quantities produced from both processes, I find a considerable gain is shown from the new process. This at first sight may appear strange; but it is easily accounted for by the fact that the analyzer removes nearly every trace of tar, and prepares the gas to be more perfectly acted upon by the denuded water from the analyzer; whereas, when the old process was employed, a very considerable quantity of suspended tarry matter was carried forward to the first purifier, and, getting deposited on the lime, was thereby lost. Of course, there is this material difference between the tars I formerly produced and those I have now, the latter being thick, sirupy, containing little or no naphtha, and have just the appearance of what is known as boiled tar. As to what may be the relative value of the tars from the old and new processes, it would take a longer experience and a more extended application of the new process before the tars would find their level; but, from inquiries I have made, and from offers received for the boiled tar, I am satisfied that a price could be got quite equal to that received for ordinary tar. There is this further advantage in the analyzer process that a much stronger ammoniacal liquor can be obtained, as the gases, being prevented from giving up their ammonia in the analyzer, enter the bottom of the scrubber in a condition capable of giving a strong liquor. I have next to refer to the amount of lime required by this process. In respect of purifying plant, the Hamilton Works are rather badly placed. There are only four purifiers, eight feet square, to pass nearly 140,000 cubic feet of gas in 24 hours, necessitating in mid-winter the changing of two purifiers daily, and further, as both the coal and shale give off a very considerable quantity of CO₂ and H₂S, the lime account is rather high. The make of gas also increased very rapidly during the 12 months ending April last. The make for the year 1876 was over 22 million cubic feet, while for the year ending April, 1877, it was upwards of 25 millions. The increase having taken place principally during the winter months, burdening the already deficient purifying power to a greater extent, one would have expected it would have necessitated an increased quantity of lime per 1000 feet of gas purified. On looking over my books, however, I find this not to have been the case, as from the superior manner in which the gases have been prepared for purification by the analyzer process, although the make was three millions more than last year, nearly the same quantity of lime has been used—viz., for the year ending April, 1876, 170½ tons; and for the year ending April, 1877, 172 tons, showing a saving of 12 per cent. This now brings me to speak of the permanency of the naphthas which have been diffused through our gas. And I believe, had we only made the same quantity of gas this year that we did last, we should have saved upward of 20 per cent. of our lime. I am fully satisfied, from experiments I have made at the works and at the distant testing-station, that our gas is just as permanent as, if not more so than when made by the ordinary process. The only difference which I can detect between the old and this new process is, that what little naphthas we have to pump from our gasholder drip-boxes are neither so great nor so heavy, or dark and tarry, but are quite pale and transparent; and I believe this small quantity of hydrocarbon liquid falling from the gas to be due to the water accompanying it in a solvent manner, causing it to deposit. I may also state that for a short time I made a series of experiments with the hydrocarbon or water-gas process, by fitting up one of my ovens in the manner explained by Mr. Young at our Greenock meeting last year. The results showed that a very large yield of gas could be got per ton of bituminous coal distilled, but that it would not pay to employ this process when coal could be got as cheap as at Hamilton. The gas was perfectly regular in quality, and I believe, when coal is high priced, the water-gas process could be practically wrought by the analyzer condensing arrangement, and to a substantial profit. I have no doubt that many of you will be surprised at the great gain in illuminating power resulting from the small quantity of naphtha vapours added to the gas. I confess, at first, I could hardly believe it possible; but experience and experiment soon convinced me that it was substantially true. Had time permitted, I should like to have given you the results of those experiments—perhaps at some other time I may be permitted to do this; in the meantime, I may briefly state that I believe the cause to be due to the greater density of the naphtha vapours, and the high per centage of carbon in their constitution. I will close by reading an extract from a paper read by Professor W. Dittmar, at the meeting of the British Association in Glasgow last year, showing the wonderful difference in the amount of light given by adding different hydrocarbons to hydrogen, the only difference being that the carbon in the one was in a much more condensed state than in the other. (See JOURNAL OF GAS LIGHTING, vol. xxviii., p. 669.)

Mr. PEEBLES: I beg to state that I think the labours of this committee deserve our very best commendations. What I observe in connexion with this report is the great honesty of purpose that seems to pervade the whole of it. The experiments have been gone into in the most intelligible way, and with a direct aim at truth. There is no mystery whatever to be seen in connexion with it. I have had something to do with inquiries of this sort, and I must say there was always some little thing that was under the rose which could not be got at—something that was hardly ready to be seen, and that, if we would wait a little longer, it would all be made clear. I remember visiting East Barnet, when Dr. Eveleigh's process was going on. At that time it was involved in a good deal of mystery, and I think that any one who takes up Dr. Eveleigh's process will see that the Doctor's imagination went a long way. At last, however, the bubble burst, and the poor unfortunate shareholders came to a bad end. With this process it is different because we see one of its projectors objecting to the results brought out by people appointed to conduct the experiments, on the ground that these experiments were of too satisfactory a description. Instead of making the best use he could of this report, he would not be satisfied until the experiments were gone over again. That speaks volumes not only for the honesty of purpose of the inventors, but also for the method which the committee adopted in conducting these experiments. I have always thought, since first I heard of this process, that it would be remarkably efficient, and ultimately, I have no doubt, it will turn out to be all that is expected. I am pleased to have had such an intelligible account of it, and I think this investigation should form a precedent for future investigations—that there should be an entire absence of the mysterious. Everything should be fair and above-board, and every facility should be given by gas managers for everything being seen. This has been the case here, and I think Mr. Dunlop deserves our best thanks for the facilities he has given to the committee to see and to go so thoroughly into this matter.

Mr. STEWART (Greenock): The committee did me the honour to ask me to assist in this matter, and I would like to say a word or two. Between the first and the second table there is a considerable difference in the amount of the sperm value, and that may lead to some questions. I think, however, I should say that everything was done in a most careful manner, notwithstanding the difference arrived at. Perhaps it would be well if Mr. Young would point out the reasons which occur to him accounting for that difference, because if that table should go before the public without an explanation accompanying it, an erroneous impression

might be formed in regard to the value of the invention. I would also have liked to have tried some experiments with second-class coals by themselves, as it would have been interesting to see the results arrived at. I have no doubt, however, but that there would be considerable increase in the sperm value per ton of coal, or, in other words, increased average illuminating power. Further, I would suggest whether it would not be an advantage, in case of works making a large quantity of gas, to have two or more analyzers, so that in summer time, when the make of gas is small, one analyzer only need be used, to avoid the risk of making the tar pitchy, which there would be a probability of if the whole analyzer power were employed as during the time of maximum make. I should like that some persons would ask questions, so that the whole process may be discussed. I may say that the experiments were openly and fairly conducted, and if explanations are wanted, now is the time, so that there may be no after-talk or disappointment.

Mr. YOUNG: I rise with great pleasure indeed to make all the explanations within my power in regard to the trials made at the Hamilton Gas-Works. In the first place, I may be allowed to explain that preliminary trials, to ascertain whether or not there was anything in the process, were first conducted at Causewayhead, where there were small works erected for the purpose of testing the material made by the Mackenzie process. We altered these works so that we could roughly test this process, and we found considerable gain. But as I could not very well devote my time to conduct the experiments at Causewayhead, at the desire of Mr. Aitken I erected a small experimental apparatus at the works at Clippens. Of course, I am quite aware that results got from a small experimental apparatus are not to be depended on, but they give comparative results. The average result of these experiments was a gain of something like 15 per cent. in the illuminating power. In all cases we had a gain, sometimes greater and sometimes less, dependent upon the nature of the coal, but invariably the gain was greater where mixtures of rich and poor, or common, coals were employed. Mr. Mitchell, now of Coatbridge, was my assistant during these experiments, and he can substantiate my statements. When the experiments were entered into at Hamilton, I made it a point to stay away, and to leave the committee unbiased in their judgment. They made experiments and obtained results, and submitted those results to a meeting of the committee, at which I was present. After hearing the report, I rather thought that there had been a mistake—that an error had crept in somewhere, as the results were higher than I had got, and higher than I expected them to be, and, I believe, were above what the average of results will be; but, at the same time, I am satisfied that the results brought out by the second table will be obtained. Midway between the two tables, perhaps, will be something like what is to be got by working third-class parrot coal with shale. I have thought over the matter, and the only way in which I can account for the extra high results you will notice in the first experiments, is that heavier charges were used in the retorts, and that a smaller yield of gas per ton was produced, and consequently the likelihood of greater production of naphthas. Further, the temperature of the surrounding atmosphere was higher, which would enable the gases to hold in diffusion a greater quantity of those naphtha vapours so produced; for, as you all know, even when the ordinary process is employed, the gases during the warm weather are always richer from a given quality of coal than from the same coal during the winter months. Indeed, the gases will take up during the warmer months of summer the volatile hydrocarbons which may have been condensed and deposited in the gasholder, &c., during the winter months. On the other hand, during the later experiments the charges employed were much lighter, and the heats higher; consequently, as shown by the table, there was produced a larger volume of gases, and also there would be, for the same reason, a smaller quantity of undecomposed naphthas. Further, during these latter experiments, the weather was very much colder, to the amount of some 15 or 20 degrees; therefore the gas would be unable to take up and hold in diffusion such a large volume of naphtha vapours. The difference in the quantities of naphthas is not indicated by the table, but this may be from the fact that it is difficult to get a fair average sample of the tars from this new analyzing process, because the whole of the trays of the analyzer are filled with tars varying in character, the bottom trays containing tars nearly entirely denuded of naphthas, and resembling what is known as boiled tars; the upper trays, on the other hand, containing pure naphthas, the whole amounting to something like four or five tons. It will, therefore, be quite evident that, before a fair average sample of the tars could be got, it would be necessary to work the process for such a length of time as would completely fill the whole of the trays of the analyzer. There was also a longer period of time between the second set of experiments, and, as already explained, it requires this process to be worked a considerable time before accurate results can be got, in consequence of the washer, &c., being charged with naphthas, which would be taken up by the ordinary gases were the ordinary process immediately to succeed that of this new analyzing process. I therefore think that the second set of experiments are more to be relied upon than the first. Perhaps, as I have already said, if you strike a mean between these two tables, you will arrive at what would be the actual results from this new process. There is one other result in the table on which I would like to make a few remarks—that is, though the low illuminating power of the gas produced by the ordinary process of a mixture of Camp parrot and shale there indicated should have given a gas of something like 25-candle illuminating power, yet, as indicated by the table, the result by the ordinary process is only 23.30. I am satisfied this is easily accounted for by the burner. To make certain that it was the same burner which was used through the whole of the experiments, it was marked. At the conclusion of the experiments I had that burner tested, and I found that it gave results very much inferior to a first-class burner. However, our results here are only comparative; but we are certain they are relative, because they were all done with the same burner and the same candle. That is the explanation I have to make, and if there are any further questions to be asked, or information I can give, I will be most happy to give it. We are most anxious to get this process thoroughly tested, because, if it is "humbug," as Mr. Brodie characterizes certain things, it will fall to the ground; but if there is anything in it, I am sure it will fight its own way.

Mr. MITCHELL: I have spent many valuable hours with Mr. Young in experimenting with this and other processes. From the table shown there is a great saving effected on the two processes. The experiments at which I assisted were mostly with the water gas, and the results with the analyzer process were marvellous. So much am I convinced of the advantage to be derived from this process, that in laying down the ground plan for new works at Coatbridge, I have made arrangements to have the analyzer erected.

Mr. HALL (Berwick): I think it would have been much better if the coals had been kept equal, because the difference in illuminating power might arise from the mixture. Shale, as those who have experience in working it know, has a greater illuminating power than splint. An analysis of each of these coals might have been given in the tables, as stated by some analytical chemist, showing the difference between the illuminating power of the coals as received from the pit, and the results by the analyzer, and then we could have seen the difference.

Mr. STEWART: The per centages of coal are precisely the same, although the quantities are different.

Mr. YOUNG: I may be permitted to mention this, further, that the figures in the tables are founded not on results made with coal worked for the purpose of giving the best analytical results. We all know that the analysis of coal which is supplied to us is, as a rule, not the actual yield got in practical working. What we have tabulated here are the actual results obtained by the commercial working of the coal in the same retorts, passed through the same scrubber, the same purifier, the same meter, and stored in the same gasholder; the same photometer, the same candle, and the same instruments were employed in ascertaining the illuminating power—the only difference being the modes of condensation; so that we have exact comparative results of the coal. We all know that shales and coals are variable far more than the difference in the per centage of results given by the tables; but the coals and shales were in the work in bulk, and the tables now show the comparative results of the actual work, and not what might have been obtained in a laboratory experiment. There were 15 retorts employed, and they worked 36 hours on the one occasion, and 48 hours on the second occasion.

Mr. SCOTT (Musselburgh): I have no doubt the process is a good one. What we want to do in distilling the coal is to make the gas serve the public, and make as much profit to the companies as we can. I believe that that process and another process which has been in operation, if thoroughly carried out, would be the means of enabling gas companies or corporations to meet the high demand of later years for wages and the increased price of coal. What I would like to know is, whether this process demands more care on the part of the workman, and does it compensate for the new apparatus which requires to be introduced? I should like also to know whether it involves additional duties to the superintendent. I have had a process working for some time, and I am perfectly convinced that it is a profitable process if it is accurately carried out; but with my process I have experienced some difficulty in doing this. I had not only to teach the men to work this process, but I had also to unlearn them the process they had previously been accustomed to. This I experienced some difficulty in doing; but to satisfy myself as to its value, old as I am, I have stood 36 hours at a stretch. I may state this process has entailed considerable extra care upon me, and I am not so able for it now as I once was; but I am sure, if in the hands of a young energetic man, it would become a success. Now, I want to know, can this new process be conducted easily, and to the same advantage?

Mr. DUNLOP: I may say I have never had any trouble in attending to the analyzer since it was introduced. The steam is turned on at the analyzer by an ordinary steam stopcock, and it has not been touched for months. The temperature applied to the tars in the analyzer depends upon the pressure of the steam. We have a pressure of some 20 lbs. on our boiler; but even if the pressure were only 10 lbs., I do not think it would make very much difference, provided there was a temperature of over 212°. In my opinion, at this temperature you can liberate most of the naphthas from the tars permanently suspendable in the gas. By using proper proportions of coals, I have found that we can suspend the whole of the naphthas produced with the gas, leaving the tars with scarcely a trace of naphtha in them; but during the course of last winter, to keep up my supply, I had to use for a short period of time a superior quality of coal, and I found that then the gases were not able to carry away the whole of the naphthas, and that the tars always contained more or less of them. Where steam-boilers are used, there is no additional expense, except that of generating the steam, which is very little.

Mr. KIRKLAND (New Cumnock): Would steam or fire be best? Could it not be done with fire without steam?

Mr. YOUNG: Well, this process, of course, is just in its infancy, and we cannot say what will be best; but we know that both fire and steam will answer the purpose, provided the temperature does not go above a certain point, and is not allowed to get below a certain point. I believe it could be worked perfectly by using the spent heat from the retort-ovens, and conducting it under the analyzer to produce the necessary temperature inside the analyzer, because it is, to a certain extent, self-regulating. This will be easily understood when I explain that this new analyzing process consists essentially of two processes—namely, a condensing and a volatilizing one; the lower portion, where the heat is applied to the tars, being the volatilizing one, and the upper being the fractional condensing one, and the relative amounts of condensation and evaporation may be modified in extent. Thus, suppose that the extra heat is applied to the tars in the lower half of the analyzer, and an extra evaporation be produced, it will be evident that the colder surface of the upper part of the analyzer will condense and return a larger quantity of cooled liquid to be revolatilized, and that, on the other hand, if there is a lessened volatilization in the lower half of the analyzer, there will be a smaller quantity of recondensed liquids returned to the lower heated trays, and consequently less heat expended. In this way, it becomes, to a certain extent, self-regulating. The keeping up of the temperature by steam is a simple process. If you keep a constant pressure of steam on the boiler, you will have a fixed temperature applied to the tars, and, so far as I have seen, it requires no attention whatever. In regard to the remark of Mr. Dunlop, I have to say, if you use coal giving 36-candle gas, the gas will not carry away the naphthas, because when gas of this character is manufactured, there will be produced from 7 to 10 per cent. of naphthas, and that is more than the gases are able to carry away in diffusion. Hence the reason why, with a good coal, we endeavour, by employing a higher heat, to decompose part of those naphthas and utilize them to carry away a further quantity of fluid—liquid—in the shape of permanently diffused vapour, or employ the gases from some other poor coal to carry these vapours.

The PRESIDENT: I have to reply to a few questions. First of all I have to thank Mr. Peebles for his kind remarks on the endeavours of the committee to bring forward a report of their investigations in as plain a manner as possible. Mr. Young referred to the quality of the gas being better by reason of the temperature. The secretary read a portion of the report bearing on that subject, which explains itself. Mr. Young also referred to the difference between the results of the first and the last tests. During the tests in October we had fine sunny weather, but during the later tests there was no sun, but severe frost, and as much as six inches of snow on the third testing. The temperature in the hydraulic main was from 180° to 190° during the first test, and during the second test it was only from 160° to 170°. That was not caused by the absence of the sun, but by a new arrangement made with the retorts. Three additional retort-ovens had been erected, and the retorts were working at each end of the hydraulic main, so that there would be 30 or 40 feet of the hydraulic between the benches, distributing the heat to that extent. The temperature of the analyzer, which is outside, exposed to the rays of the sun and the effects of snow or frost, was during the former trial from 220° to 230°, and during the latter from 214° to 224°. In reference to Mr. Hall's remarks, it does not require much calculation to show that 289 and 44 is the same proportion as 269 and 40½. The statement of the result which we got by the ordinary process is far more reliable and preferable to put before you than an analysis from any chemist analyzing gas coal. In reference to

Mr. Scott's remarks, I may say that we did not experience nor did we see any difficulty or trouble in managing the analyzer. It is a simple, self-acting thing if you keep the tars at the proper temperature.

Mr. M'GILCHRIST: Perhaps, if the report were printed, and managers had time to consider its contents, they would be better able at next meeting to put questions in reference to any difficulties which might suggest themselves. I move that the further discussion of this subject be adjourned till next meeting.

Mr. NELSON: I support the view of Mr. M'Gilchrist, on the ground that one cannot put a question on the spur of the moment, nor can another be expected to answer it. I think this is a valuable matter. The process has been backed up by the evidence of those for whom I have the highest respect. I am further glad that I was here to see the charitable manner in which the process has been received. I endorse every word that Mr. Peebles has said, and I think the spirit in which this report has been received is just the spirit in which reports of this kind ought to be received. Therefore I support Mr. M'Gilchrist's motion, and second the vote of thanks to the committee, proposed by Mr. Peebles.

Some discussion followed on the question of adjourning the debate on the report, which ended in an invitation to members to put further questions in the meantime.

Mr. A. BELL (Gibraltar): I am sorry I did not hear the paper read. It is of interest to us abroad, where our secondary products are of no use. Not only can we not get anything for them, but we have to pay for their destruction. Has the process ever been tried with English coal?

Mr. YOUNG: No; except experimentally. English coal, however, very much resembles in character ordinary Scotch coal, and it gave a per centage of increase equivalent to the naphthas in the tar. In fact, the process is based on the fact that gases have the power of taking up the naphthas which are ordinarily distilled from the tars, in the process of refining the tar into its various products—that is, if you take the tars resulting from a ton of coal, and distil them, you will get something like a third, or, perhaps, two-thirds, of a gallon of naphtha, dependent on the character of the coal, and, if you present this isolated naphtha to the gas which was derived from the coal, the gas will take up that naphtha, and hold it permanently in diffusion, showing conclusively, I think, that the tar, during the process of condensation, had such an affinity for the naphthas that it denuded the gases—took the naphthas from the gases to itself. Therefore the whole process is based on the simple volatilization of the naphthas by the gases, and I believe in warmer climates it will be of great advantage, because there the gas has the power of carrying a larger volume of vapour than with us, and, I suppose, at Gibraltar, where the average temperature is 70° over the year, you will have a larger volume of naphthas in your gases than here.

Mr. BELL: Is there no danger of pitchifying?

Mr. DUNLOP: I think I can testify to that. Mr. Brodie, who was inside the analyzer, can tell you that there was no appearance of such a thing, and that was after the analyzer had been working for perhaps four months.

Mr. BRODIE: I was inside the analyzer, and there was no pitch about it. I believe, from the questions which have been put, that there are a number of members who imagine that there is some difficulty in working this process. An ordinary steam-boiler, with a safety-valve, and a cock to turn on the steam, are all that are required, and the management of these present no difficulty to a man who can change the purifiers.

Mr. BELL: Does it absorb the naphthaline?

Mr. YOUNG: That is an experiment we have not tried; but we intend to try whether it prevents a deposit of naphthaline in the mains. I believe it will be a complete cure for that. It is customary, where naphthaline is giving trouble, to take naphthas that have been distilled from the tars—pour them into the mains, and they remove every trace of naphthaline. By this process we get gases to carry away the naphthas produced with the tars, and not only so, but a portion of the heavier naphthas, which are not suited for being permanently diffused, are left in the upper trays, and as they flow back over the wire gauze from the first tray, the whole of the gases that pass through that gauze come in contact with these naphthas, and they, having a strong affinity for naphthaline, the naphthaline is carried down or, in other words, washed out of the gas. Therefore I believe it will remove that great nuisance, naphthaline, from the English gases.

Mr. KIRKLAND: You use water as well as steam to wash it?

Mr. YOUNG: We use no water. Of course, water condensed in the upper trays is steamed back, and in streaming back over the wire gauze of the other trays it becomes denuded of its ammonia, and, as it has already been saturated with hydrocarbons, it has not the same tendency to take up the naphthas from the gas that ordinary pure water would have. We, therefore, use it as the washing liquid in the scrubber.

Mr. KIRKLAND: Would the heated air from the retorts not have something of the same effect?

Mr. YOUNG: Heated air would have the same effect, provided it was sufficiently high to volatilize the naphthas.

Mr. BRODIE: If you had fire instead of steam between the space at the bottom of the analyzer, would it not have a tendency to pitchify more than steam?

Mr. YOUNG: I do not think it would, to any extent. I am satisfied that the water, intimately mixed with the tars, falling on the heated plates, would become volatilized. Consequently, the tars would be kept in circulation and prevented from pitchifying. I can further speak practically as to the likelihood of this action, from experience gained in making our dead oils for lubricating purposes. We have to allow them to flow into a still heated to a high temperature—a temperature above that which would allow the oils to be dangerous in use—and all volatile oils are distilled out, and the heavy oils allowed to flow away from the still by a self-acting overflow, and we pass many thousand gallons through this arrangement without a single trace of deposit on the plates; and we work for months at a time by keeping the oils constantly flowing there.

At this stage Mr. M'Gilchrist's motion was agreed to, and the further discussion adjourned.

The subsequent proceedings of the Association will be given in next number.

ASHBOURNE GAS SUPPLY.—The local board of Ashbourne have resolved to take the necessary reasonable steps for the purchase of the gas-works, and the clerk has been directed to write to the directors of the company to inquire whether they are willing to sell the works, and, if so, to state the price which would be required.

SOUTHERN DISTRICT ASSOCIATION OF GAS MANAGERS.—A meeting of this Association was held at the Bedford Hotel, Southampton Row, London, on Thursday, the 10th inst. Mr. A. H. Wood, of Hastings, presided, and there was a large attendance of members. After some preliminary business, and the election of new members, a very useful paper was read by Mr. Hunter, of Woolwich, "On the Distribution of Coal Gas." This was followed by an animated and practical discussion, lasting until the close of the proceedings, when the further consideration of the subject was adjourned until the next meeting. A vote of thanks was given to Mr. Hunter for his paper.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

All branches of the iron and steel trades have remained quiet during the week, and in some instances there has been a further slight diminution of the amount of work in hand. This has been the case, for the most part, with the iron-works in this immediate neighbourhood, which are chiefly devoted to the production of merchant and ordinary commercial iron, neither of which meets with any demand at present, although prices are down to the lowest possible limit. This may be readily assumed when it is stated that common bars of this district are quoted at very little over £6, delivered either in Liverpool or Manchester. The various classes of pig iron, too, have been easy in price, and are not meeting with any increase of demand. On the contrary, there is now a very quiet sale for the several leading brands of North Lincolnshire pig, not only in respect of forge, but as regards foundry brands. Throughout South and West Yorkshire these brands ordinarily sell very well, but at the present time the call is of the quietest, and such deliveries as are being made are almost exclusively in completion of contracts entered into some time ago. The deliveries hereabouts, too, of Northamptonshire ores are small, although several local concerns are directly concerned in the working of some of the mines there. One local company, however, have given up the area they had leased, the product of the ore being much poorer than had been anticipated.

At several of the collieries, both in Derbyshire and Yorkshire, disputes exist between the miners and their employers on questions affecting reductions from the present rate of wages, which vary, according to local conditions from 2s. to 2s. 9d., for coal-getting. There is not, up to the present time, any general reduction announced, but I believe that such a step is "on the cards," and that the coalowners, as a body, will before long make an effort to get rid of the 5 per cent. which is still paid in excess of the 1871 wages. At some of the steam coal pits there is much more business doing now than the whole of the Baltic and Northern navigation has become freed from ice. Gas coal is also in rather better request, and contracts are being tendered for at 6s. to 8s. 6d. per ton at the pits.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Trade has been tolerably steady in this district, and what with the Whitsuntide holidays and the threatend strike in West Lancashire, which has been postponed for three weeks, there is every probability of a considerable interference with the local supplies of coal coming into this market, and consumers have naturally been anxious to provide against contingencies by getting in some extra stocks. Higher prices are not being asked, but sellers are generally firm, and it is not at all unlikely that an attempt may be made to obtain some small advance, although any material increase in prices is not probable. Colliery proprietors are now, in some cases, sending out tenders for gas coal; but I fancy there will be, as last season, a good deal of hesitation in settling as to price, as, from what I can learn, consumers are expecting to place their contracts on more favourable terms than coalowners are at present prepared to agree to. The better class of round coal for house fire purposes still meet with a fair demand; common coal is not quite so difficult to sell. Good burgy is also steady, whilst slack continues scarce, and in some quarters an advance is talked of for next month. The average pit prices are about as under:—Good Arley, 9s. 6d. to 10s. 6d. per ton; Pemberton four-feet, 8s. 6d. to 9s.; common coal, 6s. to 7s.; burgy, 5s. to 5s. 6d.; and slack, 4s. to 4s. 9d. per ton.

The notices for the reduction of 10 per cent. in miners wages in West Lancashire, which ought to have expired on Thursday last, have been temporarily withdrawn to enable one or two districts, which were previously holding back, to join in the general action, and the fresh notices will expire in the first week of June. The masters appear to be now more united, and as the men have resolved to resist the reduction, there is every prospect of a struggle for several weeks.

The iron trade continues very depressed, and some of the local makers of pig iron have given way to the extent of about 1s. per ton; but they are still being undersold by makers from other districts. The average quotations for Lancashire pig iron delivered into the Manchester district are 53s. to 56s. per ton for No. 3 foundry, 53s. to 54s. per ton for No. 4 forge, less 2½ per cent. The finished iron trade is very slack, and some of the works are being closed for a greater part of the present week for the holidays. Quotations are without material change, and remain at £6 11s. 6d. to £6 17s. 6d. for bars, according to quality, delivered into the Manchester district.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The gas coal shipments from the Tyne for May are quite as heavy as during the previous months of the spring. The less quantities sent coastwise are compensated by the larger shipments abroad, now that the Baltic is fully open to trade. A good business in the shipment of gas coals was effected last week at the Tyne Dock. Now that summer has really set in, the inquiry for house coals shows a slight falling off, but there have been a good few small coasting orders in the market for gas and house coals. The dispute in the steam coal trade is still unsettled; the notices served upon the pitmen by the masters have a week to run. If some arrangement is not made in the meantime a strike will occur undoubtedly, but most people in the North are sanguine that affairs will not be driven to such an extreme. The matters in dispute, it is hoped, will be settled by arbitration, as usual.

Freights are pretty firm coastwise; they are quoted at from 4s. 6d. to 4s. 9d. for steamers to load coal for London. The Channel and east coast are pretty much about the same in tone. There has been a recovery of about £2 a keel on Mediterranean outward coal rates; the quotation is £20 Genoa, and £20 to £21 Alexandria. Freights generally will keep pretty steady for the remainder of the month, as there is not an excess of steam tonnage in the coasting ports.

The iron trade of the North, it is needless to say, is in a quiet condition. Political affairs were in a more unsatisfactory condition upon the Continent last week than previously, as the change of ministry in France introduced another element of disturbance in them. Trade upon the Continent is highly sensitive, and merchants decline to enter into any business except for immediate requirements.

The chemical markets continue in the same dull state as has characterized them for some time. No improvement is expected while the war continues. It is reported that some manufacturers intend closing their works on the Tyne, as present prices are so unremunerative.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At the last meeting of the Greenock Corporation Gas Commissioners it was reported that the amount of gas made during last month was 10,213,600 cubic feet, being an increase of 66,300 cubic feet on the same month of last year. Some time ago Messrs. M'Cowan and Biggart, the public analysts of Greenock, gave the results of some experiments they

had made with the view to test the quality and illuminating power of the Greenock gas. These were published after being submitted to the Police Board, and provoked some criticism from Mr. Stewart, the manager of the works, and from Dr. Wallace, of Glasgow. At the meeting just referred to, a letter from the analysts was submitted, stating that while they had every respect for Dr. Wallace as a chemist and as an authority on gas, they could not accept his opinion as in any way affecting the truth of the analyses they had made, and they failed to see how the results of their experiments as on Dec. 27, 1876, ought to be affected by an analysis made by Dr. Wallace on the 9th of March, especially as this was not an examination of the Greenock gas, but merely an analysis of their (Messrs. McCowan and Biggart's) analyses.

At the last meeting of the Town Council of Rothesay, held on Monday, the 14th inst., it was reported by the Gas Committee that, while the town was increasing in extent and population, the manufacture of gas had decreased 62,000 cubic feet during the month of April, as compared with the production in the corresponding month of last year. A conversation ensued as to the cause. The decrease has ruled since February, and at a previous meeting, Bailie Montgomerie gave it as his opinion that it was owing to the superior illuminating power of the gas got from a high-priced coal. Another member at last Monday's meeting said that there was more than the dear coal the cause of the decrease; the people were poorer, and did not burn so much gas. The committee were instructed to inquire into the cause.

At the instance of the Police Commissioners of Johnstone, a letter has been addressed to the gas company of that town, intimating their desire to negotiate for the transference of the concern to the Commissioners. Mr. McDowall Garthland, the chairman, has replied that he will place the application before the shareholders. A similar step has just been taken by the Police Commissioners of the burgh of Alloa, and it would almost seem as if the two towns were determined to have a struggle for the honour of being the first to take the full benefit of Sir Windham Austruther's Gas Act. In the meantime they are both in advance of Dumfries.

The annual general meeting of the Innerleithen Gaslight Company was held on Thursday week, when it was resolved, on the recommendation of the directors, to declare a dividend at the rate of $7\frac{1}{2}$ per cent. per annum. A balance was carried forward to the reserve-fund.

It is reported that considerable improvements are in contemplation in connexion with the works of the Helensburgh Gas Company, in order to secure the production of good gas on the best and most approved principles, and a hope has been expressed that, when these improvements take place, the company may see their way to still further reduce the price of gas, and even to raise the quality.

A dividend of 5 per cent. has just been declared by the Aberfeldy Gas Company, and the price of gas has been reduced from 9s. 2d. to 8s. 4d. per 1000 cubic feet.

From the annual report of the Street Lighting Association of Alexandria, Dumbartonshire, which undertakes the lighting of the streets on the voluntary principle, it appears that out of 1091 ratepayers no fewer than 325 do not subscribe anything in aid of the object. The subscriptions for the past season raised in the village amounted to £52 8s. 6d., which did not suffice for doing the work satisfactorily, and the collecting of which, the committee affirm, was a most disagreeable duty. The report recommends that some more equitable way of raising the needful expenses be adopted. In particular it suggests the desirability of adopting some of the clauses of the Burgh Act. A public meeting of the ratepayers is about to be held for the consideration of the matter.

A Dundee journal says that electricity is probably destined to supersede gas as the lighting system of the future, and that another important step has just been taken in its progress to that consummation, the builders of the Tay Bridge having obtained by means of electricity a light equal to that of 2000 candles at a cost of 7d. per hour.

The £1 shares of the Lanark Gas Company, Limited, were recently sold by auction at 21s. each, whereas about four years ago only 10s. or 12s. could be obtained for them. Evidently the Russian electric candle is not regarded with fear amongst the Lanark speculators in gas stock.

It was reported to the Greenock Water Trust last week that the total quantity of water stored in their various reservoirs on the 5th of May amounted to 491,796,382 cubic feet, or 140 days supply for all purposes, which is an increase on the quantity in store at the same date last year.

On the 7th inst., the quantity of water in store for the supply of Glasgow was as follows:—In the lochs, 108 days supply; in Mungdock reservoir, 17 days supply; in Gorbals reservoir, 117 days supply—in all, 242 days supply. The quantity of water sent into the city and suburbs during the preceding fortnight was 34,170,000 gallons per day. The revenue collected up to the date just mentioned was £124,925 11s. 2d., as against £120,089 3s. 4d. at same time last year, being an increase of £4836 7s. 9d.

At a meeting of the Burgh Commissioners of Bathgate, held on the 14th inst., it was resolved to borrow £6000 from the Public Works Loan Commissioners to carry out the new water scheme, which is now commenced.

The Corporation of Galashiels have been granted a loan of £40,000 by the Public Works Loan Commissioners, for the execution of the new water-works, at the rate of £4 13s. 4d. per cent. per annum (for fifty years) the same to liquidate both principal and interest.

On Thursday last, a committee of the local authority of the parish of Beath, in Fifeshire, met a deputation from the Police Commissioners of Lochgelly, for the purpose of considering the propriety of entering into a combined scheme for supplying the different villages in the parish with water along with Lochgelly. The plans submitted met with the cordial approval of all present.

The case of *Edington and others, Glasgow, v. The Dundee Water Commissioners*, was again up before Lord Curriehill, in the Court of Session, last Wednesday. It was adjourned in April last for the evidence of Mr. Leslie, of Edinburgh, and Mr. John Page, of Glasgow, who was the inspector for the pipes under Mr. Stewart. At the close of the sitting, it was agreed that the debate upon the evidence, which is expected to last two days, should begin next Thursday.

At a special meeting of the Perth Water Commission, held last Monday, it was agreed to withdraw further opposition to the water Bill, on the ground that the Police Commission take over the Bill at present and carry it out. It is understood that if the Police Commission refuse to do so, the Water Commission are determined to oppose the Bill, and they consider that such refusal would strengthen their opposition. At a joint meeting of the Water Commission and Committee of Ratepayers, held on Wednesday, it was agreed to inform the promoters of the water Bill that, in the event of their allowing the names of the present Police Commissioners to be inserted as First Commissioners, all opposition would be withdrawn.

On Friday last the Edinburgh and District Water Trustees made their annual excursion to examine the works in progress in connexion with the new supply of water from the Moorfoot Hills.

During the past week there was a reduction of 1s. per ton on the price of pig iron warrants in the Glasgow market, and makers generally have reduced the prices of their special brands 6d. and 1s. per ton. The closing

quotations for warrants last Friday were—sellers, 54s. 3d.; and buyers, 54s. 2d., cash.

The local coal trade is very dull, and the demand for house coal will be reduced still further, owing to the advent of warm weather. The shipping department is not busy. In some few instances the miners have got back the 6d. that was taken off their day's wages some time ago.

BIRMINGHAM WATER SUPPLY.—Dr. Hill, the Medical Officer of Health for Birmingham, reports that the water supplied to that town during April, was clear, and exhibited a very marked diminution in the amount of organic matter.

GLASGOW WATER SUPPLY.—Dr. Mills, of the Andersonian University, Glasgow, reports that the water supplied to that city from Loch Katrine, last month, was almost colourless. It contained suspended particles and some hairy matter, and a minute trace of iron.

BRIGHTON CORPORATION WATER-WORKS.—The statements of account for 1876, just presented to the council, show a surplus of revenue (£28,034 4s. 4d.) over expenditure (£25,420 10s. 5d.), amounting to £2613 13s. 11d. The items on the expenditure side included "Izard's defalcations, £159 17s. 5d." The committee resolved that £2000 of the surplus should be transferred to the borough fund, and that the balance of £613 13s. 11d. be invested in Three per Cent. Consols, and carried to the credit of the contingent-fund.

FALKIRK JOINT-STOCK GAS COMPANY, LIMITED.—The following is a summary of the report submitted by the directors of this company to the annual meeting of shareholders on the 15th inst.:—"The directors beg to submit the usual balance-sheet of the company's affairs for the year ending May 15, 1877, from which it appears that a net profit of £913 13s. 6d. has been earned for the year. This result is considered satisfactory. The directors recommend that a dividend of 5 per cent. on the extended capital of the company should be paid to the shareholders at the Bank of Scotland, Falkirk, on the 1st of June next, free of income-tax. The directors would anticipate even a more favourable result next year, seeing that the large new gasholder, which the company are at present erecting, will be ready for use during the ensuing winter."

LEEDS CORPORATION GAS-WORKS.—At a meeting of the Gas Committee, on Thursday last, Mr. Woodall, the gas engineer, presented a report (accompanied by plans), in which he recommended the extension and renewal of apparatus at the York Street works, at an estimated cost of £5200. The recommendations included the erection of four purifiers, 30 feet by 20 feet, one scrubber, 60 feet high, and one Körting's steam-jet exhauster to pass 80,000 feet of gas per hour. Mr. Woodall affirmed that by means of these alterations he would be able to add considerably to the producing power of the works by rendering effective 60 retorts which had been previously out of use through the inadequacy of other apparatus. He also expressed his confidence that fully 30 per cent. per annum would be realized upon the proposed expenditure through more economical working consequent thereon. The committee adopted the whole of the engineer's requirements, including the erection of other two 60-foot scrubbers at the Meadow Lane works, at a further cost of £5000.—*Leeds Mercury.*

GAS EXPLOSION IN SOUTHWARK.—On Tuesday morning, May 15, shortly after 7 o'clock, an explosion occurred at the branch office of the London Joint-Stock Bank, situated near London Bridge, and at the corner of Southwark Street and High Street, Borough. The porter engaged at the bank had occasion to go down into the cellar to procure some coals, having a light in his hand, when suddenly an explosion of gas occurred. Every sheet of plate-glass in the windows and doors on the ground floor was broken, and the force was so great that the iron revolving shutters covering the windows were wrenched from their fastenings. At the time of the explosion a large number of market gardener's waggons were near the spot, and a boy named Elijah Herd was blown into the roadway and run over by a vehicle. Several persons who were passing at the time were also injured.

LIVERPOOL GAS-FITTINGS COMPANY, LIMITED.—The first annual meeting of this company was held on Tuesday, the 15th inst., at the offices, Duke Street—Mr. James Lister, deputy-chairman, presiding. The report and balance-sheet showed that upon a capital of £10,000, in £1 shares, fully paid up, there had been a profit during the year of £1636 4s. 9d., out of which the directors recommended that a dividend be declared for the year of 10 per cent., free of income-tax, leaving a balance of £636 4s. 9d. to be carried down to meet any contingencies that might occur from the large amount outstanding, the item "Sundry debtors" on the credit side of the balance-sheet amounting to £5704 9s. 4d. The chairman, in moving the adoption of the report and accounts, said he hoped they would prove as satisfactory to the shareholders as they were to the directors. Mr. J. A. Tinne seconded the motion, which was carried unanimously. The dividend recommended in the report was then declared. Sir Thomas Earle, Bart., and Mr. James Lister, the retiring members of the board, were re-elected, the remuneration of the board, which consists of five members, being fixed at £100 a year. Mr. D. O. Bateson was re-appointed auditor, with a remuneration of £10; and thanks having been voted to the chairman and directors for their satisfactory management of the affairs of the company, and duly acknowledged, the proceedings terminated.

RICHMOND (SURREY) WATER SUPPLY.—At the meeting of the Select Vestry on the 15th inst., a letter from the Local Government Board was read, enclosing a copy of a petition addressed to them, signed by 68 inhabitants of the parish, on the subject of the present water supply. The letter requested that the Board might be furnished with the observations of the vestry on the subject. The petition alleged that the temporary supplies drawn from surface sources would be almost, if not entirely, dried up in hot weather, while the others were quite insufficient to supply the wants of the town, and, after quoting Professor Atfield's analysis of the water, referred to the works in Petersham Meadows, with respect to which the following remarks occurred:—"Your petitioners cannot but regard the action of the vestry in drawing water from the Thames near Richmond, where the river is tidal, and the water contaminated not only by the sewage matters which are brought down from Kingston and other places above Richmond, but also with a vast quantity of such matters which are brought up from London by the flow of the tide—the tidal water, as it flows up, being thick and highly discoloured—as being most deleterious, and calculated to cause epidemics of a serious character, and to be fraught with much danger to the inhabitants of Richmond, more especially if such water is used for any domestic purposes, as it is apprehended may be contemplated by the vestry; but your petitioners submit that even if such water is used for watering the roads, such use may cause much harm and much sickness to result to the inhabitants from the bad smells which must necessarily accompany its use in hot weather and otherwise, from its very nature." The petition further asserted that some considerable time must elapse before the permanent works were completed, and urged that the offer of the Southwark Company to the Kingsbury Committee to supply water into the reservoir at 9d. per 1000 gallons ought to be accepted by the vestry. In conclusion, the petitioners prayed that the Local Government Board would be pleased to take such steps as to them might seem expedient to compel the vestry of the parish of Richmond to furnish an ample supply of pure water to that parish immediately, which, as the Urban Sanitary Authority of such parish, that body had undertaken to do.

SUPPLEMENT

TO THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

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No. 732.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MAY 14, 1877.

The Examiners reported that no further Standing Orders are applicable to the Alliance and Dublin Consumers Gas (Bray Supply) Bill; and that the Standing Order applicable to the Gas and Water Orders Confirmation (Abingdon, &c.) Bill has been complied with. The latter Bill was then read a second time.

TUESDAY, MAY 15.

The Examiners reported that no further Standing Orders are applicable to the North Cheshire Water and Stretford Gas Bills.

The Stamford Water Bill was reported, without amendment.

The Carnforth District Water, Kent Water, and Leeds Improvement Bills were read a second time and committed.

The East Worcestershire Water and Rotherham Corporation Bills were read the third time and passed.

The Longton Corporation, Middlesbrough Corporation, and Sittingbourne Gas Bills were read the third time, with the amendments, and passed.

The Ashton-under-Lyne Gas, Coatbridge Gas, and Perth Water Bills, brought from the Commons, were read the first time, and referred to the Examiners.

THURSDAY, MAY 17.

The Rotherham Corporation Bill received the Royal Assent, by commission.

The Examiners reported that no further Standing Orders are applicable to the Newport (Monmouthshire) Gas Bill.

The following Bills, brought from the Commons, were read the first time and referred to the Examiners:—Ashton-under-Lyne Improvement; Bolton Improvement; Colne Gas; Croydon Commercial Gas; Dukinfield and Denton Local Boards of Health; Epsom and Ewell Gas; Heywood Water; Leicester Gas; Newcastle and Gateshead Water; Ramsgate Local Board; Sunningdale District Water; Thanet Gas; Wakefield Gas; Wakefield Improvement.

The Alliance and Dublin Consumers Gas (Bray Supply) Bill was read a second time and committed.

The Londonderry Gas Bill was read the third time and passed.

The Warrington Corporation Gas and the Maryport District and Harbour Gas Bills were read the third time, with the amendments, and passed.

HOUSE OF COMMONS.

MONDAY, MAY 14, 1877.

The Ashton-under-Lyne Gas, Coatbridge Gas, and Perth Water Bills were read the third time and passed.

The following Bills, as amended, were considered:—Bolton Improvement; Colne Gas; Croydon Commercial Gas; Epsom and Ewell Gas; Heywood Water; Newcastle and Gateshead Water; Ramsgate Local Board; Sunningdale District Water; Wakefield Improvement.

The Leicester Gas Bill, as amended, was considered, a clause added, and amendments made.

LOWESTOFT WATER, GAS, AND MARKET BILL (LORDS).

Mr. RAIKES, on Friday, May 11, presented the following special report from the committee on this Bill:—

“The Bill empowers the company to make new service reservoirs and other water-works, and to raise an additional capital of £80,000 for those purposes and the general purposes of their undertaking. The undertaking combines water-works, gas-works, and markets, of which the principal and more costly part are the water-works. The capital is not separately apportioned amongst the different parts of the undertaking, but forms one entire fund applicable indifferently to all the purposes of the company. The company have never paid a higher dividend than at the rate of 2½ per cent. per annum on their ordinary stock, which is saleable only at a heavy discount. Under these circumstances, the committee did not consider it necessary to insert the auction clauses required by the Standing Orders to be inserted in the case of gas companies applying for an increase of capital.”

TUESDAY, MAY 15.

The Bridgewater Corporation Water and the Burslem Local Board Bills were reported.

The following Bills were read the third time and passed:—Ashton-under-Lyne Improvement; Dukinfield and Denton Local Boards of Health; Thanet Gas; Wakefield Gas.

The Bristol United Gas Bill, as amended, was considered.

WEDNESDAY, MAY 16.

The Bishop Auckland District Gas Bill, as amended, was considered.

The Glasgow Corporation Water Bill, as amended, was considered, and amendments made.

THURSDAY, MAY 17.

The Lords amendments to the Edinburgh and District Water Bill were agreed to.

The following Bills were read the third time and passed:—Bolton Improvement; Colne Gas; Croydon Commercial Gas; Epsom and Ewell Gas; Heywood Water; Leicester Gas; Newcastle and Gateshead Water; Ramsgate Local Board; Sunningdale District Water; Wakefield Improvement.

The East Worcestershire Water Bill (Lords) was read the first time, and referred to the Examiners.

The Reservoirs Bill, as amended, was considered, a clause added, and amendments made.

HOUSE OF LORDS COMMITTEE.

TUESDAY, MAY 1.

(Before Lord MONTEAGLE, Chairman; Earl MANVERS, Lord DELAMERE, Lord KENRY, and Lord SHERBORNE.)

LONDONDERRY GAS BILL.

(Continued from p. 745.)

Mr. S. Gilliland, examined by Mr. HAMILTON.

I have been for a long time a member of the Corporation of Londonderry, an alderman of the city, and also a member of the Harbour and other boards. I have had conversations with a great many ratepayers on the subject, and I never yet heard a person objecting to this Bill being opposed, with the exception of three or four members of the corporation. From representations made to us, I believe that mains are laid in the whole of the extended portion of the borough. There is a large amount of building ground between the point to which the mains are laid and the gas-works, but that land is being very rapidly built upon. In my opinion there is no necessity for any considerable extension of the mains. The town is very old, and some of the streets are very steep. The corporation wish to preserve the control over those streets, as they have always had. The gas company have never been prohibited, to my knowledge, from opening the streets for laying mains, or any other purpose. The corporation complain of the price charged for the street-lamps.

Mr. LITTLE objected to the question, on the ground that there was no reference to street-lamps in the petition.

The CHAIRMAN said there was a general allegation.

Mr. LITTLE said he should have to call evidence to contradict.

Examination resumed: The charge used to be £3 per lamp, but it has been raised at different times, and is now £4, which we think excessive compared with other towns. I am aware of the negotiations which were carried on as to the purchase of the concern from the company by the corporation. On that occasion, there was no allegation on the part of the company, or of their solicitor, that the corporation were not in a position to pay. They agreed in committee to sell to us, and we agreed to purchase from them.

Mr. HAMILTON: Then the point on which you split was this: You were willing to give them the value of the works as they stood; but they wished to have the value enhanced by passing this Bill?

Witness: We were not aware of the advantages they would gain by the Bill at the time we agreed to purchase the works from them. We subsequently advised the corporation not to carry out the agreement, inasmuch as we received information that it would be prejudicial to the ratepayers to allow them to borrow this money, and get the advantages arising from it; that we should have to pay for all that. The agreement would have been carried out but for that. We are quite willing to purchase them now as they stand.

The CHAIRMAN: I thought you said you were informed it was advisable not to buy?

Witness: To buy the works as they stand; not to give them the advantages of the Bill. If they will withdraw the Bill, and the notice served on them yesterday morning—

Mr. LITTLE: We cannot agree to do that now, as we shall have to call a meeting of shareholders, and all that sort of thing.

Mr. HAMILTON: The council came to a resolution to purchase the works before the Bill was committed?

Witness: We have been thinking of purchasing the works for a considerable time. What retarded that purchase was, there were certain gas proprietors in the corporation, and they used every effort to induce the other members to go with them and support their Bill, and not to go with us and oppose it.

The CHAIRMAN: Those gentlemen did not vote?

Witness: After having applied to them, as a matter of propriety, not to vote, they still continued to do so. After they desisted voting, we called a special meeting of the corporation, and we had ten who voted for the motion. None of the other gentlemen appeared, although I was present when it was proved that they were regularly summoned to attend. Two gentlemen attended, one of whom signed a requisition to purchase the property; and the other gentleman stated he would vote for the purchase, although he had opposed it before. That made twelve. One other gentleman never interfered in the question from the commencement, and he is a non-gas proprietor. You will see that only left four of the corporation, who, at all events, did not signify their intention, by coming here, to vote for it. As I have stated, at a consultation, we were authorized, and we are here as a deputation from the corporation, to negotiate by arbitration at this moment for the works.

Mr. HAMILTON: With your acquaintance with the city of Londonderry, and the facilities the corporation have had for borrowing, and knowing their present financial position, what sum of money could you get, and at what rate of interest?

Witness: From the evidence given by the solicitor for the Bill, I think it necessary to explain very shortly how we happen to be £3000 in debt. The water-works in Derry were held, under the Ecclesiastical Commissioners, at a rent for 21 years. The lease expired last summer, and we had notice to quit if we did not purchase the works. I was on the deputation to Dublin to purchase the works for £2500 or £2750. We had no authority at that time, and we have an application now to Government, and they have agreed to grant us a separate rate of £15,000 to improve the

water-works and sewerage for the town, and so forth, and we anticipated getting the loan by drawing on the funds of the corporation, and paying for these water-works. They threatened to cut off the supply, and leave the town without water, and for this the corporation owe that £3000. I believe more than half of it will be collected in the rates now due.

Mr. HAMILTON: Have you any doubt you could borrow the money at 4 per cent.?

Witness: There have been far more applications to us all through; we do not want the money. People think the best security of all the public boards is our corporation. In attempting to purchase the works, we never thought of purchasing them on the security of the gas-works; we intended to give the security of the rates over and above what we now owe—about £30,000. We think if the gas company can pay 10 per cent., and capitalize as much as they have done, we ought to have as much as can pay off that if we borrow the money. We hope to get it from the Government, as Belfast did, for 35 years. They have a sinking-fund to pay it off in 35 years, and we propose to do the same, and we are ready to do it.

Mr. HAMILTON: In point of fact, there would not be the slightest difficulty in paying for the works?

Witness: We believe there would not be the slightest difficulty. We have paid off punctually every year. Our sinking-fund is £1750, and there is also the money we get from the Irish Society. That goes to the Mayor, who gets £300 a year, and we get £500 a year towards the rates of the city.

Mr. HAMILTON: What you object to is that this company, with the gas-works in their present perfect state, should be proposing to raise £24,000 for which there is no immediate or prospective use?

Witness: There is another view. Though these shares are to be sold by auction, they do not relieve our ratepayers if they are bought at high prices.

A MEMBER OF THE COMMITTEE: The extra price paid on the shares will reduce the rate. Suppose a share of £20 is sold for £40, the additional £20 will go to reduce the expenditure.

Witness: Who is to pay the interest on that?

The MEMBER: The ratepayer who is saved the £20.

Witness: I do not understand it in that way. I understood that they sold at double the price—a £100 share would sell for £225, and the man who bought at that £225 would expect to get his interest on the whole money.

The MEMBER: He would get the same as the other on the £100.

Witness: That would be 5 per cent., and they would still be paying 10 per cent. on the original £100 shares.

Mr. HAMILTON: They propose to divide 7 per cent. on the £24,000 which, if they did not want, would simply keep up and add to the price of gas?

Witness: They could borrow it at 4 per cent., no doubt of that.

Mr. HAMILTON: Your only object is to reduce the price of gas to the citizens—do you think you could do that?

Witness: That is not our only object. As a corporation we are empowered to light the city, and it is our bounden duty to oppose this Bill.

Cross-examined by Mr. LITTLER: I do not think the company require any more money. If I had any doubt on the subject, the evidence given by the engineer, and what I know from my own knowledge, would convince me.

Mr. LITTLER: Do you believe Mr. Stevenson when he says we want £5000 for a gasholder?

Witness: I would not venture to say; but from the description I have heard of the works you do not require a gasholder. I am aware that at the present moment the company have the power to charge what they please; but we might be in a position to get up a competing company, although it would be an extreme point to do so.

Mr. LITTLER: Do you know all the power we ask is to break up the streets under your control? Do you know that, under the Gas-Works Clauses Act, before we can touch a street we should have to obtain the consent of your surveyor?

Witness: You have to serve a notice three days before, but not to get consent.

Mr. LITTLER: Listen to what we are obliged to do. "No such street or bridge," and so on, "shall be opened except under the superintendence of the officer, and according to such plan as shall be approved by such officer." What more do you want?

Witness: I do not know what more we want. We do not want the control of the streets taken out of the hands of the corporation.

Mr. LITTLER: But that gives you the control.

Witness: I did not think it did.

Mr. LITTLER: Then you came here under a misapprehension?

Witness: I came here under the misapprehension that they wanted to open the streets on serving the notice, and that we have no power to prevent them. I have tried an experiment in gas-making myself, and found it successful at the time, although I had only from 20 to 30 lights; but when the town was extended, and the mains were laid, instead of keeping up the retorts, which certainly did not pay for 20 or 30 lights, I took gas from the company. We have one or two gentlemen in the corporation who could manage the gas-works.

Mr. LITTLER: Do you think you could manage the gas-works better than the company.

Witness: They have been managed very well. I know that at Kingstown the charge for the lamps was £3, but the commissioners there thought it was too high, and they now burn by meter. I do not know that the lamps there are put out at twelve o'clock at night. At Coleraine they are put out on moonlight nights, which would make an alteration in price of about one-eighth. I do not know how many thousand feet one of the lamps consumes, because the gas company would not give us the information. I have made several speeches in the corporation on the subject of the gas question, in one of which I stated that the company had been making 400 per cent.; but I made a mistake at that time, although I never wrote to the newspapers to correct it. The company had added £32 per share to their original shares, and that was what was running in my head at the time.

Mr. LITTLER: If they had not added that they could have put it into their own pockets?

Witness: They could have done what they pleased.

Mr. LITTLER: It is not that the £10 shares are worth £40, but calls have been made which brought them up to £40?

Witness: I have heard to-day, for the first time, that there was a call of £3.

Mr. LITTLER: Do you know there were 400 shares of £27 10s. created in 1865?

Witness: And they are selling at £40.

Mr. LITTLER: What did the ratepayers subscribe out of the £27 10s?

Witness: The ratepayers did not subscribe anything, but, in order to pay the interest on the capital, the ratepayers are charged it. I was talking about the original stock of the company, and that led me to make the observation about the 400 per cent. I meant four times the amount, and I will admit I made an error in that statement, but it was not done intentionally. The statement was so absurd that people would not believe it; they would imagine it was a mistake by me or the press. I cannot tell why the debt of £1000 to the gas company is allowed to remain so long,

but it is not for want of means; it was an amount which was owing by our predecessors. The gas company have not asked us for it, or it would have been repaid. I do not imagine the gas company can borrow at 4 per cent., although the corporation can. The citizens of Derry are willing to buy the works at their full value. If the arbitrators said the value was £80,000 we should be bound to pay it if we could do so. We should have all the rates to offer as security, except £1800. We should not need to stop paving, lighting, sewerage, &c., because we believe the gas-works would be more than self-supporting. I do not believe there has been one shilling of the rates expended wastefully.

Mr. LITTLER: The half year's rate only amounts to £3600?

Witness: The rates, I understand, from the returns we have, amount to £12,000 a year.

Re-examined by Mr. HAMILTON: If an agreement is arrived at between the corporation and the company, we shall be prepared to apply for an Act next year for carrying it out.

Mr. W. Thompson, examined by Mr. HAMILTON.

I am an alderman of the city of Londonderry, and have been a councillor of the city for 29 years. I have made myself acquainted with the opinion of the ratepayers, as to the expediency of opposing the Bill of the company, and that opinion is that the corporation should purchase the works of the company, as they consider the gas could be supplied cheaper. There would not be the slightest difficulty in obtaining the necessary funds for the purchase. We are now getting money cheaper than we have done before. The difference in freight between Belfast and Derry is about 1s. a ton against Derry, while the difference in the price of gas is 2s. per 1000 feet. The mains are laid to the extent the houses are built; but between those houses and the gas company there is a great deal of building ground, which will be built upon in some years, although that will cost the company no additional outlay to connect with the mains. There is only a very small portion where the mains do not reach. I object to the company increasing their capital by £24,000, as it is quite unnecessary, and would tend to keep up the price of gas.

Cross-examined by Mr. LITTLER: I do not think that the whole of that £24,000 will be required during the next 15 years. I heard one engineer say the works were so complete that they will last for two generations.

Mr. LITTLER: And the same engineer said that an expenditure of £5000 was immediately required; do you believe one statement and not the other?

Witness: I do not know; but one statement does not agree with the other, I must confess.

Mr. LITTLER: You talked about the price of coal in Derry and Belfast. Do you know the manufacture of 1000 feet of gas in Derry costs what they charge for 1000 feet in Belfast?

Witness: The Derry Company must manage their business very badly if at Belfast they can supply gas for what it costs in Derry. The difference in freight is only 1s., and I am sure those who have the management of gas in Derry can buy coal as cheaply as the Belfast people. The larger the consumption of gas the cheaper it can be made; and the evidence we have heard before the committee is that Derry is progressing very fast, and the consumption of gas is rapidly increasing.

Mr. LITTLER: When we get a larger consumption we are bound under the Act to lower the price?

Witness: That would be a blessing; but I was astonished to hear that residuals in Derry only brought one-third of the value of the coal, whereas in other places they bring more than half. I do not know whether the gas company sell at the best price they can get. I have complimented the present managers of the gas company, I must confess. There are no men of higher position and honour; but they have taken power to raise the price of gas, and their successors may not be so generous. Some time ago I proposed a plan of arbitration if the public were aggrieved about the quality of the gas. I would much rather the gas company had met the corporation in a more liberal spirit, than have put us to the trouble and expense of opposing them.

Mr. LITTLER: Did it not occur to you that the company might be aggrieved by your putting them to the expense of coming here?

Witness: It is their own fault. Our proposition was to modify the Bill, which they have done. The company's offer originally was 14 candles, but before they left Derry they agreed to give 16. I am glad to hear the sliding scale is to be introduced, and if the committee give us the power to purchase I shall be satisfied.

Mr. W. Ellis, examined by Mr. HAMILTON.

I am a Town Commissioner of Coleraine, the gas-works in which town are managed by commissioners. The price of coal in Coleraine is 2s. per ton dearer than at Derry, as we are about six miles inland. The cost of coal in Belfast is about 1s. per ton more in winter than in summer, because the passage is heavier through the Channel. The population of Coleraine is between 7000 and 8000, which is much smaller than in Londonderry. The price of gas in Coleraine is 5s. 10d., but we have a motion on the books to have it reduced to-day to 5s. We should have reduced the price last year, were it not that an excessive amount was taken from the gas-works to apply to other purposes of the town, and that reduced the working capital and the plant; we were, therefore, obliged to apply the profits of the last two or three years to keeping up the works in good and efficient order. If the Londonderry Company managed their works properly, they could buy their coal as cheap as Coleraine can; the only difference would be in the freight. The coal from the Wigan and Lancashire districts will contain as much gas for Belfast and Derry as for Coleraine. If the carbonization is good, it will produce equal results; for the condition in which the works are described to be in, they should produce gas as cheap as Belfast, and cheaper than Coleraine. We light the public lamps cheaper in Coleraine than they do in Londonderry. We charge £2 10s. per lamp. They are extinguished for something like three months in the summer for the very short nights, and sometimes they are extinguished full moon nights a little earlier.

By the CHAIRMAN: The £2 10s. includes finding the lamp-posts, and keeping the lamps in order, glazing, painting, extinguishing, and lighting. The gas is made of Wigan coal, which is capable of producing about 14-candle gas, and we have only used a small proportion of cannel for the last two years. I have no means of testing the gas.

Examination resumed: We have no complaints from the public just now. Our tar we sell at Belfast by contract at 1½d. per gallon delivered. What is sold locally fetches 4d. per gallon. We produce 16 to 17 gallons per ton of coal on an average. From my knowledge of the price of materials and other local circumstances, I think 5s. 9d. is an exceedingly high price for Londonderry. I hope before another year is over we shall reduce the price at Coleraine to 4s. 6d.

In commencing his cross-examination, Mr. LITTLER read a lengthy report made by Mr. Newbigging as to the condition of the gas-works at Coleraine, pointing out several defects, and suggesting several alterations. Among other things he complained of the leakage being so high as 24 per cent., whereas it ought not to be more than from 10 to 12 per cent. He also stated that the sale of gas per ton of coal carbonized amounted to only 6500 cubic feet, which he attributed to defective carbonization on the one hand, and excessive leakage on the other, although there was no reason why, with improved working, the company should not sell 8000 cubic feet per ton, which was a very moderate computation.

Witness said there were many gas-works in a much worse condition than Coleraine. He also stated that he had sent circulars to a number of towns, asking for information on gas matters.

Mr. LITTLE: Have you got the price in Timbuctoo?

Witness: I have several here, and you shall have them.

Mr. — Darcus, examined by Mr. HAMILTON.

I have been Mayor of Derry on six occasions, and three times sheriff for the city and county. For myself and others I represent one-twentieth of the rateable property of Derry. I oppose the Bill on account of the price charged for the gas, which is much more than it should be. The public lights are our great bone of contention. We have had them raised from £3 to £4, and we do not know when they may be raised again. Each rise of £1 means an expense of £500 to the city. If the corporation became the purchasers of the gas-works they could supply the town cheaper, because we should save all the profits they make. As a corporation we are not personally concerned, because we should get nothing for our trouble. I have not the least doubt we could borrow the money for the purchase at 4 per cent., thus giving the town the advantage of 6 per cent.

Cross-examined by Mr. LITTLE: There is another Mr. Darcus in the corporation—a son of mine—who was formerly in favour of the gas company's Bill passing, but who has now changed his opinion.

Mr. LITTLE: Seeing you get your rating increased, is it proper for you to complain of the public lights?

Witness: We do complain of them, because we have no control; you can charge what you like. It might be an advantage for us, under the Gas-Works Clauses Act, to be able to go to arbitration as to price, but I was not aware that was in the Bill.

Mr. LITTLE: Do you know what Parliament has put into Bills when corporations and companies have agreed to a purchase?

Witness: Yes; it is arbitration.

Mr. LITTLE: No, it is 25 years purchase of the maximum dividend—whether it is 10 per cent. or 7 per cent.; and 25 years purchase of 10 per cent. on £36,000 is upwards of £80,000. You would not like it on those terms?

Witness: I would not like to give more than the value.

Mr. LITTLE: Supposing the value is put at £90,000, would you like to go back to Londonderry and tell the public you bought the works for that amount?

Witness: I should not, but whatever Parliament has stated to be fair, we must say is fair. We ask the protection of the committee that we shall not be subjected to the caprice of those who come after the present directors.

Mr. LITTLE: But that is what we have come here to do for you—to place ourselves under parliamentary control—so that you can regulate the quality of the gas, and compel us to give the proper pressure, and supply your lamps on arbitration terms. What do you want more?

Witness: We want to get the gas without the profit being added to it. I am not aware whether we have any gas engineer present to give evidence. We came here to give evidence which we considered sufficient, without going to any expense.

Re-examined by Mr. HAMILTON: It does not require a gas engineer to tell the difference between 5s. 9d. and 3s. 9d.

Mr. J. Greg, examined by Mr. HAMILTON.

I am solicitor to the Corporation of Londonderry. Under the authority of the Londonderry Improvement Act of 1848 the corporation borrowed £40,000, one-fortieth to be repaid each year. The net assessable property in the borough was then £36,400. In 1855 the Improvement Act of that year authorized a further sum of £10,000 to be borrowed, the net assessable value being £38,371. In 1864 a third Act was obtained, which authorized the corporation to borrow a further sum of £20,000, at which time the net assessable value of the property had increased to £49,903, and in the ten following years it had increased to £62,000 in round numbers. During all this they have been paying off a sinking-fund of one-fortieth part. The total amount now owing is about £22,000. I have obtained my information from the town-clerk's office. The corporation have never experienced any difficulty in obtaining what money they required at 4 per cent. I have had thousands of pounds offered for them over and over again, which they could not take. It is considered one of the first securities, and the interest being regularly paid is a great inducement for people to invest in it. If the corporation obtained the gas-works, that would be an additional security.

Cross-examined by Mr. MICHAEL: During those periods of increase we have taken in a large area of excess over the former area of the borough, and with that additional area we have additional burthens to bear. [Witness was cross-examined at some length as to the financial position of the corporation.] If my advice had been taken, a gas engineer would long ago have been appointed to value the works.

Mr. HAMILTON said that was the case for the corporation.

WEDNESDAY, MAY 2.

Mr. J. Macnie recalled, and examined by Mr. LITTLE.

Our charge for the public lighting is £4 per lamp. First of all we have the wages for lighting, the cost of maintaining and cleaning, and so forth, and the interest on the cost of the plant, which is all the property of the company, before we can arrive at the cost for the gas. We put down those items at 16s. 6d. per lamp, which is not an unreasonable amount. We have applied a few test meters, and find the quantity consumed to be 14,000 cubic feet, which is charged for at the minimum rate to any consumer.

Cross-examined by Mr. CRIPPS: The whole of the plant belongs to the company, who do all the lighting, the corporation having nothing to do beyond paying the money.

Mr. CRIPPS, in addressing the committee on behalf of the Corporation of Londonderry, pointed out that the corporation, in endeavouring to purchase the works, were following the precedent of recent legislation. In England, corporations had, in a great many instances, become proprietors of gas-works, but he did not know whether it had been largely or generally followed in the sister country. The company, however, declined to sell till they came to Parliament, and upon the evidence of their own witnesses, if they obtained their Bill, the value of the works would be increased by at least five years purchase. There was no necessity for the additional capital, and if it were allowed to be raised, the price of gas would, consequently, be increased to the consumers. The witnesses for the company could not show that they wanted more than £2500 for extensions and improvements, for he put out of the question Mr. Stevenson's statement that £5000 was necessary for a new gasholder, the manager of the company having made no reference to that. At present the company were going on very well, and there was no complaint of a deficiency of gas. What, then, could the necessity be for an extension of the company's capital, except to obtain borrowing powers that would greatly augment the selling price of their property? Then, again, it was stated that power was wanted to break up the streets; but the corporation had never interfered with them in doing so; nor had it been shown that the new capital asked for would in any reasonable time in the future become necessary. Negotiations for the purchase of the works were broken off through the company determining to apply to Parliament, and if the Bill were now rejected, these

negotiations would be resumed. There could be no question as to the ability of the corporation to pay. Why, if the corporation were unable to pay, did the company enter into negotiations with them with a view to purchase? The only explanation of the suggestion was to be found in the hope that a great accretion in value would result from the passing of this Bill. A large portion of the capital of the company, described as original, was made up of profits coming out of the concern, and upon such profits, amounting to £12,000, only 5 per cent. could be authorized, while, no doubt, they were entitled to 10 per cent. on the remainder. It was to be recollected that, if statutory powers were given to the company, competition would be made very difficult. Hitherto the company were wisely contented to make no great show of profits, and thus kept competitors out of the market. In the Bill promoted by the Metropolitan Board of Works for obtaining all the bridges in London, for the purpose of doing away with tolls, it was held that the value of the bridges was the value of the tolls levied in respect of them, and that the structural value was not an element of the value. In the same way the structural value of the gas-works could not be considered apart from the income derivable from the works. By the Standing Order just agreed to, the auction clauses and sliding scale were to be introduced into all gas Bills, requiring that the shares should be put up to public sale, and that the dividend should increase as the price of gas to the consumer was decreased.

The CHAIRMAN: Do you want the sliding scale put into the Bill?

Mr. LITTLE: We have consented to insert the sliding scale.

Mr. CRIPPS contended that the capital powers and the initial price of 5s. 9d., which the company asked to be allowed to charge, would be in conflict with the purpose of economy and cheapness of production aimed at by the recent Standing Order. Considering the price of gas in Belfast, it was out of the question to allow 5s. 9d. to be charged in Derry. The actual price charged in Derry at the present time was 5s. per 1000; but if the initial price of 5s. 9d. was allowed, the company would pay £12 5s. per cent. on their shares—£2 5s. on each share more than they were allowed to divide before. It was never contemplated that companies should commence with such an advantage. In conclusion, the learned counsel asked their lordships to reject the Bill.

The room was then cleared. On the parties being re-admitted,

The CHAIRMAN said the committee considered the preamble of the Bill was proved, the only point to be particularly considered on the clauses being the initial price.

The consideration of the clauses was then proceeded with, in the course of which

Mr. HAMILTON asked to have the dividend on the £12,000 reduced to 5 per cent., that amount being profits.

The CHAIRMAN: We could not entertain that.

On clause 52A, with reference to the standard price,

Mr. LITTLE complained that the corporation had embarrassed the inquiry by not producing a gas engineer on their side. Under all the circumstances he argued that the company ought to have 10 per cent. on the original capital of £36,000, and to secure that an initial price of 5s. 9d. would be required.

The CHAIRMAN inquired the price of gas in Belfast?

Mr. HAMILTON replied it was 3s. 9d.; and, not only had the Town Council of Belfast reduced the price of gas, but upon that reduced price they had carried over £7000 profit on the production of gas. For twenty years, excepting the coal famine year, the company had charged no more than 5s. per 1000.

The CHAIRMAN, after consideration, said the committee would unanimously allow the price of 5s. 9d. to stand.

Mr. HAMILTON submitted a clause enabling the corporation to purchase the works at a valuation, and obliging the company to sell.

Mr. LITTLE objected on the ground that Parliament had never, under any circumstances, entertained a Bill for compulsory purchase, and still less had they ever inserted clauses for compulsory purchase against the will of the promoters.

The CHAIRMAN: We unanimously refuse to allow this clause.

The other clauses were then agreed to, and

The CHAIRMAN announced that the Bill would be reported to the House.

HOUSE OF COMMONS COMMITTEES.

WEDNESDAY, APRIL 25.

(Before Mr. SANDFORD, Chairman; Mr. LANBERT, Mr. HANBURY, and Sir HUGH CHOLMELEY; Mr. BONHAM-CARTER, Referee.)

ASHTON-UNDER-LYNE GAS BILL.

ASHTON-UNDER-LYNE IMPROVEMENT BILL.

[The following is a full report of the last day's proceedings in committee on the above Bills, an abstract only of which appeared in last number, page 749.]

Mr. MICHAEL, in resuming his address on behalf of the Corporation of Ashton, said he was endeavouring to show the previous day that, under the operation of the Act which had governed the company up to the present time, there was no interest remaining beyond the payment of the maximum dividend; and, further, that the maximum dividend being secured to a company, owing to the fluctuating character of the trade they had to carry on, and the contingencies that might occur, they would be better off than at present if the maximum dividend were secured to them upon such security as the borough of Ashton-under-Lyne had to offer. It had always been said, in cases where it had been proposed to transfer a gas undertaking to an urban sanitary authority, that it would be unfair to take away from the gas shareholder the advantage of the prospective profit given him by the operation of the Companies Clauses Act, 1863, by which when capital was at a premium the shares were allotted to the existing shareholders at par, and therefore all the benefit of the premiums fell into the pockets of the shareholders, but where auction clauses prevailed that did not in any way apply. There was no prospective profit whatever; indeed, on the other hand, instead of any further capital being of any advantage to the shareholders, it was a positive disadvantage. By a decision in the courts of law in the Leamington Priors case it was held that before 10 per cent., or any per centage, could be distributed the dividend must be equalized over the whole of the capital, though the new capital that came into the concern might be productive of a loss, or carry a much less amount of profit. If 7 per cent. were given to that new capital by the Act, that 7 per cent. must go over both new and old capital before anything in excess, to go up to the 10 per cent., could be earned by the old capital; and the same if the dividends were equalized. Though the new capital to be raised by the Ashton Company might be expended, it was expended for a considerable period before it would fructify. It was, as it were, a quasi preference stock which was put upon the old shareholder, and therefore it was to his advantage that no fresh capital should be raised, but that the capital should be kept down to the smallest amount. The transactions of the company showed how they had appreciated that fact, as they had endeavoured throughout to keep the capital down to the minimum amount. That was the reason why Mr. Stevenson was able to refer to the fact that they had a very small per centage of capital, as compared with other companies, upon one million feet of gas made or sold. They were met for the first time by an entirely new matter, as far as provincial gas companies were concerned, and that was the introduction, with the auction clauses,

of the sliding scale, which was said to be the antidote to the bane, and to put an end at once to any prospective profit of the gas consumer; but the profit, though put an end to, never died, because by the operation of the sliding scale it all depended on what the initial price might be, and that initial price might be of such a character as to allow continuously the largest profits to accrue to the gas company. His learned friend might urge, "See what has been done with the vast population in the Metropolis, and with that large population; and with the immense amount of capital expended. Parliament has not been afraid to introduce those clauses." To that his answer was that they knew everything about the metropolitan gas companies—they had official commissions, official referees, and official testers. At every step they were met with a mass of information and reports, which made them perfectly acquainted with the manufacture of gas in the Metropolis. They knew what the price was at which gas could be produced, and therefore the committee did not hesitate to insert an initial price of 3s. 9d., except in one case, when it was fixed at 3s. 6d. The responsibility that committee took upon themselves was nothing like that imposed upon the present committee, with the imperfect information which had been afforded. In the 20 years which had elapsed since 1856 there had been passed by Parliament 360 Acts for gas companies. Of that number 45 had had the auction clauses incorporated, but in none, except the Acts affecting the Metropolis, had the sliding scale been introduced. Up to the present time the practice was for the committee to be asked to fix in the Bill what should be the maximum price, the dividend also being fixed; but it had always been said, and very truly, that though the maximum price was inserted in the Bill, it did not follow that that price was to be charged. It was merely a kind of safety-valve introduced in order to meet contingencies which might arise. The maximum dividend being fixed, the company were bound so to conduct their proceedings, that after having provided 10 per cent. for a reserve-fund, they should only earn such an amount of profit as was competent to pay the maximum amount of dividend fixed in the special Act, or failing that being fixed, 10 per cent. under the Gas-Works Clauses Act. The consumers also had always the protection of being able to apply to the quarter sessions for an accountant to be appointed to see whether the company had conducted their proceedings in a proper way, and whether they were charging such a price as would only enable them to pay their maximum dividends, and if they were found to be charging too high a price, then that price was to be reduced. By the introduction of the sliding scale, those provisions were entirely abrogated, and there was no protection given to the consumers. The committee were asked to fix a price, absolutely and arbitrarily, which, whatever the cost of manufacture might be, the company might charge. In view of that, he (Mr. Michael) asked the committee to turn to the account to which his learned friend referred the previous day in his cross-examination of some of the witnesses, as illustrating the working of the gas company. They had a reserve-fund, but instead of using the fund as they ought to have done—to meet extra contingencies, and to cause them to have a fund to pay back dividends—they put that amount into the works. Those works were not sufficient to carry on the undertaking, from the confession of their own engineer, for Mr. Clarke said it was an improper way to conduct a gas undertaking not to have the gasholder power equal to the maximum quantity required, and if anything had broken down on the day of the greatest consumption a portion of the town would have been left in darkness, as they had no reserve powers whatever. Their whole object had been—and it was wise from their point of view—to keep down the capital, in order that they might be certain to have the maximum dividend to pay their shareholders. In 1875 the total profit earned was not the £4700 which was required to pay their dividend, but was only £1425. According to that statement, they had to take from the reserve-fund £3300, and therefore a single year and a half would have exhausted their reserve-fund according to that calculation. But if the committee would look at another item in this account, they would see that the company absolutely expended £3377 1s. 10d.—or 8 per cent. upon their capital—for the repairs of works. How did that enure to the injury of the gas consumers? If the committee would turn to the next sheet (for the year 1876) they would see an item of £4965 for repairs in that year, and yet they would find the company had a balance of profit of £4820. Supposing those two accounts to be correct, there was absolutely a difference of profit between £4800 and £1425, and the prices were, to a great extent, the same, because the reduction in price did not enter into that account. Under those circumstances it was a difficult matter for the committee to determine what the initial price should be. In that year the price of gas was raised by 1½d., owing, as Mr. Clarke said, to repairs: "Those three years in which these large sums so occurred are wholly exceptional. We have charged the original cost of the gasholders into these three years." If that were so, they must strike out the exceptional item, and strike out the 1½d., leaving in the sum that ought to be carried on from year to year in order to meet the proper amount for repairs and renewals. That left 8d. to take off the price of gas. The committee had not sufficient evidence to determine whether or not they should take off the 8d., or the 3d. which Mr. Stevenson was alleged to acknowledge was a surplus upon the price. If what was improperly charged to revenue instead of to capital—i.e., £5000—ought to have been put into capital to pay 10 per cent.—that was £500 a year, at 10 per cent., but it was only £250 a year properly, because the 10 per cent. capital was raised at 5 per cent.—it would only have been £250 to be charged on the gas undertaking, and come out of profits. There was, therefore, in that single year £4750 charged in excess of the amount that ought to have been, and that came out of the pockets of the gas consumers. The gas-consuming body was a fluctuating one, and it was no use to say they would obtain some advantage ten years hence. They had a right to ask that the affairs should be so conducted, that year by year they should have any advantage arising from the proper and economical conduct of the company's works—works which ought not to have been conducted by an accountant—works in respect of which there ought not to have been such a resolution as had been read to the committee from the minute-book, showing a sad neglect of the company's undertaking. The corporation had a right to say they could conduct the works better; they would have a proper manager and engineer, and would not have those fluctuations. It could be seen by the action of the company that they had no great interest in the concern. They parted with Dukinfield; they would presently part with the Houghton district, and when it suited them with Audenshaw. There was nothing to prevent them cutting off any portion of their district. The company had to pay 5 per cent. upon their capital, while the corporation could raise it at 4 per cent., and even if they were obliged to provide a sinking-fund that would not take it up to the amount they had to pay at present. The attention of the committee was particularly asked to the introduction of the sliding scale, which would not only operate to the advantage of the shareholders upon the capital now asked for, but over the whole capital. Capital raised under one condition was, by the action of the sliding scale, to have an advantage given to it totally foreign and alien to the powers under which it was raised. The whole of the £47,000 would realize the advantage of the sliding scale. At present it was strictly limited to 5 per cent., or to such amount as it would realize in the open market; but now it was not only the new capital which would have the advantage of the sliding

scale, but the whole of the previous capital, to the injury of the corporation as representing the gas consumers and ratepayers of the district. Why should that advantage be given? It never was contemplated in the old Act. If advantage there be, why should it not be given to the gas consumers and ratepayers? Under the provisions of the Public Health Act, 1875, the corporation were charged to see that there was proper lighting in their district, and they were liable to a *mandamus*, to be obtained by the Local Government Board, if they did not carry out their engagements properly, and therefore they wished to have the conduct of the gas undertaking, so as to be able to carry it on in such a way as would impose the least possible burden upon the ratepayers. They asked the committee to allow them to equalize inequalities, to allow them to consider the fair discount to be allowed to the large consumers as against the small, to put it into their power to equalize the price which should be charged upon persons near to the gas-works, who cost less to supply than persons who lived a long distance from the works, for it must be very evident that gas could not be supplied at a distance of two miles from the works, as it could be close to them, because there was the primary cost of laying down mains, of additional leakage, and loss in illuminating power, and the sparse population who took a supply from the mains. He (Mr. Michael) asked the committee whether the corporation had not made out a case to show that while they did no injury, and must confer benefit, they should be allowed to economize the supply of gas, and if any profit was to be derived from it, that profit should be earned by the consumers rather than by a company, which at present really did not exist, because it was a company to be constituted that day. He would not dwell much upon the consideration, but the corporation being the highway authority, it evidently would be more economical, when they were breaking up the streets, to be in the position of representing the interests of the gas consumers also. The whole tendency of modern legislation had been, where no injury was to be inflicted, to put the local administration into the hands of the local authority. The committee had not heard, in the progress of the case, any single reason why the prayer of the petition should not be granted, and why they should not transfer the undertaking. On the other hand, there were the gravest reasons why the company should not be allowed to extend their works on the site they had chosen. If the works passed into the hands of the corporation, they would have ample power so to extend them, as to meet all the wants of the community without creating a nuisance and without doing injury, and all they would do would be for the benefit of the gas consumers and ratepayers. He therefore asked the committee to pass the preamble of the Bill of the corporation, and reject that of the company, in order that the lighting of the community might be placed in the hands of the former.

The CHAIRMAN said the committee were of opinion that the preamble of the Ashton Gas Bill was proved, and therefore Mr. Cripps need not address them on that subject, but only on the question of the maximum initial price and the sliding scale.

Mr. MICHAEL said he did not intend to take any part in the discussion on clauses.

Mr. YATES said he should like the standard price to be lower than 3s. 9d. Mr. CRIPPS said the Earl of Stamford's petition was simply to the effect that, if powers were to be given to purchase, they ought not to be compulsory.

The CHAIRMAN said the objection to Mr. Yates had better be taken when he rose upon the question.

Mr. CRIPPS said that at the present time, and under their present Act, the company had the power of charging a maximum price of 5s. 6d. per 1000, reducible to 5s. when the sale exceeded 50 million cubic feet; but that point was arrived at some time ago, and, therefore, the present maximum was 5s. Consequently, if the price of coal were to rise, or if any accident occurred, or the price of labour were to rise, the company, who now charged 3s. 1½d., could raise that price at any time to 5s. to make their 10 per cent. dividend safe. Beyond that, in their present Bill there was no compulsion as to what should be the illuminating power of the gas, and that would be the same as being able to charge more; because if they found the price of coal increase, and their business not so profitable, instead of giving an illuminating power equal to nearly 18 candles, they could give 10 candles, 12 candles, or any other number, without incurring any penalty whatever.

The CHAIRMAN: I may tell you now what is upon my mind. It appears to me that under the sliding scale—I am looking at it solely in the interest of the consumer—the illuminating power of the gas ought to be considerably raised, as otherwise it is the interest of the company to furnish the consumer with a cheap bad gas.

Mr. CRIPPS said what they were going to do by the present Bill was to incorporate the Gas-Works Clauses Act, 1871, obliging them to fix the illuminating power, and also to give facilities for testing by the public authority to see that that illuminating power was kept up, or to impose a heavy penalty if it was departed from, so that they were taking upon themselves very much more in favour of the public than they had been liable to before. If the committee decided that the illuminating power should be 16 candles, it would ensure the ordinary average to be 18 candles; but the company were quite willing to accept that standard. The Gas-Works Clauses Act also provided a proper pressure and proper purity according to the standard, and the company accepted that responsibility, not having been liable to it before. With reference to the sliding scale, the wording of that clause was copied from the metropolitan Acts. After fixing the standard price—which was a very different thing from the maximum price—it stated that "for every penny charged in excess or in diminution of such standard price in any year, the standard rate of dividend for such year shall be reduced or increased by 5s. in the £100 per annum." A total mistake had been made in arguing that matter with reference to the sliding scale—as if it were to be a benefit to the shareholder and not to the consumer. It was a consumer's device, and was first brought up on behalf of the consumer, although he (Mr. Cripps) believed in the end it would be for the benefit of the gas companies if they conducted their business carefully and economically. It was, however, very possible that, when the price was reduced to the consumer, it might be a long time before it was any benefit to the gas shareholder. The Gaslight and Coke Company, in the second year after their Act had passed, had reduced the price to consumers, and they would be entitled, if they found any surplus left over that to divide it; but they did not anticipate that. The first thing was to reduce the price, and it was only as a consequence of that they could get anything; but it was not a necessary consequence. Some of the witnesses had totally mistaken what the sliding scale meant.

The CHAIRMAN: I think I may say the committee perfectly understand that, and they are of opinion that the sliding scale is in favour of the consumer.

Mr. CRIPPS said he would then pass on to the standard or initial price, which was originally inserted at 4s.; but after the company had considered the matter more, with Mr. Stevenson's assistance, he (Mr. Cripps) had taken upon himself the responsibility of advising 3s. 9d. It must be remembered they were going to incorporate the Gas-Works Clauses Act, which would involve more expense to produce gas than at present. Under those circumstances was 3s. 9d. more than they ought to have? Only a short

time previously the Chairman of Ways and Means had given, in the case of the borough of Louth, a price of 4s. 7d., but precedents could not be relied on very strongly, because circumstances differed. The sliding scale was at present in its infancy, and nothing would be so prejudicial to future gas legislation as to do anything which might be considered unfair or hard upon the companies themselves. In all cases of that kind it was necessary to have the co-operation of the company, but that could only be obtained by treating them in the fairest possible manner. There was unquestionably a possible loss of 10 per cent. dividend entailed upon the company by imposing a sliding scale. They were secure of 10 per cent. at the present time, and, if the price of coal rose, they could raise the price of gas, and so get their 10 per cent., but they were giving that up and taking their chance. That was a new principle, which probably would be applied universally if it acted well, and was certainly a most useful principle for the consumers. It would be unfortunate if, so soon after the resolution of the House, anything were done which the companies would consider made that sliding scale so unfair to them that they could not accept it, or would not apply for it. Mr. Stevenson's estimate of the proper price to be charged was 3s. 8d., taking into consideration the present price of coal and other circumstances, but there was no allowance made in that estimate for coal being at the present time very cheap, nor yet for the additional expense that might be put upon the company by reason of the limitation of the illuminating power, and more especially as regarded the purity of the gas. On the following day a very important Bill was going to be brought in by certain of the metropolitan gas companies to get rid of some of the restrictions put upon them with reference to purity. They said the matter had gone too far—that they had been put to a greater expense than the thing was really worth, and they were going to try whether they could not get off some of the restrictions as to purity which were attached to them under the Act of 1871. However, it was a very heavy onus to put upon them—more than 1d. per 1000—but if that was added to Mr. Stevenson's 3s. 8d., quite independently of the probable increase in the price of coal so soon as trade revived, it would make a fair starting point of rather more than 3s. 9d., certainly not less. Another way of testing the matter was—and the attention of the committee was particularly directed to that point—that after Mr. Stevenson had given his evidence, Mr. Lyon did not in any way challenge Mr. Stevenson's figures. He said, "I took my figures from your books." Mr. Stevenson's evidence stood clear, therefore, that, without taking into consideration those questions of purity, and so on, the company ought to have a price of at least 3s. 9d. Mr. Stevenson also said there had been fair working, and whatever more was put upon the company would be so much out of their pockets. The only objection raised to the accounts was that they had charged too much for renewals and repairs in the later years; but, if the committee looked on the other side, they would find the company did not earn their dividend, or anything like it. In one year they only earned a profit of £1400, while £4700 odd was required to pay the dividend of 10 per cent.

The REFEREE: Look at the next year, when you made your 10 per cent. and also effected very heavy repairs.

Mr. CRIPPS said, taking the two years together as an average, it was less than enough to pay their dividend. Taking the average when they might, they had not earned enough for several years past to pay their dividends. That was a most material matter in considering whether they could have divided their 10 per cent. if they had not done those repairs.

The REFEREE: The contention is that you took out of income money for expenses which properly ought to have gone to capital account.

Mr. CRIPPS said that was a mere matter of account. So far as the body of the consumers were concerned, it mattered not whether it was done by setting aside a depreciation-fund, or by spreading it over a few years. It made no difference to the company whether it was done in one way or the other. It was not the consumers, but the shareholders, if anybody, who had the right to complain of the directors for having applied the reserve-fund for the purpose of renewals. If the corporation assumed to represent the consumers, they must do so as a class, and not the consumers of one year as against the consumers of another year. It was only by more economical working and more energy in business that the company could hope to make 3s. 9d. anything but a loss, and he (Mr. Cripps) was not at all surprised that his clients thought that 4s. was a price they might fairly ask in the first instance. He, however, could not have supported anything quite so high, but he did think that 3s. 9d. was abundantly fair to the consumers; it was a reduction at once from the maximum they had been entitled to charge. To go to another point, he did not say that precedent was everything in a case like the present; but he thought it was most important not to go lower than that which had been fixed as the initial price over the greater part of the Metropolis, which was 3s. 9d., with the exception of the South Metropolitan district, which had only been paying 3s. 2d., and about which there was a great fight, the result being that the initial price in that district was fixed at 3s. 6d. Suppose the parties did their best, let them compare the two sets of circumstances. Coal might be somewhat cheaper in Lancashire, but there was a greater demand in London for the residuals and for coke, and therefore there was great analogy between the two cases in that respect; but there was another matter, which was so immensely different that it totally destroyed any difference that might have arisen from what had been just referred to. The number of consumers upon so many yards of main in London was not comparable with the number in any other place. The population was so dense, and the area to be supplied so entirely built upon, that the profits to the gas company in supplying at per 1000 cubic feet was so much greater, and the quantity supplied from a given main so much larger, that it would totally alter any little difference, if there was any, with reference to the price of coke and labour. Seeing, therefore, that the manufacture of gas from coal could be made a much more profitable thing in London than it could at Ashton-under-Lyne, and assuming that the parties worked equally well in doing their best, contrasting one with the other, there could not be the slightest reason why the initial price at Ashton should be one farthing lower than it was for the north side of London. There being no other precedents to go upon than the Metropolis, he (Mr. Cripps) expressed a strong hope that the committee would not, in the infancy of the matter, do anything which the company would consider a prejudice to them; or, in fact, do anything to cause great dissatisfaction with the sliding scale generally. When they came to the circumstances of the Ashton Gas Company, working the matter out any way they would—whether by looking carefully into the figures and seeing that they had had to get 3s. 11d. hitherto for the purpose of dividing the profit, or whether they took Mr. Stevenson's argument, that 3s. 8d. was a fair price under the present state of things, it was submitted to the committee that they would not think 3s. 9d. to be a higher price than the company were entitled to ask for. The success or failure of the sliding scale depended on the fairness of the price in the first instance, because that price could never be varied unless the dividend of the company was altered. It was not a question of making a profit entirely for the benefit of the shareholders; but if a profit was made it would go first to the consumers and then in the same proportion to the company. They might go on making gas cheaper by economy and good management, but what was derived from reduction of price could not go to anybody but the consumers jointly with the shareholders. He (Mr. Cripps) therefore trusted,

in fairness to the company, that not a single farthing lower than 3s. 9d. would be imposed upon them.

Mr. YATES applied to be heard in opposition to the standard price, as he contended it should be lower than that proposed.

Mr. CRIPPS objected, and read certain paragraphs in the petition of the Earl of Stamford.

The CHAIRMAN said the committee thought Mr. Yates had a right to be heard.

Mr. YATES said his learned friend had addressed the committee entirely upon the assumption that there should be, at all events, a dividend to the company of 10 per cent., and that that was to be the dividend they were always to have, just as if they were guaranteed that dividend. His argument had been entirely founded upon that view, and not upon the view of giving the cheapest gas it was possible to supply with a fair ratio of interest to them as a gas company. He had made his comparison entirely with London, treating the London companies as being the only ones who had had a sliding scale introduced into their Acts; but he submitted to the committee that London was not a fair test to compare Ashton-under-Lyne with. In the first place, London was a very great distance from coal, while at Ashton the coal existed right under the town, and there was nothing more than cartage to pay for; they got it almost out of the pit on to the gas company's premises, and if so it was delivered at the cheapest rate to the company. Mr. Stevenson had said that the net price of coal in Lancashire was 6s. 6d., but in London, in addition to that, there was 6s. 6d. for cartage, and then there was barging and trimming, he supposed, the London coal dues, and the cartage to the company's premises.

Mr. CRIPPS: They have a wharf of their own.

Mr. YATES said in that case there was 6s. 6d. to add, *plus* barging and trimming, on to the 8s. 6d. before they got the price of coal delivered in London. It was also said, in order to show that London was on an equality with Lancashire in the price of coal, that the price of coke was much more in London than in Lancashire. Upon that there was no evidence one way or the other, but there must be a large inequality indeed to make up for the difference between the two. Mr. Stevenson said there was an advantage in Lancashire in the price of labour, and if that were so there were at all events two advantages in favour of producing cheaper gas in Lancashire. If they took Burnley, which produced 150,000 cubic feet, against 133,000 at Ashton, the mean price of gas there, both inside and outside the district, was 3s. 6d. per 1000. They had coal all round Burnley as they had at Ashton. The wages would be about the same, and the price of coke also. Taking Manchester, there was an enormous difference in the amount of gas made, the quantity being 1,900,000 cubic feet, and the mean price there was 3s. 7d.

The CHAIRMAN: In Manchester the corporation have the gas-works, and they have not to divide 10 per cent.

Mr. YATES: But they have to earn interest upon their capital; they make £80,000 or £90,000 a year upon the gas-works there.

Mr. CRIPPS said his learned friend was quoting things which he should have to reply to. He had a general reply upon the whole case, and no one had the right to address the committee after he had finished.

The CHAIRMAN said he understood Mr. Cripps was addressing the committee upon the clauses which he had proposed.

Mr. CRIPPS said he thought he was on the preamble.

The CHAIRMAN said the committee had considered the preamble to be proved.

In reply to the chairman, Mr. YATES said he did not propose to call any evidence. Resuming his remarks, the learned counsel said that, taking the company's own figures, the mean price was 3s. 11d., but that price he presumed was subject to discount.

Mr. CRIPPS: It is without the discounts.

Mr. YATES said in that case, taking their own figures in 1871 and 1872, it seemed that in those years they were enabled to sell gas at 3s. 9d., and take off the discounts; that was to say, taking off 6d. to every one who paid within a certain time. With regard to the liability which they took upon themselves, they proposed to give gas of 16 candles, while according to the evidence they had been giving 18 or 19 candles up to the present time, and, therefore, they proposed, instead of giving better gas, to give a lower illuminating power.

Mr. CRIPPS complained that his learned friend was getting out of order.

Mr. YATES said he was only saying what they had been doing; they had been supplying gas at 4s. 2d. per 1000 feet, less 6d. discount, which was 3s. 8d., and they had been supplying gas of 18 and 19 candles, but by the present Bill they proposed to charge 3s. 9d., and to have an illuminating power of 16 candles, so it was clear that they were proposing two candles less and 1d. more.

The CHAIRMAN said it was explained about the candles that virtually it was giving 18 candles.

Mr. CRIPPS said his learned friend had taken the prices charged in towns supplied, not by companies, but by corporations, so that the whole thing was different. A corporation had a right to fall back on the rates—a corporation could never incur a loss, if they had rates to supplement it—a corporation might always keep the thing at a minimum, while a company had to run the whole of the risk, and, therefore, the cases were totally different. A corporation might say, "We will sell at almost anything, and if we cannot get on at that we will have a rate," and, therefore, the comparison did not apply; but if the committee took the test of towns supplied by corporations, even then the proposal his clients made was very low. At Barrow-in-Furness the charge was 5s. within and without the borough; at Blackpool, 4s. 2d. within and without; at Bolton, 3s. 6d. within, and 4s. 3d. and 4s. without; at Burnley, 3s. within, and 4s. without; at Bury, 3s. 9d. within and without; at Halifax, 3s. 4d. within, and 4s. 10d. without; at Heywood, 4s. 2d. within, and 5s. 7d. without. He would not go through any more; but even in those cases where the corporations had to run no risk, they were not so low as the Ashton Company proposed the standard to be.

Clauses 1 to 10 and A to E were then read and agreed to.

On clause F the committee-room was cleared. After some time the counsel and parties were called in, and

The CHAIRMAN said the committee were of opinion that the initial price should be 3s. 8d.

The remaining clauses were read and agreed to, and the chairman was directed to report the Bill to the House.

MONDAY, APRIL 30.

(Before Mr. PLUNKETT, Chairman; Mr. FOLJAMBE, Mr. STARKEY, and Mr. COURTNEY.)

CRYSTAL PALACE DISTRICT GAS BILL.

Mr. PHILBRICK, Q.C., Mr. MICHAEL, and Mr. PAULI appeared for the promoters; Mr. CRIPPS, Q.C., and Mr. O'HARA for the Metropolitan Board of Works, petitioners against the Bill.

Mr. O'HARA, at the sitting of the committee, applied that this Bill and the Bill of The Gaslight and Coke Company might be taken together, on the ground that the questions involved in each were similar. The object of the present Bill was to amend the 17th section of the Crystal Palace District Gas Act, 1873. That clause provided that the gas supplied by the company should not contain more than 20 grains of sulphur in any form

in 100 cubic feet of gas. The promoters sought by this Bill to be relieved from that condition. The Gaslight and Coke Company by their Bill also sought to be relieved from a similar obligation under a somewhat different form. By their Act of last session, which revised many of the provisions of the City of London Gas Act, 1868, three gentlemen, called Gas Referees, were appointed by the Board of Trade, and it was the duty of these Referees to prescribe, from time to time, the maximum amount of sulphur impurity to be allowed in the gas supplied by the company; and to that duty was attached the condition that they should ascertain with what degree of purity the company could supply gas continuously without occasioning a nuisance in the neighbourhood in which their works were situated. But both Bills, though different in form, related to the question of the maximum amount of sulphur impurity to be allowed in gas. In the one case, the maximum amount was prescribed in the company's Act; and in the other, the amount was to be prescribed under special conditions mentioned in the Act. He (Mr. O'Hara) appeared with his learned friend Mr. Cripps in this case, and with Sir E. Beckett in the next, which was the larger case, and they were exceedingly anxious on this point. Of course an investigation like this involved the examination of scientific witnesses, and other persons whose attendance it was difficult to obtain, and whose remuneration was a matter of great consideration to the Board and to the Corporation, for whom he appeared. He had, therefore, to ask the committee to allow Mr. Philbrick to open the case for the Crystal Palace District Gas Company, and, when the evidence on that Bill had been heard, the committee would suspend their decision until after they had heard the case of The Gaslight and Coke Company. He admitted that he was asking for a slight departure from the usual course, but he thought it was one which would be most convenient for the committee, and advantageous to the public.

Mr. MICHAEL said he appeared for the gas companies in both cases. It was not for him to dictate to the committee what course they should adopt, but he thought he could put before them some considerations to prove that it was not desirable to adopt the course suggested by his learned friend. Although it was quite true that the objects of the two Bills, so far as the sulphur question was concerned, were identical, the matters which the committee would have to consider, in coming to a decision on each, were as diverse as they could possibly be. In the first place, the area supplied by each company was essentially different; the one was suburban, the other was entirely metropolitan. Now the circumstances attending the production of gas and the dealing with the refuse products were in each case different. In the surrounding places the parties who appeared in opposition to the two Bills were quite different persons. In the case of the Crystal Palace District Gas Company, the Metropolitan Board of Works obtained a *locus standi* before the Referees, because the company, although not a metropolitan company, supplied gas within a small portion of the metropolitan area. In the case of The Gaslight and Coke Company, the Metropolitan Board and the Corporation appeared to oppose, and was it fair that the promoters of the first Bill, being a small company, should be put to the expense of attending before the committee, and waiting the whole course of the proceedings of a large company with immense revenues, and having a considerable number of witnesses to call in support of their case, when the question which the committee would have to decide was, as he ventured to assert, knowing the particulars of both Bills, entirely different in each? In the Crystal Palace District Gas Company's case, the question pure and simple was whether or not the restriction as to the quantity of sulphur other than sulphuretted hydrogen should be allowed to continue. In the case of The Gaslight and Coke Company there were complicated questions with reference to the duties of the Gas Referees. These questions did not affect or interest the promoters of the first Bill, as the Referees had no control over the gas supplied by them. In truth, what he considered the crucial point of the whole matter was this, that it did not follow at all that the decision in the one case would govern the decision in the other. The case which would be presented for the Crystal Palace District Company would be so placed before the committee that they would be able to come to a decision upon it without any reference to the circumstances which would be afterwards brought before them on the other Bill.

The committee having deliberated,

The CHAIRMAN said the committee felt that, though the parties had a right, according to practice, to have the two cases heard separately, they might, with a view to economize time and expense, hear the promoters of both Bills together, then take the opposition to the Crystal Palace District Company, and dismiss them from attendance, hearing the opposition to The Gaslight and Coke Company's Bill afterwards. It seemed a rather unnecessary expenditure of time and money that the cases of the promoters of the two Bills, if they were really and substantially the same, should be heard twice over.

Mr. MICHAEL said the committee would find they were entirely the reverse. Except the scientific portion, there was nothing in common.

Mr. O'HARA said he would then propose to his learned friend to take the larger case first.

Mr. MICHAEL declined to consent to such an arrangement, which he said would be grossly unfair. The witnesses for The Gaslight and Coke Company were not present, to begin with, and he was not prepared to go on with that Bill.

After some further conversation, the committee decided to proceed in the usual course with the first Bill.

Mr. PHILBRICK opened the case for the promoters. In doing so, he said: Sir, it devolves upon me to state to the committee the case of the first Bill before you, which is that of the Crystal Palace District Gas Company, and which is, as you have heard from my learned friend, Mr. O'Hara, a short Bill. It seeks to accomplish its object with singular brevity and directness—namely, to repeal a portion of section 17 of the company's Act of 1873, which restricts the maximum quantity of sulphur to be contained in the gas to 20 grains per 100 cubic feet, with the proviso that nothing in the repeal shall authorize the presence of sulphuretted hydrogen in the gas to be supplied to the consumers. Now, sir, from what has passed in a preliminary discussion, I am afraid that the committee may have formed the opinion that the matter embodied in this Bill is likely to involve considerations of a highly scientific and delicate nature. I think, if I am sufficiently able to explain that which, I trust, I in some measure appreciate myself, the matters in this Bill will not resolve themselves into any considerations of that kind, or involve such minute and delicate analyses as seem to be hinted at. If I shall be successful in conveying to the committee what has been brought to my mind, the matters that will have to be disposed of will depend not entirely on chemical or scientific results of analysis, but upon what I may rather call physical considerations; and if at all I venture, in the course of the remarks I am about to make, to describe the history of gas-making, the committee will understand it is simply for the purpose of enabling them to follow the evidence, and to bring it to a point at once, instead of troubling them with a great quantity of scientific analysis, and the results of rather elaborate tables, which have had to be gone through in order to get at what I shall be able to state briefly. I may mention at once that the position of the Crystal Palace District Gas Company differs entirely from that of the large companies, or rather large company who supply London. I say large company,

because, practically, on the north side of the Thames there is but one company, The Gaslight and Coke Company, who, by a series of amalgamations and extensions, have become the great supplier of gas on that side of the Metropolis. We, the Crystal Palace Company, are situated on the south side, and we were originated and incorporated under a deed of settlement in the year 1854, shortly after the Exhibition was removed from Hyde Park to Penge. It so happened that in the year 1855 the Metropolitan Board of Works were organized and incorporated chiefly for the purpose of removing the sewage of London out of the Thames, and of constructing a large system of drainage for the Metropolis. In drawing the line for the metropolitan area to be under their jurisdiction, it was so drawn as to include a portion of the suburban district—about one-third of it—which was within the limits of supply of the Crystal Palace District Gas Company; and in that way, and in that way only, did we become, as it were, under the jurisdiction of the Metropolitan Board of Works. In 1858 we obtained parliamentary powers, and put ourselves under the Gas-Works Clauses Act of 1847. That Act is a general Act, which is incorporated in all Acts of gas companies throughout the country, and it contains a series of clauses applicable to such undertakings, framed much as the Lands Clauses, or the Police Clauses, or the Town Commissioners Clauses (which are general Acts) are framed. By those clauses, under which we were until the Act of 1873, we were bound to supply gas of not less than 12 candles illuminating power. We had a maximum price of 6s. per 1000, and under our Act we obtained power to raise our capital, subject to the ordinary restrictions—that is to say, our maximum dividend not exceeding 10 per cent. per annum. In 1865, our district having increased, we came to Parliament, and got powers to raise additional capital; and in 1873 we obtained a further Act, the 17th section of which we propose to partially repeal by the Bill now before the committee. The necessity for coming to Parliament in 1873 arose from the fact of the growth of our district, and our resources not being adequate to supply our consumers without a further expenditure of capital. We had at that time raised a considerable portion of our capital, not at 10 per cent., but at 6 per cent.; we had exercised our borrowing powers, and we had for years been doing that which we have continued, thinking it the right course for the company, and a course the best adapted to our own interest and the interest of our consumers, all in the same direction—we have been, so far from charging our maximum price, keeping our price down—we were raising our capital only when compelled, and not raising it to the maximum amount of dividend which we were entitled to charge, so that in consequence we were supplying gas in the suburban districts practically as advantageously as gas was being supplied within the Metropolis itself; and in addition we were burdened with a very small capital in proportion to the amount of the district we were supplying, and the extent of the gas we were making. When we came to Parliament in 1873, the Metropolitan Board of Works appeared to oppose us, and what they wanted to do was to include us within metropolitan gas legislation, and to bring us to the level of a metropolitan gas company, putting us under the Referees and under the restrictions that were then in existence as to the metropolitan companies. You may, sir, perhaps know—but it is not for me to anticipate the case of The Gaslight and Coke Company—but you will certainly hear at great length, and I may state it shortly, that the metropolitan gas companies in the years 1868 and 1869 were placed under a tribunal called Gas Referees, appointed by the Board of Trade. The gas was directed to be tested by a number of gentlemen called Gas Examiners, and the general provisions of the system of gas legislation then in force in the Metropolis involved a maximum price to be charged for the gas, with a power on the part of the companies to come before commissioners appointed by the Board of Trade to revise the price in case they desired to increase the maximum, and there was a similar power of revision, in the interests of the consumers, before the same commissioners, in case the consumers desired to reduce the price of the gas. The commissioners were a body who have since become extinct. They were to consist of an accountant, a gentleman practically versed in gas manufacture, and a barrister, who presided as chairman. My learned friend, Mr. F. S. Reilly, presided; Mr. Pattison was one of the commissioners, and Dr. Odling was the third commissioner. That system was alleged by the Metropolitan Board of Works and by the Corporation to work to some extent prejudicially to the interests of the consumers; and in the year 1875 a very lengthened investigation took place in Parliament before a committee, of which Mr. Forster was the chairman. The result of that inquiry was that, although no legislation took place with regard to The Gaslight and Coke Company, certain principles were arrived at which formed the basis of an Act then passed, which affected the Commercial Gas Company; and, in 1876, these principles were embodied in an Act affecting The Gaslight and Coke Company. But these provisions and the whole of that legislation were applied to the Metropolis properly so called, and never touched and never affected the Crystal Palace District Gas Company. In 1873 it was desired by the Board of Works to include us within the limits, and subject us to metropolitan legislation; but after some considerable discussion, the committee thought we were not a company falling within the purview of that legislation, that we were exceptional, and that our case depended entirely upon its merits, and they excluded us from the operation of metropolitan Acts. The chairman said: "The opinion of the committee is that each of these companies as they come before Parliament ought to be taken upon their merits. This case is not to be taken as a precedent with reference to any of the metropolitan districts. It is one which the committee have thought exceptional, and depending entirely upon its own merits." So that the attempt of the Metropolitan Board of Works to subject us to metropolitan gas legislation entirely failed. The question was then set at rest—and I think I may say set at rest for ever—that we were not a metropolitan company, but were to be dealt with like other gas companies.

Mr. CRIPPS: I assume my learned friend would not state this unless it had some bearing, and if it has, it has some importance; the fact is, the committee did not decide whether they were within or without these obligations, but that it was a case to be taken by itself. Some of the regulations, or a great many of them that applied to the metropolitan companies, were put in, and others were left out.

Mr. PHILBRICK: My learned friend, Mr. Cripps, did not follow me. I read the exact words that fell from the chairman.

Mr. CRIPPS: Then you went on to say that you were entirely excluded from the legislation of the Metropolis?

Mr. PHILBRICK: I say we were not included in the general Acts of the legislation of the Metropolis. In the Bill, however, which we brought forward at that time, and which was principally a money Bill, we said that we were willing to give the consumers the benefit of an increased illuminating power in the gas. I have told you that we were under the Gas-Works Clauses Act of 1847, with a limit of 12 candles; but we then volunteered to place ourselves under an obligation to supply 14-candle gas. That was a voluntary obligation undertaken by us. The 17th section of our Act then provides—"And such gas shall not contain more than 20 grains of sulphur in any form in 100 cubic feet of gas." Those words we are now proposing to repeal. I will just tell the committee how they came to be in that Act. In the cross-examination of Mr. George Wilson Stevenson, the very eminent gas engineer, who was a witness for the promoters of that Bill, he was asked whether there was any clause in

the Bill, as then introduced, as to purity—that is page 25, question 151. It was an immaterial question, because I think I was then representing the Metropolitan Board of Works, and it was a question that fell from me:—"By the by, there are no clauses in the Bill as to purity, are there? (A.) I think not; I do not remember that there are.—(Q.) Nor are there any in the Act of 1871, are there? (A.) Yes.—(Q.) Except as to sulphuretted hydrogen? (A.) Yes.—(Q.) Not as to sulphur or ammonia, nor any product of sulphur, except only as to sulphuretted hydrogen? (A.) Just so. I think it is quite right that there should be clauses inserted to protect the consumer from an undue amount of sulphur and ammonia." And there I left it. That was Mr. G. W. Stevenson, who was a witness on the part of the promoters of the Bill; and when he came to be re-examined by my learned friend, Mr. Horace Lloyd, he was asked this:—"At present they are under no test for purity, and you say there is a test for sulphuretted hydrogen by the Act of 1871? (A.) Yes.—(Q.) You think there should be one as to sulphur. (A.) I think there should be one as to the maximum of sulphur.—(Q.) What quantity of sulphur? (A.) I think 20 grains. The promoters have not consulted me upon that point at all. I think it is quite right." Upon that the 20 grains were put into the Bill in the shape in which it is now an Act; and it is because we have found that that which was then supposed to be an ordinary limit which might fairly be fixed, and which would be carried into practical working in the manufacture of gas, without either nuisance, or inconvenience, or undue expense, is intolerable and almost impracticable, and produces no useful result at all to the consumer, that we are here asking Parliament to remove that restriction as to the sulphur compounds. Now, sir, having told you how and why it came into the Bill, there being no restrictions before, I shall trouble the committee with a few observations as to what these sulphur compounds are, and how they come to be present in the gas which is manufactured for commerce. Roughly speaking, the manufacture of coal gas is carried on by distilling the coal in sealed vessels called retorts, exposing them for some time—six or seven hours—to a bright red heat, the effect of which is to send off a portion of that which is within the retort in the shape of volatile matters, leaving behind the residuum, which we all know as coke. These volatile matters, the product of distillation, contain tar and ammoniacal liquor, which, the moment the vapour cools, condense and become liquid; but in the gas which remains there are certain foreign substances—perhaps I may call them impurities—and those impurities may be classed as follows:—One is ammonia—there is a large quantity of ammonia; secondly, there is a large quantity of carbonic acid; thirdly, there is sulphuretted hydrogen; and fourthly, there is the presence of what are called "other sulphur compounds," which are not exactly determined by the resources of chemistry up to the present moment, but which are known as sulphide of carbon. The ammonia in the gas is partly extracted; its presence can be detected exceedingly easily by litmus or turmeric paper—that is one test for it—and it is removed from the gas by the processes called washing and scrubbing, to which the gas is subjected—that is to say, by treating it with water in certain vessels called washers and scrubbers. The presence of ammonia is not objectionable in one respect; but it is objectionable to gas manufacturers, because its presence tends to decrease the illuminating power. If you get a large quantity of ammonia in your gas you get less illuminating power, so that if you have an excess of ammonia, what you have to do is to put more canal into the retort, and thus increase the lighting power of the gas. Ammonia itself is productive of no particular nuisance. The presence of carbonic acid is very easily ascertained. You have only to take a little clear lime water, send the gas through it, and if there is carbonic acid you turn it milky white, and make the water quite cloudy—that is very easy, and there is no difficulty at all in removing it. Then there is the sulphuretted hydrogen. Now, sulphuretted hydrogen, as we all know, is an exceedingly foul and offensive gas. It is a gas which, wherever it exists, creates great nuisance and inconvenience, and while it is always present in crude gas as manufactured and produced in the retort, it never is, or never ought to be, present in the purified gas delivered to the consumer. It can be got rid of by proper means of purification, and practically it always is got rid of; so that that remote quantity which an analyst calls a trace—which, I believe, means, in chemical language, enough to satisfy him that it is there present, but in a quantity which is inappreciable—does not exist, or scarcely ever exists in the gas as it is delivered to the consumer. It can be removed, or used to be removed, by lime; but some years ago it was discovered that a substance called hydrated peroxide of iron, under proper conditions, entirely absorbs the whole of this deleterious sulphuretted hydrogen, and when the gas is purified by the process of the peroxide of iron, the sulphur becomes precipitated in it, or, rather, comes into it in a solid form, and I believe modern science has shown a means of extracting it from the oxide, so that the oxide becomes available for use again, and chemists have shown the manufacturers how to avail themselves of the sulphur thus extracted from the gas. Now, sir, I have dealt with all the impurities found in the gas delivered from the purifiers, except the sulphur products other than sulphuretted hydrogen. Those sulphur products were discovered by Dr. Letheby some 20 years ago, though their existence had been suspected for some time. They are impurities which are not discoverable in crude gas, but which are given off only when the gas is burnt. Suppose you were to allow the gas to escape from a pipe, you would not detect them, or could not detect them chemically then. The only way in which, up to the present moment, they have been detected chemically, I believe, is by burning the gas at the rate of half a foot an hour for 20 hours in a closed chamber that contains the products of combustion. You will then find that there is undoubtedly present sulphide of carbon—that is the name given to it for want of a better distinction—and this body, and this body only, is that which is designated "other sulphur compounds" in the gas. It necessarily arises from the combustion of ordinary coal gas, and I believe that, as a matter of fact, between 30 or 40 grains—some 33 grains—is about the average in gas which is not purified from this substance. Now, sulphuretted hydrogen, as it is always a nuisance, is prohibited in various gas Acts, but to this day, except in the Metropolis, and a few places in the country, there is no limit and no restriction about these other sulphur compounds in the gas. At Birmingham and Manchester, and other great towns in the kingdom, where the municipalities supply their own gas, they are absolutely without limits in this respect. Paris, which is most particular, and where the most exhaustive scientific experiments have been made with regard to the presence of, and the alleged deleterious effects of these sulphur compounds in the gas, is also without a restriction. But in London the Referees have a power, within certain limits, to say how much of these "other sulphur compounds" shall be present in the gas. They have power to fix it between 30 grains and something less, but we are put—and I believe we are the sole instance almost in the kingdom (there may be two or three other cases)—we are put under the hard and fast line of 20 grains per 100 cubic feet of this impurity. I hope the committee will pardon me if I venture to call their attention to the extremely inappreciable quantity of this impurity in the gas. You see, if you turn to it at once, how misleading the matter really is—it is 20 grains (that is weight) per 100 cubic feet (which is volume), so that you are comparing weight with volume. It would be a much fairer comparison, I think, if you compared volume with volume, or weight with weight.

Now, let me see what it is. One hundred cubic feet of gas weigh, taking it at the ordinary specific gravity, 22,500 grains, and the 20 grains of these "other sulphur compounds" that are allowed by the 17th section occupy "0088 foot—that is, $\frac{88}{10000}$ ths of a foot. Increase it to 40 grains and it is "0018, or $\frac{18}{10000}$ ths; which, of course, is almost inappreciable. I have stated it by weight. Now let me state it by volume. It would be 5 cubic feet in 10,000, or 1 in 2000. But now suppose there were 40 grains, which is the maximum almost that has ever been found after a large number of testings. These products, as I have told you, are only to be detected when the gas is consumed by combustion, and when the gas is so consumed they become a double quantity—that is to say, they produce 80 grains of sulphurous acid gas per 100 cubic feet, or just 1-15th portion of one cubic foot. So that to get one cubic foot of sulphurous acid gas, which will go easily into the crown of a man's hat, I have to burn 1500 cubic feet of the gas supplied. Now, when I have burnt 1500 cubic feet of the gas supplied as a necessary consequence of the combustion, it produces two things—vapour and carbonic acid; and, necessarily, the 1500 cubic feet of gas would produce 1000 cubic feet of carbonic acid, so that my one foot of sulphurous acid and vapour is diluted with 1000 times its volume of carbonic acid gas. Now there is another fact I may mention which may be known to you. An ordinary adult human being respires carbonic acid gas which is equivalent to two ordinary 3-feet gas-burners; and in the most crowded theatres, where the atmosphere has been analyzed, the amount of carbonic acid discovered by analysis is 0.32—rather less than a third—per cent.; and now what I have mixed with that quantity I have to divide by 1000, before, at 40 grains of sulphur impurity per 1000 feet of gas, I get any product of combustion that can possibly even include sulphur, whether deleterious or not. So you will have, from the most exact scientific evidence, that, even under the most unfavourable conditions, I have got it mixed with 1000 times its volume of carbonic acid, and I have got the whole of that in the proportion of one-half millionth in the volume of the atmosphere, and that is the worst result there possibly can be. Taking the maximum of carbonic acid that has ever been discovered under such unfavourable circumstances as I have mentioned, you are dealing with a matter which is so inappreciable as to be positively one-half-millionth of the volume. If I have made these figures clear to you—and they will be spoken to by a very eminent gentleman indeed, Dr. Odling, whose calculation it is really (and he is one of those commissioners that we have heard mentioned, appointed as practically conversant with the make of gas)—if I have brought it home to you, the committee will see how small a quantity it is that we are dealing with—utterly inappreciable, you will find. I will not now detain you by going into other calculations, but I may state that we have had experiments made. There is one company in London who have always been held up as a model, and they have been to some extent a terror to other companies. They have been fortunate in having one of the ablest gentlemen connected with the manufacture of gas, taking an active part in the management; I mean the South Metropolitan. That company have supplied pure gas cheaply, and have carried out the process of gas manufacture so well as to be held up as the good child whom all others are to copy as an example. Mr. Livesey, the manager of those works, placed a room at the disposal of some eminent chemists whom I shall call before you, and in that room was burnt gas manufactured by his company, which had not been purified from any of the sulphur compounds, and contained between 33 and 35 grains per 100 cubic feet of them. That room was an ordinary room; it had a door, a fireplace, and two windows, and the gas was burnt there for hours, and, after about six hours of burning, the maximum amount of sulphur impurities found in the atmosphere, whether or not the burning were continued for a greater or less time, was this—it showed substantially this, that in an ordinary room where gas is burnt you may divide the atmosphere into three zones. There is one about 18 inches from the ceiling, caused by the heat of combustion, and is about 20 degrees above the ordinary temperature of the room. After about five or six hours burning the hydrometric conditions there are bad, and the bulb of the thermometer is very dry. At 18 inches down from the ceiling to about 5 feet six inches, or something of that sort, which is about the height of an ordinary individual, is the middle or temperate zone; and at 18 inches from the floor there is a third and distinct condition of the atmosphere. In the middle zone, in the most unfavourable conditions, burning gas without these impurities extracted, you would have to be shut up as close as possible, and have to respire that atmosphere, and nothing else, for five or six hours before there could possibly enter into the system one-tenth of a grain of sulphurous acid gas. Well now, sir, it may be common knowledge to all of us—certainly, if I may venture to say so, it was brought home to me personally in a peculiar manner—that the burners which are employed in our houses do not consume all the gas, and that a great deal of the annoyance found from the ordinary domestic use of gas is because a great quantity of the gas that is delivered from the pipe escapes into the atmosphere of the room without being consumed. I have heard in these rooms, over and over again, by scientific witnesses, that a perfect burner, if you can get it—an ideal model burner—is so to regulate the combustion of gas behind it, that, at the point of combustion, where the spark comes to the gas, you have no pressure; that is to say, that the flame consumes all the gas as it is delivered, and none escapes into the atmosphere unconsumed. As to any of these sulphur compounds that escape into the atmosphere unconsumed, there positively is no question, and could have been no question, because they cannot be detected even by analysis, and it cannot be suggested that they cause practical inconvenience to a single human being, or damage to a single farthing's worth of property. All these calculations I have been giving you, and all these minute quantities, are upon the supposition that the gas is absolutely and perfectly consumed, which we know it really is not. But if you take into consideration that in all places where gas is burnt, where the ventilation is good and sufficient, there is positively no inconvenience felt, and the presence of these sulphur compounds cannot be detected, or, if detected, only in the minute proportion which chemists call a trace; so that, if gas is burnt under ordinary and fair conditions, the presence of these sulphur compounds is absolutely immaterial, and if it is burnt even for the purpose of satisfying the chemist as to what amount of sulphur he possibly can get, it comes to so small a proportion as to be practically inappreciable. Still, although most minute, if it is noxious and hurtful, it should be removed at any cost if it can be. But I state broadly, in the presence of those in authority (the Metropolitan Board of Works here), that the researches of chemistry show that even in a laboratory test you cannot remove it. It is utterly impossible to remove; and, in the practical working, such as is necessary in the manufacture of gas, all that you can do, by the best means at present devised by the most eminent chemists, is to take out from something between 30 to 40 grains per 100 cubic feet of gas, so as to reduce it to something under 20 grains. That is all you can do. You can remove from one-fifteenth to one-tenth of the quantity there present. Now, in order to do that, let me tell you what is to be done. You have to resort to lime purification. Formerly all gas was purified by lime. When the properties of oxide of iron were discovered, it was had recourse to, partly only at first, because there was a patent, and it was protected by royalties, out of which arose litigation. But the result of working by lime is this: In removing the impurities of gas, the lime employed becomes exceedingly foul and exceedingly

offensive. The ordinary way in which purification is accomplished is first to pass the gas through purifiers, in which the lime is put on trays. You take out the carbonic acid by the first, and by the second you take out the sulphuretted hydrogen. It has been found that, after this, the objectionable bisulphide of carbon, or sulphide of carbon, exists in the gas, and the only way of removing the small quantity that practically can be removed is to expose the gas to the action of dry lime already saturated with sulphuretted hydrogen. First of all the gas is passed over the lime, to remove the sulphuretted hydrogen, and then the lime, which is thoroughly saturated with sulphuretted hydrogen, and is in the foulest and most objectionable condition that it possibly can be, has a chemical affinity for these "other sulphur compounds." But, in order that it may thus act upon the "other sulphur compounds," you have to keep it in this foul and highly objectionable state, and when, ultimately, you discharge these lime purifiers, you create an enormous nuisance in the neighbourhood—I say nothing of the men.

The CHAIRMAN: Will you allow me to interrupt you? I thought you spoke of a second tray of lime, by which the sulphurous particles were extracted, but now I think you say it is the same.

Mr. PHILBRICK: No; the first purifier removes the carbonic acid, the second the sulphuretted hydrogen. If you will allow me, I will just mention how it is done. I think there are two vessels, which are lime purifiers, and which have trays of lime in them—several trays of lime in each. The lime is spread so as to afford the greatest amount of surface for the gas to travel over. The first of these processes adopted by us removes the carbonic acid, and the second removes the sulphuretted hydrogen, and being saturated with it, it acts upon these other obscure sulphur compounds. Then a third tray is filled with the oxide of iron, and that removes the residue of the sulphuretted hydrogen; and we must do that, because, keeping the second tray charged to the full, saturated with sulphuretted hydrogen, it does not remove any of the sulphuretted hydrogen that after that period of saturation passes over it. If once you have got it fully saturated, then all it does is to take the other sulphur compounds, and you must treat it with oxide of iron afterwards, to get the sulphuretted hydrogen from it. I say nothing of the offensive nature of the lime which has to be removed from that purifier by the men; it is difficult to get them to do it—the suffering they have to undergo physically is very great; but the nuisance to the neighbourhood is something tremendous. It is naturally complained of wherever it exists, and it is so great that the lime process of purification cannot practically be resorted to in any crowded city, or near any city. But further than that, I ought to mention that there is a most expensive process resorted to by this particular company, in order to get rid of these other sulphur compounds. We can get rid of all the other impurities, but since the presence of these other sulphur compounds has been restricted, the effect upon this company has been to add as much, I think, as 2d. per 1000 cubic feet of gas to the actual cost of production, during the three years which have elapsed since the Act of 1873 has been in force; and when we have studiously endeavoured to carry out the requirements of the Legislature, it has averaged over a penny. But during the last year the necessity for the extended use of the lime has been so great that it certainly costs the consumer 2d. at least per 1000 feet more for gas, and in actual amount of cost in the purification you will find that it really costs us, per ton of coal carbonized—which is the unit that they use in gas manufacture—5d. more; the figures are 2½d. (I am not going to decimals) as against 7½d.; and, in addition, we have this foul compound, the very presence of which is a nuisance, and the removal of which is complained of by the neighbours and the neighbourhood at large, and we have to pay for removing it. It has to be carted or taken away by truck, and I believe it is useful for no purpose whatever. The lime can only be used once, and when once it is fouled it is got rid of as an offensive compound. I believe, in the case of the Chartered Company, they send it out to sea at a vast expense; but I will not anticipate their case. We have to get ours taken away; and it costs us 5s. a ton to get it taken away into the country, and that entails a cost which is of considerable importance—something like £250 to £300 a year. Let me be very frank with the committee, as far as I can, in this matter. I agree that these sulphur compounds are objectionable, and, if we can get rid of them, they should be removed; but the question is, what harm do they do? what is the cost of getting rid of them? and what is the necessity for removing them? and what is the trouble they cause? Let me tell you, as far as we can ascertain, it never has been alleged, even by Dr. Letheby, who discovered its presence, or by any of the eminent chemists or gentlemen who have been consulted on the point, or who have given their attention to the matter, that, with regard to the health of the community itself, the presence of this infinitesimal quantity is at all objectionable or deleterious. That never has been alleged.

The CHAIRMAN: Do you mean the 20 grains, or the 50 grains, or the 40 grains?

Mr. PHILBRICK: Even 40 have never been alleged to be injurious. I desire to adhere to the largest number at once. It has never been alleged that the presence of those other sulphur compounds has been at all objectionable, and I should be much astonished to hear it alleged in this committee-room. I do not think it can, in the face of all the scientific knowledge which has been applied to this subject. It is said that the choking sensation of an ill-ventilated room where gas is burning under proper conditions is due to these "other sulphur compounds." That is absolutely without proof, and is insusceptible of proof; it is only carbonic acid and the perfect combustion of gas. The carbonic acid being produced by the burning of gas gives rise to that sensation of heat and malaise that one feels in a badly-ventilated room. But then it is said that it destroys and tarnishes the gilding of rooms, the gilding of mirrors and picture frames, and the picture-ropes round the tops of the rooms, and so on. All I can say with regard to that is this—and you will have positive evidence upon that point—that it is the heat in the air that I referred to, which generally causes the rot of the gilding of rooms, and the nuisance which is occasioned by the gilt tarnishing in the upper portion of the room. If any of the members that I have the honour to address may recollect, there was a great question some years ago about the library of the Athenæum Club, which is a room lighted with gas, and I believe there is a library in that building also, in which books are stored, which is not lighted with gas—that is to say, in which the products of the combustion of gas do not come into the room itself. I think it is shielded off with glass shields, as I believe the gas is in the House of Commons; but it was discovered in the library of the Athenæum that the maximum amount of injury that had been caused was all in a certain portion of the bookcases; and when Mr. Layton, the eminent builder, went to examine, he found that the flue of the kitchen chimney went up there, and that, almost entirely, the bulk of the mischief was in the books where the heat went. He could trace the course of the chimney by the leather of the books having perished. Well, but it has been said: "Oh, in other cases sulphuric acid has been found." Now, sulphuric acid, or oil of vitriol, is a very objectionable thing, and I am told (I am not chemist enough to understand it practically myself) it can always be produced where you have sulphur and water and combustion under certain conditions. I believe, in any very large city where coal is burnt, there is a trace, more or less, of sulphurous acid, and, sometimes, sulphuric acid; but that there is any sulphuric acid in these sulphur com-

pounds I believe will be denied. It has been said that when you see the binding of a book perished you can taste the acid with your tongue. It is a most amusing thing if that be so, because practically in bookbinding they do use acid for the purpose of bringing about on the leather certain colours, applying certain pigments to them as mordants, and certain other books which were said to be affected and prejudiced did not contain a taste of acid; so that, in all probability, the acid which was supposed to have been detected would be rather that which was used in the original binding of the book. Otherwise, there is no reason why Gibbon's "Decline and Fall" should exhibit the acid, while Macaulay's "History of England," side by side, should not have the acid. Under these circumstances, we believe most thoroughly, from all our inquiries, and all the evidence we can produce, that there is really not a shadow of mischief to be attributed to this sulphur compound. People did not know what it was, and, therefore, they were afraid of it. Not the slightest injury can be alleged from the production of those sulphur compounds, even 40 grains in 100 cubic feet of gas. The mischief done is infinitesimal, and the labour, trouble, expense, and annoyance of creating a nuisance to the neighbourhood by the use of lime are so great that we feel that the restriction put into the Act in the way we describe would never have been there had all these facts been known, and had due consideration been given to them. We shall call Mr. Stevenson before you, who will explain his views. He is not ashamed to say that, having bestowed further attention on it, he is convinced that there are really not the slightest injurious effects produced by the presence of these sulphur compounds, and we shall ask the committee, when they have heard the case, to relieve us from this obligation, we at the same time putting ourselves under the limitation that in no case shall the sulphuretted hydrogen which is objectionable be present in the gas which we deliver to our consumers.

Mr. George Livesey, examined by Mr. PAULI.
I am a member of the Institution of Civil Engineers, and Past-President of the British Association of Gas Managers. I am engineer and secretary of the South Metropolitan Gas Company, and also a director of the Crystal Palace District Gas Company. In the manufacture of gas, the raw material—the coal—is placed in a retort, which is heated to a bright red heat, and the result is that the volatile matters are driven off by the heat, the volatile matters consisting of condensable tar and water, and other matters consisting of the illuminating gas and certain gaseous impurities, such as sulphuretted hydrogen, ammonia, carbonic acid, and other sulphur compounds. The coke is left in the retort, to be drawn at the expiration of five or six hours, when the gas has all been expelled, and the tar and water are condensed by simple cooling—by simply carrying the gas through a pipe exposed to the air, or carried under water. In this way they are removed mechanically. We then have to remove the gaseous impurities, which consist of ammonia, carbonic acid, sulphuretted hydrogen, and other sulphur compounds, which are principally sulphide of carbon. The ammonia is first removed, and, owing to its extreme affinity for water, it can be very readily removed by bringing it into contact with water only. The sulphuretted hydrogen—which is the most objectionable impurity, and, in fact, such an objectionable impurity that if it were left in the gas it would render the gas totally unfit for burning, and totally intolerable—was removed originally by the use of lime. Up to about 1850, or a little later than that, all the gas-works employed lime for the removal of sulphuretted hydrogen. This lime, when taken from the purifiers absorbed carbonic acid from the air, and sulphuretted hydrogen was evolved, causing a very objectionable stench in the neighbourhood. I lived near the gas-works—on the premises, in fact—in those early days, and can remember very numerous complaints that were made respecting this lime. In 1850, or thereabouts, it was discovered that sulphuretted hydrogen could be most effectually removed by means of hydrated peroxide of iron—a material which not only absorbs the sulphuretted hydrogen with great readiness, but also renders it perfectly innocuous. This material, on being taken out of the purifiers, is exposed to the air, and by that exposure it absorbs oxygen, which causes the sulphur or sulphuretted hydrogen which had been combined with it to be deposited as sulphur in a solid form. Exactly the reverse of that was the case with lime. The sulphuretted hydrogen by the lime process is driven off into the air; but with the oxide of iron process it is deposited in the solid form; and this oxide of iron, after a few days exposure, becomes what we describe as revived, and fit for use again, and so can be used over and over for perhaps twelve months. The sulphur is not absolutely separated from it. We start, say, with 100 cubic yards of oxide of iron. Some of it is got from the bogs of Ireland, and some of it is artificially prepared. By putting it in the purifiers it absorbs a certain amount of sulphuretted hydrogen; then on exposure to the air that sulphuretted hydrogen is decomposed, and solid sulphur is deposited in the material. We then put it into the purifiers again and again; and at the expiration of about twelve months the 100 cubic yards become converted into 200 cubic yards. We then sell it to the sulphuric acid makers, who use it for making sulphuric acid, instead of purchasing sulphur or pyrites.

Mr. PAULI: I believe the removal of this sulphide of calcium is attended with considerable expense?

Witness: A very great expense. It costs the Crystal Palace Company 5s. per ton of coal carbonized. They have tried various means of getting rid of it, and after being complained of by the neighbours and the local authorities, creating a nuisance by depositing it either on their works or in other parts, they have been obliged to send it away by rail at a cost of 5s. per ton. A further impurity is carbonic acid, which has this effect, that it diminishes the illuminating power of the gas—it has no other detrimental effect; but it may be advisable, in certain cases, to remove it by lime, or to substitute the use of a little cannel coal, which yields a richer kind of gas, and so brings up the quality. We may remove the carbonic acid, or we may increase the quality of the gas, and the result is the same. There is now a better plan of removing it than by the use of lime. Mr. Hills has invented a means of rendering the ammonia water caustic, converting the ammonia water from its crude state into a state of caustic ammonia, and this can be used, and is used by me at the South Metropolitan Gas-Works, for removing carbonic acid. This does not affect the sulphur question. It will ultimately affect it. The carbonic acid will bear very materially, ultimately, upon the sulphur question.

Mr. PAULI: Have you had practical experience of the nuisance of emptying these purifiers?

Witness: Yes, I have had, all my life, except when we used oxide of iron only. The nuisance is experienced a considerable distance from the works. I smelt it yesterday morning half a mile from our works in the Old Kent Road; commonly it extends further than that.

Mr. PAULI: With regard to the presence of ammonia, there is no difficulty whatever in ascertaining the existence of that?

Witness: It is just one of the simplest things possible. I have here, in this little case, a test for ammonia and sulphuretted hydrogen. It is simply a piece of blotting paper, saturated with acetate of lead; by wetting it, and exposing it to the gas, it will detect an infinitesimal quantity of sulphuretted hydrogen—considerably less than one grain in 100 feet of gas. This yellow paper is a paper saturated with turmeric, and by exposing it to the gas, it will detect as small a quantity as two

grains of ammonia in 100 feet, by turning red. So that the test for those impurities is of the readiest and most sensitive character, and can be applied at any moment.

Mr. PAULI: And for carbonic acid the test is equally simple, I believe?

Witness: For carbonic acid a little clear lime water is put into a small vessel, and the gas allowed to bubble through it for perhaps a minute; and if carbonic acid is present, the water becomes cloudy.

Mr. PAULI: With regard to those other sulphur compounds in their gaseous state, can their presence in the gas be detected?

Witness: There are no direct means of testing for those other sulphur compounds. The old plan was to burn a jet of gas under very peculiar conditions for perhaps 20 hours, and condensing the products of combustion with an alkali. The products of combustion were then analyzed for sulphur. It was a very long process, and we are indebted to Mr. Vernon Harcourt, one of the Referees, for a much simpler means. This, however, is not a direct method. By heating the gas to a certain temperature—I do not know the exact temperature, but perhaps 400° or 500°—he converts the sulphur compounds into sulphuretted hydrogen, and then by testing with this lead paper, he can detect their presence. The tests for ammonia, carbonic acid, and sulphuretted hydrogen are absolutely reliable—perfect you may say; but the same cannot be said of the test for the other sulphur compounds. Those tests seem to vary in a most unaccountable manner. I may give an instance of tests made at different places upon the same gas, tests made about six weeks ago at the South Metropolitan Works, and the tests made by the official tester. We had 29 grains in 100 feet at the works, and the official tester gave a return of 42. I can only account for the difference (and other experience has gone to prove the truth of this) by the possibility of these sulphur compounds being absorbed or arrested, by accidental causes for a time, by the pipe through which the gas flowed, and then, under other circumstances, being carried on by the gas. And a further proof of that is this. For the purposes of this inquiry I had a special quantity of gas made and purified by oxide of iron only—that is, purified from ammonia, sulphuretted hydrogen, and partially from carbonic acid; but the sulphur compounds were left untouched. That gas was stored in a separate gasholder, to the extent of about 400,000 feet. Dr. Odling and Dr. Russell have been making experiments on that gas during the last three months; the gas has been tested daily for sulphur compounds; one day it would be 26 grains, and another day it would be 39. I therefore thought that the great length of pipe through which it travelled—namely, 200 feet—might be the cause of it, and I had a pipe put direct into the gasholder and conveyed into the testing-room, and then I found there were variations, not to so great an extent, but very nearly; and the only conclusion I can come to is this, that the pipe absorbed or arrested something of the sulphur on some days, and gave it up on others. It was found uniformly to be the case that when the flow of the gas through the pipe was at the rate of half a foot an hour, the results were small—about 30 grains, or perhaps a little less; but that when the flow of gas through the pipe was at the rate of 15 or 20 feet an hour, we got 35 to 39 grains.

Mr. PAULI: Have there been any cases in which companies, without the use of lime, have attempted to purify their gas from the other sulphur compounds?

Witness: There have been numerous attempts made to purify it, but they have all failed; nothing but lime will do it at all.

Mr. PAULI: Is it correct to say that you cannot attempt even to purify gas from the other sulphur compounds without the use of lime?

Witness: Undoubtedly.

Mr. PAULI: And it is equally undoubted that you cannot use lime without being a nuisance?

Witness: It is undoubted.

Mr. PAULI: And I believe in those cases where it has been attempted without the use of lime, to purify the gas from sulphur compounds, it has only been done with a certain class of coal at a greatly increased cost?

Witness: There have been instances where companies have supplied gas containing a comparatively small quantity of sulphur without the use of lime. For instance, at the late City Gas-Works, Mr. Mann, the engineer, for a number of years maintained his sulphur at something very little over 20 grains in 100 feet, and even then there were the same discrepancies of testing. Mr. Keates tested for the company on the works, and Dr. Letheby tested for the Corporation in the City; and I believe their results never agreed. But it is possible to get a coal which yields a comparatively small amount of sulphur compound. On one occasion the South Metropolitan Company got a coal of this sort, and used it for twelve months. The quantity of sulphur amounted to not much over 20 grains, but the yield of gas was 900 feet per ton less than from the ordinary Newcastle coals. Moreover, the collieries which supply the coal yielding this small quantity of sulphur are so few and so small that it is absolutely impossible to get that coal as a general thing.

Mr. PAULI: Is it a fact that, where lime is used, in many cases the lime will give out the greater part of the sulphur that is previously absorbed?

Witness: That is just what it does do on exposure to air.

Mr. PAULI: Will you tell me about the discovery of these sulphur compounds?

Witness: A little over 20 years ago, I believe, they were absolutely unknown, and their existence was unsuspected until something like 20 or 25 years ago. Dr. Letheby, after being appointed by the corporation as analyst of their gas, discovered, by analyzing the products of combustion resulting from gas, that there was a certain amount of sulphur that was undetected by ordinary tests.

Mr. PAULI: Then, I believe, after his discovery, which was published there was a kind of panic among gas consumers; they had an idea that they were all being poisoned by some unknown compound?

Witness: I suppose they did; at any rate, there was a great deal made of it; and, of course, it being perfectly well known that in a room lighted with gas there is a certain oppressiveness felt, and a certain disagreeableness in the air, the conclusion was jumped to that it must be these newly discovered sulphur compounds.

Mr. PAULI: And was it this outcry against sulphur compounds which induced the Legislature to inquire into the matter, and to try and fix some maximum?

Witness: By the Metropolis Gas Act of 1860, the Legislature imposed a limit of 20 grains upon the companies, and, in fact, took "a leap in the dark." Nobody knew how to deal with it; and that Act to the present day is a dead letter. Three of the large companies, supplying nearly all the south of London, are under that Act at this very moment, and the vestries and parishes who have had authority to enforce the Act have never done it. They are the Phoenix, the London, and the Surrey Consumers.

Mr. PAULI: Now, the process of purification that you use is practically Mr. Patterson's, is it not?

Witness: The certain means of dealing with the sulphur compounds by means of lime is undoubtedly Mr. Patterson's plan. The old plan was to use oxide of iron in one set of purifiers—four purifiers, for instance—through which the gas passed in succession, in order to be perfectly secure that the gas was thoroughly purified. In order to deal with those sulphur

compounds, you must have three sets of purifiers instead of one set. We are indebted to Mr. Patterson, one of the first Referees, for making it clear, and Dr. Odling also investigated the same thing about the same time. You must have one set of purifiers to remove all the carbonic acid, and another set of purifiers also charged with lime to absorb first the sulphuretted hydrogen, and then, when this lime has become saturated with sulphuretted hydrogen, it is in a condition to absorb the sulphur compounds. Then you must have a further set of purifiers to absorb the remaining sulphuretted hydrogen. When the lime is in the condition shown in the specimen produced, it is in a fit state for absorbing the sulphur compounds. That lime is saturated with sulphuretted hydrogen. This bottle contains some of the oxide before it is exposed to the gas. The other contains the same oxide which has been taken out of the purifier after purifying the gas. If this were spread out and exposed to the air for a few hours, it would become a brown colour, and ready for use again. This abominable stuff [pointing to the bottle containing foul lime] is of no use. There is a little smell from the oxide when the purifier is being emptied, but nothing appreciable.

Mr. PAULI: Just explain to the committee for one moment the difference between the purifiers with sulphide of calcium and oxide, when both are impregnated with sulphuretted hydrogen?

Witness: In removing the oxide you expose it to the air. I think I have explained that. In the one case the oxide absorbs the sulphuretted hydrogen, and deposits the sulphur in a solid form, and in the other the lime absorbs the carbonic acid, and the sulphuretted hydrogen is driven off into the air.

Mr. PAULI: With regard to the results of this very expensive and inconvenient mode of purification, what results have you obtained?

Witness: The results amount to something like this, that the sulphur compounds are diminished to little more than one-half. I have here the tests of the gas for sulphur compounds during 18 months—from July, 1870, to December, 1871—the first 18 months of the testing of the South Metropolitan gas, under the authority of the Referees. At that time no sulphur limit was fixed, and no lime whatever was used in the purification. There were during that time 415 tests made by the official tester, and the sulphur ranged from 25 to 42 grains in 100 feet; the average was 32 grains. The highest was 42.2, and the next highest was 40.5; it never exceeded 40 but on those two occasions. The lowest was 20, but I struck that out, as I believe there must have been an error. The next lowest was 24.9. You may say the range was from 25 to 42 when we used nothing but the oxide of iron, and the average was about 32 or 33.

Mr. PAULI: Do you consider that that reduction is at all compensated for by the trouble, cost, and nuisance involved?

Witness: I have hardly answered your question. The reduction is from an average of 35 to an average of a trifle under 20, and I certainly do not think it is worth the trouble and cost.

Mr. PAULI: Will you tell the committee the effect which the sulphuretted hydrogen or the sulphide of calcium has upon the men who enter the purifiers?

Witness: The effect upon the men is very objectionable. I have had men very often laid up for several days by temporary blindness. When the lime happens to be in a dusty condition it is exceedingly irritating to the eyes, and nostrils, and throat. If it is in a very wet state, it clings to their hands and makes them sore; in fact, I very often feel exceedingly sorry to be obliged to require the poor fellows to work in those lime purifiers. I have tried respirators and gloves, which are of no use; the lime destroys the gloves. I got some of Professor Tyndall's respirators, those with cotton wool, and the men could not draw sufficient air through them when at work. I think it is the dust that affects the eyes.

Mr. PAULI: Do you find that in a gas-lighted room there is any practical difference between gas that contains 35 grains of sulphur and gas that contains only 15 grains?

Witness: In my own house I burn gas rather lavishly; and having had experience during all my life of burning different sorts of gas, I have never been able to detect the slightest difference, whether the gas contains 40 grains or 10; and I have burnt it under those conditions repeatedly. The unpleasant feeling which everybody more or less experiences from gas has never been traced to sulphur. I have read everything that has been stated upon the subject, and I have never seen or heard such an assertion. An ordinary gas-burner, burning at the nominal rate of 5 cubic feet an hour, would be equal to something like 15 or 16 candles. A small room would have three burners going; and multiplying that by 15, it would be perfectly absurd to put 45 candles in such a room. Probably the heat and unpleasantness would be something like it is from the gas, if the same quantity of light were supplied. The difference between gas and candles is this, that you are obliged to have gas at a distance from you, whereas you can bring candles close to you, which will serve equally well with a very much smaller quantity of light. I know something respecting the alleged effects of this sulphur on binding leather and furniture. It has been said that it destroys leather and furniture. I remember the case of the Athenæum Club. I do not believe that there is any truth whatever in the assertion that the bindings of books are destroyed by the sulphur compounds in the gas. I think there are other things which would account for it far more satisfactorily. I attribute it to the excessive heat chiefly. Evidence has been given over and over again to show that books and furniture will suffer just as much in a room which is hot, and where there is no gas burnt, as in a room where gas is burnt plentifully.

Mr. PAULI: I would ask you one more question, which does not affect us much; but I believe before you had imposed upon you this liability, you used to find your life generally much more pleasant than it is now?

Witness: A director's life is not an unpleasant one anyhow, but a manager's is very different. In my business as engineer, I used to take the extremest delight in it, and I have often thought that I could not have found a more pleasant and suitable occupation; but since there has been the trouble about the sulphur, it is perfectly unendurable. Sometimes I cannot sleep, and cannot think of anything else.

Mr. PAULI: With regard to the limits which are imposed in large towns in England, is it not the fact that the principal towns, such as Manchester, Birmingham, &c., have no limit whatever?

Witness: It is. I was at Manchester last year, and made special inquiry upon that point. I was there, called in by the corporation, in conjunction with Mr. Hawksley and Mr. King, to advise them as to the selection of plans for new gas-works to make 10 million feet a day. There were 28 sets of plans exhibited, and the corporation would not say anything about the sulphur. I therefore made further inquiry, and ascertained that they did not intend to take any trouble whatever about it, and did not deal with the sulphur compounds at all. In Paris I made a special visit of inspection two years ago, and ascertained precisely the same thing.

Mr. CHIEFS: It will probably be convenient to the committee if I state, before cross-examining the witness, the course that I intend to take. This is now a small part of a large case which is to come before the committee. In that large case I am also engaged, and we have the assistance of a great number of eminent persons, and my learned friend, Sir Edmund Beckett. I do not intend to interfere with that case in the slightest degree by what takes place in this case. It would be to give the committee a great deal of trouble to hear the same evidence twice over, and, therefore, I decline

entirely, in this case, to go into any one of these scientific matters which we must then have at greater length, and with better means of discussing them than we have in this case. I shall have just a few general questions to ask this witness, and I will dismiss all this science entirely for the present. Of course I do not assent, for the present purpose, to any portion of it.

Cross-examined by Mr. CRIPPS: The Crystal Palace District Gas Company were not included in the Act of 1860, which prescribed 20 grains as the maximum amount of sulphur impurity. Until the appointment of the Referees, all the Metropolitan Companies were under that Act, and, during all that time, it was not lawful to exceed that maximum. If they did exceed it, the manufacturers were liable to penalties; but it was not observed—that I can state most positively. In 1868 the legislation in this respect, in reference to the Chartered Company, was exchanged for what is now the Referee legislation. Subsequently this system was applied to nearly all the north of London. The legislation of 1868 altered the limitation of 20 grains of sulphur in 100 feet in the Metropolis, and enacted that the proper quantity should be determined by the Referees; but I think I am entitled to give the reason for that. It was found to be utterly impossible to comply with the 20 grains legislation. There was nothing known about it, so the committee thought, or the promoters and opponents of the Bill thought between them, that it would be fair to remit it to a scientific body. The larger question has to be fought before this committee with regard to the Referee legislation, and to their prescription of the quantity of the sulphur to be allowed. The experiments which I and others have ventured on are in their relation similar to those which affect the larger question, because if the larger company win their case it will relieve me at the South Metropolitan works. The Crystal Palace District Company are not a little company, except by comparison. About half the area they supply is within the metropolitan district. I represent that company here.

Mr. CRIPPS: Do you state for the South Metropolitan Company that you have not been able to comply, and have not complied, with this regulation about the 20 grains of sulphur?

Witness: I stated that I have not been able to do it continuously and perfectly.

Mr. CRIPPS: But you have been able to do it generally?

Witness: I perhaps have by creating a nuisance.

Mr. CRIPPS: I hold in my hand a report made by the Chief Gas Examiner on the results of testing the gas of different companies. It is a report made to the Metropolitan Board of Works, and I find for the last quarter, or rather the quarter ended on Dec. 31, 1876, the average result of the testing of your company was only 17·7 grains in 100 cubic feet.

Witness: Quite right.

Mr. CRIPPS: Then you have complied with the regulations?

Witness: Yes. I may go back a little, as you have referred to these reports, and state that in December, 1875, my gas was ten times over the limit of 25 grains—the Referees allow 25 grains in the Metropolis during the six winter months, and 20 grains during the six summer months. In the latter part of November, and during the month of December, I was 14 times in excess of the 25 grains; in the month of January I was ten times in excess, and I am bound to say here that the Metropolitan Board have always acted most fairly and liberally in these matters. However, from the end of January, 1876, up to the end of February of this year we went on without a single excess, and then the excesses came on, and why they came on I never could find out. We went up to 42 grains.

By the COMMITTEE: There is a larger margin allowed in the winter than in the summer because of the greatly increased quantity of gas that is made. We make four times as much gas in December in one day as we do in June, and therefore there is greater difficulty in dealing with it.

Mr. MICHAEL: The reason is that the larger make of gas taxes your purifying power?

Witness: Yes. People burn more gas in winter. We went on all right for 14 months, and then there was an excess of sulphur on the 1st, 2nd, 3rd, and 5th of March; and I think there must have been on other days, but the testing office was shut up for repairs. I wrote to Dr. Williamson, the Chief Gas Examiner, and stated that there was something wrong, but I could not find out what it was; and here he quotes from me: "Though how or why, or to what extent, I am totally unable to say, unless the cold weather of last week had something to do with it." Then Dr. Williamson goes on: "A careful investigation of the circumstances of the case has brought to light evidence that portions of the lime in the purifiers have remained inactive, and I have reason to believe that the quality of the lime employed is subject to variations which affect its absorbent power."

Mr. CRIPPS: During the time that you have been under this restriction, and during the time that the metropolitan companies have been under this restriction, they have always claimed to divide 10 per cent.?

Witness: Yes, they have; but you know how it is.

Mr. CRIPPS: If the matter came to that, you could divide a little more in the South Metropolitan?

Witness: Yes; but you remember about the sliding scale.

Mr. CRIPPS: We will not go into all those matters now; but, however, you have managed to comply with the regulations and to divide 10 per cent., and could divide more?

Witness: Yes; our Act gave us the power to charge a price that would enable us to pay 10 per cent. That is altered now.

Mr. CRIPPS: Never mind what the Act gave you; your mode of making gas, as long as you are enabled legally to do it, does enable you to divide more than 10 per cent.?

Witness: Yes; it comes to this, that we make the consumer pay 2d. per 1000 for these things—perhaps 2d. per 1000 more than he would otherwise do. Why did not the Metropolitan Board insert the sulphur clause in their Bill when they proposed to have gas-works of their own?

Mr. PHILBRICK: Representing the consumers when they were bringing in a Bill to supply gas to London, I understand you that the Metropolitan Board of Works introduced their Bill without any limitation of this kind upon the purity of the gas?

Witness: They did; and every other corporation do the same.

The COMMITTEE: In what year was that?

Witness: That was 1875.

Mr. CRIPPS: That was merely a skeleton Bill introduced into Parliament.

Mr. MICHAEL: They wanted to reduce the companies to skeletons.

Re-examined by Mr. PHILBRICK: The Crystal Palace District Company supply a suburban district, and they have an absolute hard and fast limit of 20 grains in their Act; but in the Metropolis itself the companies which are under the Act of 1868 have no limit, but it is left to the discretion of the Referees. Originally the Referees fixed the sulphur limit at 30 grains, then it was reduced to 25 grains in winter and 20 in summer. We are therefore absolutely worse off in the suburban district than the great metropolitan companies are, because during the whole year we have the extreme limit put upon us which is put upon them in the summer time, when gas is easier to manufacture, and there is more time to purify it.

Mr. PHILBRICK: Now I do not want to go into other matters; but my

learned friend, Mr. Cripps, asked you this: He said that the South Metropolitan could comply with the requirements of the Act, and yet divide 10 per cent. Are there circumstances connected with the history of your South Metropolitan Company which render you peculiarly situated with reference to your capital and to your dividend over every other company in the Metropolis?

Witness: Yes; and it simply comes to this, that we are allowed to charge a price for our gas which is sufficient to cover the cost of making it and to pay a 10 per cent. dividend, and it also covers the extra cost of lime purification. So that it becomes a question in this way, that if lime purification is more expensive, it is a matter which the unfortunate consumer has to pay for. The Crystal Palace District Gas Company are not a 10 per cent. company. They have £50,000 at 10 per cent., and the rest at 7 per cent. and 6 per cent. And although they have a maximum price of 6s., they keep the gas at 3s. 11d., and reduce it a penny when they can.

Mr. COURTNEY: Would the increased difficulty of testing this gas in winter, on account of the greater amount required, apply as much to the Crystal Palace Company as it does to any metropolitan company?

Witness: Yes, because their apparatus is in full proportion to their works, and there is a greater difficulty, especially in the depth of winter, because there is always a pressure on gas companies. We work at our full power.

Mr. COURTNEY: Is this process of purifying by hydrated peroxide of iron a very expensive one, as compared with purification by lime?

Witness: It was, when it was first introduced, just about as costly as lime, but the improvements that have been made have brought down the cost, so that, in some companies, they purify their gas really for nothing—it does not cost a halfpenny per 1000 feet. The value of the spent oxide is as much as the material in the first instance. You may buy fresh oxide at, perhaps, 50s. per ton, and when it is doubled in bulk you sell it at 25s. per ton.

Mr. COURTNEY: The process with the hydrated peroxide is not at all open to the disadvantages of disagreeable smell and injury?

Witness: The only objection that has ever been urged to the oxide of iron process is, that it does not attack the sulphur compounds other than the sulphuretted hydrogen. On all other grounds it is undoubtedly and undeniably the best.

Mr. COURTNEY: Besides the injury to the eyes and hands of the men by the actual contact of solid lime in the process of purifying by lime, do you think that the vapour given out, which produces the disagreeable smell, is injurious to human beings—to health?

Witness: I have been amongst it all my life, and I cannot say that the smell is injurious. The workmen are mostly engaged in the air in these processes. There is free circulation of air; so that I do not think their health is injuriously affected by the emanations, except so far as contact with the solid lime.

Mr. COURTNEY: The Crystal Palace Company are under the same limitations as the metropolitan companies were under before 1868?

Witness: Precisely. The limitation was imposed in respect of this company in 1873. It was made in the case of the metropolitan companies because the Act of 1860 was totally inoperative; and it was utterly impossible for the committee to settle what should be the proper limit, therefore it was remitted to the Referees to investigate.

Mr. COURTNEY: You do not think it necessary to have any limit?

Witness: By the use of oxide of iron the quantity of sulphur in the gas will not exceed these 40 grains, and, therefore, I think the limit is unnecessary; but if any limit is imposed, we should probably have to use a portion of lime, and that would not be a small portion, because the whole of the carbonic acid having to be removed first, we should have nearly as large a use of lime if we were limited to 35 grains as if we were limited to 25. Moreover, if you use lime you get sometimes less excesses; for instance, the Crystal Palace Company, on one occasion, when they used lime, had 49 grains, and they were prosecuted by the Lewisham Local Board for it. That was entirely owing to the carbonic acid in the gas driving off some of the sulphur compounds that had been absorbed by this lime, and sending them on with the gas. The lime absorbs them, but it holds them with a very feeble affinity; and if I passed a stream of carbonic acid into this bottle, you would have those sulphur compounds driven off largely.

Mr. George Wilson Stevenson, examined by Mr. MICHAEL.

I am a gas engineer, carrying on business in Westminster, and have had large experience in gas undertakings. For the past ten years I have been consulted by the Corporation of London and the Metropolitan Board of Works upon all questions affecting the supply of gas in the Metropolis. I know the works of the promoters, and the district supplied by them, and the Acts under which they are authorized to supply gas. I have read the Bill which is now under the consideration of the committee. I know pretty well section 17 of the Act of 1873, which the Bill seeks to repeal. I gave evidence upon the Bill in 1873. At that time very little was known with certainty as to the cost and inconvenience attending the purification of gas from sulphur compounds other than sulphuretted hydrogen. Since 1873 there has been a very large amount of inquiry, and a very considerably augmented knowledge as to these sulphur compounds. Nothing even now is exactly known as to the conditions in which they exist in gas, or a precise and scientific determination of the quantity. From time to time the same gas, tested in exactly the same mode, will give different results. The best means of taking out the sulphur compounds, I believe, are not yet known. I gave evidence as engineer in favour of the Bill of 1873, and was cross-examined by Mr. Philbrick, who then represented the Metropolitan Board of Works, on the general question of impurities in gas. In re-examination I stated that I thought 20 grains might be inserted, and upon that, without any question, it not having been asked at all of me in cross-examination, the promoters of the Bill at once assented to put in 20 grains as the limit. There was no discussion about the 20 grains; it was merely because I at that time stated from my knowledge up to that time that 20 grains might safely be inserted. If I had had the knowledge I have at the present time, I should not have stated that 20 grains was a safe limit to put in. I could not have done so. There has been no department of gas manufacture which has been submitted to more critical inquiry the last few years than the purification of gas, and we have knowledge now in regard to the cost, inconvenience, and nuisance occasioned by the elimination of sulphur compounds that we had not a few years ago; and with my present knowledge I could not say that 20 grains of sulphur, other than sulphuretted hydrogen, is the proper limit to impose upon a gas company. At the present time there are no other means known which can be used practically for taking out the sulphur compounds, other than sulphuretted hydrogen, except the use of lime, and that, too, in its most foul state—in a state of sulphide of calcium. That being so, in my opinion it was almost inevitable that a nuisance, and a nuisance of a very considerable extent, must be created by such a mode of purification. The lime is used in a very foul state—it is made foul in large quantities—it has to be removed from the purifiers by manual labour; and then, unless a river carriage is available, as it is at some stations, where they can put it into barges immediately, and cover it with tarpauling, or with some deodorant, the foul lime has to be put into carts or railway vans, and everybody who comes near it, or into whose neighbourhood it is

brought, complains of the nuisance. It is a deleterious matter to deal with on the part of the workmen who are engaged in the process; it injures their hands and their sight, and produces nausea.

Mr. MICHAEL: Previously to the introduction of hydrated oxide of iron as a means of purification, lime was the purifying agent employed, I think?

Witness: Yes; I can remember when milk of lime was employed, and it resulted in what was called "Blue Billy;" and a very valuable mode of purification it was, except for the nuisance it created. It was on account of that nuisance that chemists so ardently sought for some other means of purification to avoid the use of lime. It was on that account also that oxide of iron was hailed as a great boon, as it entirely superseded the use of lime as a means of purification from sulphuretted hydrogen. No sulphuretted hydrogen is under any circumstances permitted in gas. It is an injurious compound, and is strictly prohibited and most carefully guarded against in every well-conducted works. There is no proposition in the present Bill that any sulphuretted hydrogen should be allowed. The Gas-Works Clauses Act, 1871, which is the general legislation on the subject, prescribes an entire freedom from sulphuretted hydrogen, and except for a special provision in a special Act, the general legislation does not provide for the removal of any other sulphur compound than that. The Board of Trade have passed, I think, some seventy Provisional Orders since 1871, which have been confirmed by Parliament, for the regulation of gas companies in the provinces, and in not one of those is there any other restriction with regard to sulphur than the complete elimination of sulphuretted hydrogen. The last of these was in 1876.

Mr. MICHAEL: You are very well acquainted with the Acts which have been passed for transferring undertakings from companies to corporations and local authorities and urban sanitary authorities through the country?

Witness: I am. In none of them, as far as I know, has any such restriction been inserted. I am very largely engaged in advising gas companies through the country. I do not know of any such limitation as 20 grains of sulphur being imposed in any of the Acts which have been recently passed for regulating provincial undertakings. There have been three Acts passed of late years with a 30 grains maximum only. One is the Act of the British Gas Company, at Norwich, the year before last; and another, the British Gaslight Company, at Hull, last year; and there is a third, the name of which I have not here, but which was either in 1873, or since 1873. Each of them has a limit of 30 grains.

Examination continued: I have been engaged by vestries to advise them upon this subject as against the gas companies of the Metropolis. I was engaged by the Vestry of St. Luke's, Chelsea, to advise them in regard to an alleged nuisance arising from the Fulham works. I do not know that we could trace sulphuretted hydrogen 700 or 800 yards, but the stink from the works was distinctly perceptible at 700 or 800 yards in the direction in which the wind blew; and, upon a detailed investigation, it was found to be perceptible only at times, when the lime purifiers were being changed at the works. The company take every possible means to obviate the nuisance by transferring the lime as quickly as possible into trucks, which are covered over with breeze—that is, very small coal dust—so as to prevent the escape of these noxious vapours; and then those trucks are taken down a short incline and tipped into barges, and the same process is gone through of covering the spent lime with coal dust or breeze, and subsequently it is covered with tarpauling; but, notwithstanding all that precaution, the inhabitants are very much annoyed, and will always remain so, as long as this system of purification is adopted. I believe the company adopt the best means; and I was compelled to report that, in my opinion, they could do no more than they are doing to avoid creating a nuisance. No gas company could have done more. The Crystal Palace Gas Company could not do more than they do now, in my opinion, to prevent a nuisance. With the most scrupulous care, the use of lime must create a nuisance. The employment of lime in purification, as compared with oxide of iron, is as 1½d to 1d., or five times as much. In this company it amounts to £1500 annually, which comes out of the pockets of the consumers, as they would otherwise be able to supply gas 1d. per 1000 cheaper. But I do not look at the money part of the question itself; it is the irremediable and irreparable nuisance which is the evil in this matter. If it came to a question of money, the gas company, if it really was essential, must bear the cost, whatever it might be. Throughout the very large district supplied by the Manchester Corporation the gas is sent out with as much sulphur in it as it naturally contains, after being purified only by oxide of iron. The gas there is of 20-candle illuminating power. I have never seen any bad results attributable to sulphur in gas supplied by corporations under the same circumstances as Manchester or Birmingham. I have never heard a complaint. At Paris the same circumstances prevail. I do not know what is done at Madrid, but I had the supply of Oporto myself some years ago, and I used only oxide of iron. I have never seen, in my experience—which is very large—as a gas engineer, any bad results occur either to person or property from such a quantity of sulphur in the gas as may be left after purification by oxide of iron, and that alone. I do not believe that any bad results could occur. I was the engineer with Sir Joseph Bazalgette, for the new gas-works proposed to be erected by the Metropolitan Board of Works, in 1875, and I had to do with the preparation of that Bill, which was a Bill complete in all its parts. It was very carefully considered by me, and in that I depended chiefly upon the general law of purification, and put in no special clause other than general legislation had provided. The Metropolitan Board of Works and the Corporation of London, I think, very wisely did what the Board of Trade have done, and all other municipal authorities—that is, they depended upon the supply of sufficiently pure gas when sulphuretted hydrogen only was eliminated.

Mr. MICHAEL: In your experience, and in your opinion, are there any circumstances in the district supplied by the Crystal Palace District Company which call for special legislation upon these points?

Witness: If exceptional legislation were desirable with regard to the Crystal Palace, it would be in the direction of enabling them to create as little nuisance as possible, and at present, by the terms imposed upon them, they are obliged to create a greater nuisance than even the South Metropolitan Gas Company. Those works are situated in the Old Kent Road—not the most delightful neighbourhood in the world—but the Crystal Palace District Gas-Works are situated really in a district among villas and good residences, where it is important that a nuisance should not be created. If the existing obligations were removed, no nuisance could arise from the conduct of the gas company. The effect would be to simply remit the company to the operation of the general law, which I think is quite sufficient to protect all consumers.

The CHAIRMAN: As far as I gather from the evidence which you have given, if you want to reduce sulphur 20 grains you are obliged to use lime.

Witness: Yes.

The CHAIRMAN: But with oxide of iron you can reduce it say, generally, to about 30 grains?

Witness: 30 to 35. Not 30. A limitation of 30 would not materially help the company. They would then be obliged to use lime in such a quantity as to create a nuisance, although not a nuisance to the extent which they now create. From 35 to 40 grains of sulphur is what is left in gas after purification by oxide of iron. In canal districts it is more.

Cross-examined by Mr. O'HARA: In towns and populous places there is a difference in the provision with respect to the purification of gas, but I do not think there ought to be. I do not think it is of the same importance whether a nuisance is created in an agricultural or a district built upon. There are plenty of places—in Lincolnshire, for instance, in the Fens and other places—where they might use lime, to any extent almost, without it being a nuisance, in fact, it would rather be an advantage than otherwise to take lime there. I know at York they sell the spent lime at 5s. per ton. But this does not lead me to say that general legislation would be inapplicable in another place where a different state of things prevailed. With regard to sulphur compounds, I think the present legislation is very wise indeed in regard to the purification of the gas; that is, that it should be entirely free from sulphuretted hydrogen. That is a state of things that is applicable to all districts. I was concerned in advising the Metropolitan Board of Works and the Corporation of London in a Bill which took the form of what was called a Regulation Bill. It was first heard before Mr. Forster's committee, and then again taken up last year and passed. That Bill referred the whole question of sulphur impurity to three Referees, who were to be appointed by the Board of Trade, and I am not surprised that the Metropolitan Board, or anybody else, wanted to get rid of the question; it was one upon which there was very great disagreement. The clause inserted in the Bill was, "The Gas Referees shall from time to time ascertain with what degree of purity each gas company can reasonably be required to make and supply gas continuously without occasioning a nuisance to the neighbourhood in which the works are situate, and shall thereupon prescribe and certify the maximum amount of impurity in each form with which gas supplied by such gas company shall be allowed to be charged, and the time from which the allowance thereof shall be enforced as against such gas company, regard being had to the necessity for any alteration of works by such gas company consequent on any such certificate." I approved of that clause as far as I was consulted upon it, but it is more a chemist's question than an engineer's; I had not much to do with it. I think it a very wise provision.

The CHAIRMAN: Does the authority of the Referees apply to all the impurities as well as to the sulphur compounds?

Mr. O'HARA: To the sulphur compounds and ammonia.

Mr. MICHAEL: It refers, in fact, to any impurity.

Mr. O'HARA: Take it generally, it means any impurity other than sulphuretted hydrogen, because that is interdicted altogether.

Cross-examination continued: In Bills transferring the works of gas companies to corporations, I have never seen any clause dealing with the question of purity. In the Bill to enable the Metropolitan Board of Works and the Corporation of London to apply gas, there was no such clause, and I did not advise one.

Mr. O'HARA: Was not the reason of that, that where this interdiction comes into the hands of the local authorities they are the representatives of the people, and the people can put the screw on them if they do not give the gas which they ought to do?

Witness: That is very plausible, but it is utterly impossible for the consumers to know whether they are burning gas with 5 grains of sulphur or 50. I will defy any consumer to tell whether he has 5 grains or 50 in his gas; 50 grains in 100 feet of gas will not corrode silver, or leather either.

Mr. O'HARA: At all events, as a fact, these matters are left by the ratepayers and burgesses of towns to the local authorities?

Witness: They are, and the fact is that when gas-works or water-works are in the hands of the local authorities there is very little complaint.

Mr. O'HARA: Supposing that the local authorities were to make default in following any prescribed regulation, and that default was accompanied with a penalty. Who would pay the penalty?

Witness: The ratepayers.

Mr. O'HARA: Then would it not be absurd in the ratepayers to be paying penalties out of their own money?

Witness: You may say so.

Mr. O'HARA: But is not that the reason? You know perfectly well, no one better; and no one can be more candid. Is not that one of the reasons why these clauses are not put into corporation Bills?

Witness: You are assuming that the ratepayers and the consumers are identical. They are not so; or, if they are as regards numbers, they are not as regards the degree. There is a good deal of fallacy in those arguments. I do not agree with you; I do not think they are identical.

Cross-examination continued: I suppose it is possible to disinfect the foul lime; it is a question of expense and space, and the possibility of subsequent nuisance. I think that gas cannot be purified by lime without producing a nuisance. The purifiers at Fulham are not small; I think they are amply large enough. If they were much larger the smell from them would not be considerably less. I remember the passing of the Act of 1860, but I was not concerned in it. That Act prescribed 20 grains of sulphur. By the Act of 1868 the limit was left to the Referees, because it was found that the limit prescribed in 1860 could not be kept within, and it is not now kept within by the companies still under that Act. I know what the maximum prescribed by the Referees is. It is 30 grains in winter and 20 in summer. I do not know that it is 15 in some places. For the Commercial Gas Company no limit has yet been fixed, because their new works have not been finished.

Mr. O'HARA: The Referees, in their printed Instructions, say, "For gas made at the works of the Commercial Gas Company it shall be 30 grains."

Witness: I have not seen that; it must be just out.

Cross-examination continued: I do not know as a fact what the average impurity at those works has been during the last six or eight months. I should not be at all surprised to hear that it has been kept down to 17.7 grains. There are times when it may be kept down to 10 or 11, but that is not the point at all. I do not mean to suggest for a moment that 20 or a less number of grains may not be attained. I was a witness for the Crystal Palace District Company in 1873. Since that time I have derived a great deal of information that I did not possess before, with regard to purification by lime and its cost, the space required for it, and the nuisance occasioned by the spent lime. It has not come suddenly upon me, but by degrees, as most information does. At Oporto my works were not far from the river, and I could very easily get rid of the lime, but gas was more costly to purify in that way, and I used oxide. The gas in Paris is not made from the same coal as in London; I think it is mostly Belgian coal. I should think that coal is as likely to produce foul gas, but I really do not know. I only know they do not use lime. In the three provincial cases I mentioned, in which 30 grains of sulphur impurity had been fixed of late years, I should have said the companies volunteered that limit; it was not put upon them. In the Crystal Palace District Company's case, I believe they volunteered 20 grains. I gave evidence at the time, which perhaps conduced to their getting their Act in that form. All the information I now give in reference to the matter has come since 1873. I dare say I should be prepared now to qualify a great deal of evidence I then gave as to purification.

Mr. O'HARA: Do you think it advisable that a company should be left entirely free as to sulphur impurities?

Witness: As to sulphur compounds, yes; as to sulphur impurities, no.

Of course, they ought to be restrained from sending out gas with sulphuretted hydrogen in it, but as to sulphur compounds I think they may be safely left perfectly free.

Mr. O'HARA: What would be the amount of sulphur that might, in that way, get into and pollute the atmosphere?

Witness: I do not know about polluting the atmosphere. The quantity of sulphur in other forms than sulphuretted hydrogen would be about 35 grains. It might go up to 40 or more, but not to 50 grains. If you put it at 40 I think that would be the extent.

Mr. O'HARA: Do you not think you can put it up to 50 without any very great effort?

Witness: I will leave that for somebody else to do.

Re-examined by Mr. MICHAEL: Under exceptional circumstances the quantity might be largely increased. I do not mean to suggest for a moment that it is not possible by the use of lime to bring down the sulphur to even something less than the average which has been mentioned; but in order to do that there must be a far greater nuisance than the presence of the sulphur itself. Practically it does not make any difference whether the purifiers are small or large. If they are small they have to be frequently changed, and if they are large they last longer unchanged, so that there is a larger bulk of this foul stuff taken out at once. The oftener you carry off the nuisance the smaller the amount. There is no known means of preventing the nuisance altogether.

Mr. MICHAEL: Is not that contemplated in the very clause of the section which provides that the Referees are to take into account the difficulty of putting an absolute test to the amount of sulphur without occasioning a nuisance to the neighbourhood in which the works are situated?

Witness: Yes, only this company are not under that provision. I do not think that the presence of 40 or 45 grains of sulphur in 100 feet of gas would be injurious to a person burning gas in his own room, but that can be better spoken to by chemists. As far as I have studied the question as an engineer, there is no case in which that amount of sulphur has caused injury, either to person or property.

The CHAIRMAN: You said that the limit of 20 grains of sulphur compounds allowed by the Act of 1860 had practically to be given up, because it was found to be impossible to obviate it.

Witness: It could not practically be acted upon. There are several companies now in London that are still under that Act—the Phoenix and the Surrey Consumers on the south side of the Thames, and the London on the north side of the Thames—and they are not proceeded against.

The CHAIRMAN: I want you to explain this, because you did not quite finish one of your answers. You were asked, "Might it not be the fact that, in some companies, the average of these sulphur compounds was kept down to 13 grains?" and you said, "Yes; that might be so, but that is not the question." I want to know what it was you meant to say?

Witness: I was asked that question in regard to the works of The Gaslight and Coke Company at Beckton, Bow, and Bromley, where they can use any quantity of lime without creating a nuisance to the surrounding neighbourhood.

Mr. O'HARA: You were asked that question by me, in reference to all the gas companies in London except the South Metropolitan.

Mr. MICHAEL: You read, as I understand, to the witness, the average amount of impurity from sulphur compounds during three months period, which amounted to 13.7 grains. Was not that so?

Witness: I understood so.

Mr. O'HARA: What I had in my mind at the time was this: I excluded the South Metropolitan, and I took all the others. The Gaslight and Coke Company, for example—at all their stations.

Mr. MICHAEL: It is but fair to read this table. The Gaslight and Coke Company's average is 12.6; at Ladbroke Grove, 14.1; Millbank Street, 19—that is cannel gas; Carlyle Square, 14.1; Camden Street, 14.7, &c. My friend has added these together, and takes his figures, I suppose excluding the 19, at 13.7—that is to say, over the whole of that period the proportion of sulphur in other forms than sulphuretted hydrogen, taking the average, amounts to 13.7. Then I asked the witness whether, under exactly the same circumstances, it might not suddenly rise to 25, or even 35, when employing that means of purification?

Witness: It should be explained that fully two-thirds, if not three-fourths, of the gas supplied by that company is made at Beckton, Bow, and Bromley, where they can use an unlimited quantity of lime without creating any nuisance to the neighbourhood; therefore, it is to be expected that we get a very low average of sulphur impurities in the gas supplied from those stations; but from the stations and districts where it is not admissible to use a large quantity of lime it will be found that the sulphur impurities are very much larger, and what I meant by "that is not the point" was this, that while it was quite possible, by the abundant use of lime, to bring down sulphur impurities to a standard like 13.7, or even less, the means of doing that would create a far greater nuisance than the nuisance they do get rid of by the elimination of a difference of between 13 and say 35 grains of sulphur from the gas.

The CHAIRMAN: Then do I understand that the reason why it is found practically impossible to maintain the limit of 20 grains, required by the statute of 1860, is on account of the nuisance?

Witness: Yes; and the impossibility of getting space in which to manipulate the gas through lime.

The CHAIRMAN: Have you, yourself, heard of any complaint from the Crystal Palace district of the nuisance of the lime works?

Witness: I have not. I do not live in that neighbourhood, but I believe evidence will be given to that effect.

The CHAIRMAN: Then, besides the injury to the hands and eyes of the men who clear out these lime purifiers, do you consider there is any injury done besides to the health or life of human beings?

Witness: I am not aware that they permanently suffer from it, but they have to be paid extra wages, and they have to be coaxed to their work. It certainly does lead men into drinking habits; they will drink, and drink to excess, over this work. To outsiders, who are not employed in it, there is really no nuisance except the smell.

The CHAIRMAN: As to the metropolitan companies, you are aware of the existence of the restriction, between 1860 and 1863, of 20 grains, the same as in the Act of this company, and you know that there was substituted for it, in 1868, the Referees jurisdiction?

Witness: Yes.

The CHAIRMAN: You knew it in 1873, when you gave evidence?

Witness: I did; but I thought that out in the country, as these people were, they might be able to use that quantity of lime without creating a nuisance; but the district has got so overbuilt that it is a very great nuisance. In fact, that point was put to me; I am free to say, that the question of the 20 grains was not in my proof for the promoters. It was put to me in an off-hand way, and I said, "I think you may safely put it in at 20 grains." I was aware of the practice of the metropolitan companies before that.

(To be continued.)

DEEP WELL BORINGS IN LONDON.

The constantly increasing wants of our English Metropolis were very amply provided for during all the earlier stages of its history by the stores of water contained in the extensive beds of gravel lying within the Thames Valley. These stores of water could be reached by means of shallow wells, and all the ancient and famous pumps of our city drew their supplies from this source. But, as the population of the district increased, the value of this source of water supply became greatly impaired from two causes—firstly, the excessive drain upon it, caused by the rapid multiplication of wells; and, secondly, the pollution of its waters by the refuse matter of a great city. Hence it became necessary to seek for new sources of water supply, and the success which had already attended the construction of artesian wells in the tertiary districts of Northern France led to attempts being made to obtain supplies in a similar manner by putting down borings through the impervious London clay into the water-bearing beds of the lower London tertiaries. For a time the quantity of water thus obtained, as at Merton, Garrett, and many other points, seems to have induced the belief that an inexhaustible source of the all-essential element had been discovered; but the rapid multiplication of these artesian wells soon revealed the fact that the new and valuable stores had their limit, and that this limit was being very rapidly approached, in consequence of the excessive demands which were now being made upon the new source of supply. The deepening of the wells, by which means water was drawn from the chalk, as well as from the tertiary strata, promised, however, to do something towards staying off the evil day when London would no longer be able to depend on draughts being honoured by her great subterranean bank. Such was the state of the question when Mr. Prestwich, now the Professor of Geology in the University of Oxford, undertook its complete investigation as an important geological problem. No one more competent for the task could possibly have been found, for during many years Mr. Prestwich's studies had been devoted to the Tertiary deposits of the London and Hampshire basins, and his great work, "A Geological Inquiry respecting the Water-Bearing Strata of the country around London, with reference especially to the Water Supply of the Metropolis," which was published in 1851, is a masterpiece of minute observation and close and accurate reasoning. More than this, the geologist points to the work with pardonable pride, as affording convincing proof that his science has now acquired a character for exactness analogous to that which is justly regarded as the crowning attribute of astronomy. After a most elaborate study of the nature and relations of the various strata which crop out all round the London basin and of the disturbances to which they have been subjected since their deposition, Mr. Prestwich ventured on a bold prediction—namely, that the chalk beneath London would be found to have a thickness of 650 feet, the upper greensand of 40 feet, and the gault of 150 feet. (*Op. cit.* p. 142.) At the time when this announcement was made no well in London had been sunk to a greater depth than 300 feet in the chalk, but now we can appeal to no less than four deep borings in the Metropolis, which afford the most convincing proof of the reliability of the data, and the accuracy of the reasoning by which Mr. Prestwich arrived at his interesting results. For the sake of distinctness, we place the estimated and determined results side by side in a tabular form:—

Mr. Prestwich's Estimate.	Boring at Kentish Town.	Boring at Crossness.	Boring at Loughton.	Boring at Meux's Brew.
Chalk 650	645	646	650	653
Upper greensand . . 40	134	12	40	28
Gault 150	130½	148	(?)	159

When it is remembered that the chalk graduates downwards insensibly into the upper greensand, and that it is almost impossible to decide on their line of separation in the cores brought up by boring operations, it will be admitted on all hands that the agreement between the estimated and proved results is marvellously close. One of the most important conclusions of Mr. Prestwich's work was that the strata below the gault, the so-called "lower greensand," would in the future afford a most valuable underground source of water supply to our overgrown city. But in 1855 Mr. Godwin-Austen brought before the Geological Society of London his masterly essay "On the Possible Extension of the Coal Measures beneath the South-Eastern Part of England," in which he announced the conclusion—based on a most elaborate study of the geological structure of the South of England and the adjoining portions of the Continent of Europe—that an old ridge of Palæozoic rocks underlies the line of the Thames Valley, and is only concealed from us by the upper cretaceous strata. Mr. Godwin-Austen's announcement was as strikingly verified as was that of Mr. Prestwich; for, in the same year that it was made, a boring at Kentish Town, which passed through the gault, reached a curious series of red rocks, which are now believed by geologists to be either a portion of the old Palæozoic ridge itself, or a set of littoral deposits formed upon its flanks. And in 1857 the deep boring at Litchfield afforded still more unmistakeable evidence of the existence of this old Palæozoic ridge in the fact that black slaty rocks were found immediately below the gault clay. Although the old ridge of Palæozoic rocks must thus limit the area of the available water-bearing "lower greensand" beneath the metropolitan district, yet Professor Prestwich has constantly argued that very large and valuable supplies of water will yet, in all probability, be obtained from the latter source. Hence it is that the endeavour to tap this great subterranean reservoir, which is now being carried out in such an enterprising spirit by Messrs. Meux and Co., in the Tottenham Court Road, is attracting so much attention from geologists and engineers. The nodular beds at the base of the gault were reached at a depth of 999 feet from the surface, and some 60 feet of rock below has since been penetrated. The splendid cores brought up by the diamond borer are at once submitted to Mr. Robert Etheridge, the palæontologist of the Geological Survey, who is carefully studying every trace of fossils which they exhibit. At present there are very strong grounds for believing that the "lower greensand" has been reached, and we soon hope to be able to announce that the new source of water supply, so long ago pointed out by Professor Prestwich, has at last been made available for the ever-increasing necessities of this great city.—*Nature*.

STRIKE AT THE NORWICH GAS-WORKS.—At the Norwich Town Council, on Tuesday, the 8th, complaints were made that the repair of the streets after main-laying was not proceeding satisfactorily, and in reference thereto, the town-clerk stated that on the previous day he had had an interview with the gas company's engineer on the subject. The engineer confessed that the streets were not repaired so rapidly as he could have desired, which was owing to the want of men, and he applied to the city authorities to grant them the loan of one or two men to assist in the work. A letter embodying that application had since been sent to the Executive Committee for consideration. It might as well go forth to the public that all the men employed at the gas-works had struck that morning. Measures were, however, being taken, so that the city should not suffer from want of a supply of gas. The company hoped in a few days to settle the matter.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

H. H.—As there are diversities of opinion on the subject, the insertion of your letter would probably lead to a correspondence, for which, at the present moment, we have not space. The arrangements of such works will be described in due course in the “Treatise.”

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 29, 1877.

Circular to Gas Companies.

WHILE “waiting for the verdict”—that is, the decision of the Select Committee of the House of Commons, who have the Bill promoted by The Gaslight and Coke Company under their consideration—we may, once again, briefly refer to the matter in dispute, which is of interest to every Gas Company in the kingdom. It is true that, at the present moment, there are very few Companies—only eight, we believe—who have restrictions on the amount of sulphur imposed by their special Acts; and there are still fewer Corporations who, possessing gas undertakings, are limited in the same respect. When, however, a case like that of the Chartered Company is presented to the public mind, it is apt to take a serious hold, and thus the decision of the Committee, in this instance, may determine whether sulphur restrictions shall be generally imposed in the future, or whether the matter may not be left entirely in abeyance, and the sulphur be altogether disregarded. It is, we think, to be regretted that the Chartered Company did not call the Gas Engineers of such Corporations as those of Manchester and Glasgow, and of such Companies as those of Edinburgh and Liverpool, to explain the modes of purification they follow, with perfect satisfaction to their customers. It would then have been made clear to the Committee that in no large city but London are sulphur restrictions imposed, and that, when they are absent, no complaints are made. This is a telling fact, which must have greatly impressed the Committee. It is not, however, too late. When the Committee adjourned for the Whitsuntide holidays, it seemed to be under-

stood that there only remained one witness to be called, at the desire of the Committee, and that the case would be decided on this day week. It seems probable, however, that further evidence will be called by the opponents of the Bill, which may prolong the proceedings for a day or two, and we may not get the decision of the Committee until the end of next week. It is, of course, possible for the Committee to put an end to a case which they regard as virtually closed, and they may decline to receive any additional evidence.

We remarked in our last issue on the foreshadowings of the Chairman, and pointed out that the relief asked for could not be accepted, if accompanied by a reduction of the initial price of gas. The question must be looked at in a broader light. Does purification by lime inevitably and unavoidably produce a nuisance? and is “sulphur” in gas productive of damage to goods—textile or metallic—and injurious to health? Those are the questions really raised by the Bill before the Committee. The question of an alteration of the initial price will raise another issue, on which a large amount of additional evidence must be heard before the committee can arrive at a satisfactory conclusion. When a fixed price is considered, regard must not only be had to the conditions obtaining to-day, but to possible and even probable future contingencies. There can be no doubt that in the course of a year or two the cost of coal will again rise, and with that the price of gas must rise, or dividends go down. Now, the sliding scale was invented to encourage Gas Companies to do their best for consumers, the inducement being the prospect of dividends beyond what we may call the statutory rate. But circumstances may, one day, arise, under which the Gas Companies, doing their utmost, may fail to realize profits sufficient to pay what we have called the statutory dividend. To reduce the initial price would therefore be a gross injustice. It is not for a moment to be supposed that the Chartered Company, relieved from their present obligation to purify gas by means of lime, will relax their efforts to supply gas as free from sulphur compounds as possible. Science happily progresses, and we entertain a confident opinion that new or more perfect means of purification will soon be discovered, by means of which “sulphur” will be almost entirely eliminated from gas, or, better still, some changes in the process of carbonization may result in preventing the formation of sulphur compounds. All this, however, requires time for study and experiment, which may occupy some years, and, in the meantime, what could be more unfair or more impolitic than to remove from the companies all inducement to exert themselves to perfect the process of purification. To reduce the initial price would be a simple condonation. The reduction would be accepted, if accepted at all, as a set-off against any amount of impurity. That, we are certain, is not what the Chartered Company require. In seeking to be relieved from present legal obligations, they do not endeavour to shirk the moral obligation to furnish the purest illuminating agent they can. If any process should be devised which promises to realize the desired end, they will certainly give it a fair trial, and, if successful, adopt it. What more can be required of them we do not know. But, as matters stand at present, the Chartered Company are on the horns of a dilemma. They can purify gas from sulphur; but they get prosecuted for a nuisance. They leave sulphur in the gas beyond a certain amount, and again they are liable to prosecution. This is a state of things which ought not to be allowed to continue.

The Vestries of Paddington and St. Pancras are again congratulating themselves on the success achieved by the adoption of the average meter system for the public lamps. Success, of course, means the saving effected. It must be admitted that a part of this saving is due to the fact that the hours of burning have been reduced in number. To our mind, the great gain is the contentment of the Vestries, who now pay their gas bills without grumbling. The ratepayers, also, are satisfied, for the lighting rate is now only one penny, whereas it used to be three halfpence in the pound. We do not expect that the Company are prejudiced by the system, inasmuch as it must be supposed that they are now paid for all the gas consumed, while under the old system it was difficult to say how much gas was burnt.

Some members of the Town Council of Maidenhead are in favour of the adoption of the meter system, and the Gas Company do not object. A deputation from the Council recently waited on the Directors of the Company to endeavour to arrange amicably the terms on which the public lights are for the future to be supplied, and we hope the interview will result in a satisfactory settlement. We are bound to say, after reading the report before us, that the Gas Company have displayed a very liberal spirit. There can be no doubt that, barring an occasional accident, Maidenhead has been lighted in a most satisfactory manner. The

lamps are fitted with Sugg's burners and regulators for a consumption of five feet, and the pressure is never below eight-tenths. It may, then, be taken as certain that the full rate of consumption is guaranteed. The gas has an average illuminating power of 15·35 candles, the statutory minimum being 14 candles. The Company offer to supply the lamps for £3 17s. 6d. a year, lighting, extinguishing, &c., included; but the Corporation want it done for £3 10s. Failing the acceptance of the above terms, the Company offer to supply by meter, at 5s. per 1000 feet, which is, we think, 6d. less than the charge to private consumers. In a town like Maidenhead, where the hours of consumption are irregular, and the lamps are only lighted on 305 nights of the year, it seems to us that the adoption of the meter system is highly desirable, and, failing the acceptance of the liberal offer made by the Company, we hope it will be adopted.

It seems probable that the recent gas explosion in the King's Road, Brighton, will give rise to a good deal of litigation. The Insurance Companies, who had to pay for the damage done, have served the Corporation of Brighton with notice of action to recover the money so paid, and the Corporation deny their liability. It is not disputed that the fracture of the gas-main, which brought about the catastrophe, was caused by the steam-roller used by the Corporation. This body, however, allege that the mains of the Gas Company were not properly laid. On the other hand, the Company contend that the supports of the gas-pipe were removed by percolation from a leaky water-main, the natural consequence being that the passage of the heavy roller broke the undermined pipe. The Insurance Companies seem to have accepted the defence of the Gas Company as valid, and have, therefore, elected to sue the Corporation, with what result we shall know by-and-by.

The Annual Meeting of the British Association of Gas Managers will commence at Bristol on the 12th proximo, and the proceedings promise to be of a very attractive character. The name of the President is a sufficient guarantee that the Inaugural Address will be highly instructive. Mr. Spice's large knowledge of gas affairs, his happy faculty of expression and natural eloquence, adorned with much wit and humour, will make, we expect, the Address the chief feature of the meeting. Apart, and in addition to this, however, some valuable and practical communications are promised. Mr. R. O. Paterson will relate his experiences with the Körting-Cleland Steam-jet Exhauster, and we shall be much disappointed if his narration does not confirm the opinion we have always expressed of its value. Mr. Corbet Woodall will treat of the cost of exhausters and exhausting; and Mr. W. J. Warner, of periodical district pressure-taking; the much-vexed question of the supply of gas to public lamps will be discoursed on by Mr. R. W. Brett; Mr. J. Eldridge is to give some particulars as to the economy in carbonization by the use of West's system; Mr. Wilson will describe his process of lighting and extinguishing public lamps automatically. Mr. Sugg promises a paper on railway carriage lighting, on which a great deal may be said; Mr. Lass is to criticize the form of accounts scheduled in the Gas-Works Clauses Act, 1871, and discuss the desirableness of its general adoption; and, finally, Mr. W. H. Bennett, the Secretary of the Association, will suggest means of extending the use of gas and coke, and show how their consumption may be increased. This is financially to Gas Companies a most important matter, and we hope it will receive full consideration. The Lecture to be delivered will be by Mr. Cargill, President of the Society of Engineers, "On the Strains upon Girders, Trusses, and Braced Structures, and the Mode of Ascertaining and Calculating them." The excursion arranged for will extend into the most delightful part of the valley of the Wye, and, weather permitting, must necessarily afford much enjoyment. We have been requested to state that it is essential, considering the limited means of conveyance which the locality affords, that early notice of the intention of members to join in the excursion should be given to the Secretary.

Water and Sanitary Notes.

THE Local Government Board, acting upon a report of Colonel Cox, have arrived at the very important decision to constitute a united district, to be called the "Lower Thames Valley Sewerage District," for combined action in the sewerage of Ham, Hampton Wick, Kingston, Richmond, Teddington, and some other places lying on the Surrey side of the Thames. The population of the district is about 115,000, the rateable value is £743,000, and the area is 28 square miles. It has been more than once remarked in these columns that the supineness or obstructiveness of some of the Local Authorities concerned rendered the constitution of such a district inevitable. A draft Order

has been prepared, providing for the formation of a Board, to consist of six *ex officio* and twenty-six elected members, the representation being apportioned according to population and rateable value of the sub-districts. The Board is to be constituted before the end of September of this year, and the Order proposes to make compulsory the completion of the sewerage works before the expiration of two years from that date. It is thus seen that, supposing the Order confirmed, there will be no time for idle talk and discussion. Action must be promptly taken. Happily for the new Board, there are well-devised schemes already prepared, either one of which would answer their purpose, and they have simply to make their choice. It is not for us to indicate which we consider the best. The Board will, of course, choose that which provides for the utmost efficiency with the greatest economy. So far as we have yet seen, the draft Order has only been brought before the Select Vestry of Richmond, who have, at present, raised no objection, except on the score of inadequate representation on the Board, and the shortness of the time in which the works must be executed. It is not to be disguised that the newly-formed body will have a difficult task before them, and the period of two years is certainly too little for the completion of works for the drainage of an area of twenty-eight square miles. In the course of the next few weeks, we shall have the opinions of the other authorities interested, some of whom, we have no doubt, will make urgent remonstrances. They must, however, in the end, succumb to the central power.

The Corporation of Birmingham are promoting a very wise scheme for the combined sewerage of their borough and the surrounding district, including Bilston, West Bromwich, Wednesbury, and Wolverhampton. Birmingham has made great efforts, and gone to great expense, to provide for the effective drainage of their district, and the inoffensive disposal of their sewage. They have been subjected to costly litigation, and have had to answer for sins not their own. The scheme they are now promoting is one eminently calculated to achieve the end they have in view—namely, the purification of the rivers Tame and Rea. The pressure on our space prevents us from giving any part of the evidence adduced at the inquiry now proceeding before Mr. Harrison, the Local Government Board Inspector, but we shall duly announce the result. We hope that in this case we shall not have one Inspector giving evidence against a scheme sanctioned by a colleague.

It is difficult, without personal inquiry, to say how water affairs are progressing at Richmond; but we may take it that they are still far from satisfactory. The Vestry put the inhabitants on a short supply for a few days, so as to get the reservoir full, and then experimented with their hydrants, which proved to be moderately successful in the lower parts of the town. It is undeniable, however, that the domestic supply is still too limited, and the quality of the water not all that could be desired.

SAN PAULO GAS COMPANY, LIMITED.—The adjourned ordinary general meeting of the shareholders in this company was held on Monday, May 14, at the offices, Pinners' Hall, Great Winchester Street—the chairman of the company, Mr. F. O. T. Delmar, presiding. The report recommended a dividend at the rate of 6 per cent. per annum, free of income-tax, for the half year ending the 31st of December last, and carrying forward the balance of profit and loss £1161 1s. 1d. The chairman, in briefly moving the adoption of the report and balance-sheet, referred to the steady increase in the private lighting, and the hopes entertained of a speedy extension of the public lights, and congratulated the shareholders on the improving state of the company's business generally, and stated that the works, plant, and all the company's affairs were in a highly satisfactory condition.

GAS LIGHTING IN THE METROPOLIS IN 1814.—It affords us the highest satisfaction to be able to state that the first of practical modern discoveries, the means of illuminating by the gas of coal, proceeds in its application with all the success that can be desired. A new establishment has been opened in Worship Street, in addition to that in the City Road, and both manufactories are constantly employed in evolving gas, which is preserved in butts like beer, and sent for use to any distant place at which it is intended to be consumed. Many hundred butts, besides large reservoirs, have been thus manufactured during the summer, and kept in store for the winter. Already above a mile of the public streets is enlightened by this means, besides the Houses of Parliament, and many public buildings. The beauty and brilliancy of the light exceed the powers of description, and can be understood only by being witnessed.—*London Monthly Magazine*, Oct., 1814.

A LARGE GASHOLDER.—We understand that the Phoenix Gas Company have just commenced the erection of what will be the most capacious gasholder at present erected—viz., that of a capacity of some 3,100,000 cubic feet. The tank to contain it will be 218 feet in diameter, and the holder will consist of two lifts, each rising 44 feet. The works are to be carried out to the designs of the company's engineer, Mr. C. Woodall, and the holder will, we understand, be on the non-trussed principle. Mr. Woodall has departed somewhat from the general type of guide-framing, he substituting standards formed principally of wrought-iron in place of the usual circular cast-iron columns. We hope, as the works proceed, to be able to illustrate in our pages some of the details. The contractors selected by the company to carry out these important works are, for the tank, which is to be of brickwork, the firm of Messrs. J. Aird and Sons, of Lambeth; and for the gasholder and guide-framing, the firm of Messrs. S. Cutler and Sons, Millwall, both firms having already respectively built several tanks and gasholders for the same company.

Communicated Articles.

ON THE PURIFICATION OF COAL GAS.

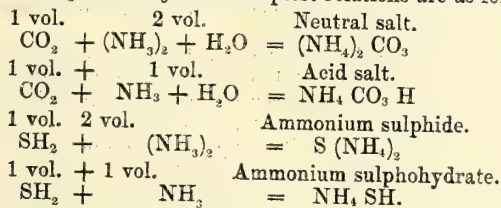
By Dr. H. BUNTE.

[Translated from the *Journal für Gasbeleuchtung*.]

The removal of carbonic acid from coal gas constitutes a part of gas purification generally. The natural purifier for the gas is the ammonia produced in the distillation of coal, which of itself performs in some degree the function of a purifying agent, by converting into ammoniac carbonate and sulphide the gases CO_2 and SH_2 , which of themselves are scarcely soluble in water.

But the quantity of ammonia produced from the coal is small compared with that of the gases CO_2 and SH_2 , though it varies much according to the proportions of nitrogen, sulphur, and water contained in the coal employed. Generally, the quantity of ammonia produced will be only a fractional part of the carbonic acid and sulphuretted hydrogen; from the analyses made, the volume proportion of ammonia to the carbonic acid, plus sulphuretted hydrogen, may be taken as from 1 to 4 to 1 to 6.

The ammonia unites with the CO_2 and the SH_2 in simple proportions, apart from intermediate combinations which arise during the combination of CO_2 and NH_3 . The simplest relations are as follows:



But the combination of carbonic acid or sulphuretted hydrogen with ammonia will only take place within comparatively narrow limits of temperature. Beyond these limits the mixed gases show very little, or no, disposition to unite. Carbonic acid, water, and ammonia will only unite at temperatures below 58° to form a carbonate, while at this temperature carbonate of ammonia is decomposed into its constituents— CO_2 , H_2O , NH_3 . This process is called dissociation—decomposition or cessation of chemical affinity, by increase of the elasticity of the gas (or vapour) through increased temperature.

A similar proceeding takes place with sulphuretted hydrogen and ammonia. Bineau, Deville, and lately Horstmann, among others, have shown that, in a mixture of sulphuretted hydrogen gas with ammonia gas, at temperatures above 57° , no chemical union of the two gases takes place. Their union only occurs at lower temperatures, and gradually. Analogous proceedings take place when water is present, except that the temperature of decomposition is different.

The combinations formed are soluble in water; if the temperature of decomposition is exceeded, the component gases are liberated in proportion to their co-efficients of absorption, which are rather complicated functions of temperature, and are influenced by the presence of other gases in a way not yet sufficiently understood.

These last-named relations play an important part in Hills's process for regenerating ammonia water by heating the solution, and afford a clue to the peculiar behaviour of the ammonia salts during the process.

From the above description of the behaviour of ammonia salts, it follows that the gases CO_2 , SH_2 , NH_3 , contained in raw gas, during condensation gradually form into salts, which are dissolved in the water formed at the same time.

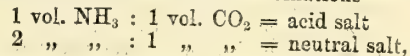
As a basis for the following considerations, let it be assumed that the volumes contained in raw coal gas of

NH_3 CO_2 SH_2

are as 1 : 4 : 2 respectively, so that the coal gas contains 0.5 p. ct. 2 p. ct. 1 per cent. of these different constituents.

As carbonic acid and sulphuretted hydrogen act in exactly the same manner under the circumstances to be considered, we will confine our attention to carbonic acid.

It appears from the above-named combinations—



compared with the proportionate volumes existing in the coal gas (1 vol. NH_3 : 4 vol. CO_2), that a much greater quantity of carbonic acid exists in the coal gas than is requisite to form an acid salt—viz., four times as much, and for a neutral salt eight times as much. It has, therefore, been concluded that the gas liquor contains acid ammoniac carbonate. This will, in fact, generally be the case if the gas liquor is used in the scrubbers, and if all the condensed water is allowed to run into one tank. But, if separate samples are taken from the liquor condensed in different parts of the work, examination will reveal not only a great variation in the content of ammonia (generally increasing with the distance from the retort, and with refrigeration of the gas), but also a great difference in the proportion of carbonic acid to ammonia. Further on a method will be described for easily and quickly determining the proportions of carbonic acid and ammonia (and, similarly, SH_2 : NH_3). Such an examination proves that the ammonia water from the hydraulic and from the condenser usually contains no acid carbonates, although a large surplus of carbonic acid is found; but, on the contrary, besides neutral salts, free ammonia is found in this water.

This circumstance is easily explained from the above-named properties of ammoniac salts. At the temperature of the hydraulic and of the condenser only part of the gases can unite to form salts; the uncombined gases dissolve in proportion to their co-efficients of absorption corresponding to the temperature, and as the co-efficient for ammonia is much greater than that for the other two gases, the medium of absorption—namely, the gas liquor—is found to contain free ammonia precipitated from an atmosphere charged with carbonic acid gas.

In the scrubbers wetted with gas liquor, a small quantity of acid salt was found along with much neutral salt. On the other hand, it is known that in the apparatus behind the scrubbers, in gas-pipes, and also in dry coke scrubbers, flakes of salt are found, consisting of crystals of acid carbonate of ammonia. These facts establish the following rules for utilizing ammoniacal liquors produced in purifying the gas:

1. To employ the water collected separately from the hydraulic and the condenser, which frequently contains free ammonia capable of fixing, at least, half its volume of carbonic acid gas.

2. To keep the temperature of the scrubbers, in which liquor is used, and of the liquor itself, as low as possible, so as to absorb the greatest possible volume of carbonic acid (1 vol. NH_3 to 1 vol. CO_2) and produce the acid salt.

But even under the most favourable conditions,* it will only be possible, as remarked above, to remove from the gas one-fourth to one-fifth; or if neutral salt, as is usually the case, is formed, one-eighth to one-tenth of the CO_2 and SH_2 by the ammonia contained in the gas at the same time.

It has been proposed to deprive the ammonia water of its sulphuretted hydrogen and carbonic acid by some means, and to pump the ammonia water, thus rendered caustic, over the scrubbers again for purifying.

Of course, any such removal of the sulphuretted hydrogen and carbonic acid from the gas liquor is only partial, but even if they were completely removed, the ammonia water produced must be regenerated at least three or four up to eight or ten times, to remove the whole of the carbonic acid, and of the sulphuretted hydrogen. In other words, ten times the quantity of ammonia water produced during distillation must be completely regenerated to effect the entire removal of the CO_2 and SH_2 from the gas.

If we reckon 15 cubic metres of gas to the cwt. of coal, and 5 litres of gas liquor, each cubic metre of gas would require at least 3 litres of perfectly regenerated gas water to pass the scrubber, or that simultaneously with the quantity of ammonia water produced along with the gas, one-third litre per cubic metre must be regenerated from three to ten times.

It is clear that the number of regenerations, and the quantity of ammonia water to be regenerated depend on the ammonia contained in it. With very weak liquor, if heat is required to effect regeneration, a disproportionately large bulk of water has to be heated also, which takes up nearly all the fuel heat and retards the eventual cooling. The water also impedes the absorption of the carbonic acid, while a concentrated solution of ammonia will absorb the carbonic acid quicker and more completely. It is, therefore, of the utmost importance, both from an economical and from a technical point of view, to reduce the number of regenerations, and the quantity of liquor to be regenerated to a minimum, by employing a concentrated gas liquor rich in ammonia. It follows from this that the ammoniacal liquor produced in gas-making must not be used directly in the scrubber, but rather as a source of ammonia for the production of a concentrated purifying liquid—a strong ammonia water. The weak gas liquor may, when strengthened by that from the hydraulic and condenser, be used in the last scrubber, on account of the small quantity of free ammonia it contains; but the gas liquor obtained direct is to be kept carefully separated from that intended for purifying.

I consider this point, which, as far as I know, has never yet been so prominently brought forward, as most important; and I believe that the key to the whole process lies in the employment of concentrated ammonia water, so that it would be preferable to remove the sulphuretted hydrogen (which is always much less in quantity than the CO_2) also by wet purifying, and employ the dry oxide of iron purifier only to remove the last traces of SH_2 .

It now remains to determine the maximum quantity of ammonia which the purifying liquor may contain.

Although it is desirable, in more than one respect, to employ in the scrubbers liquor in as concentrated a form as possible, there are certain limits which must not be exceeded.

The gas liquor may be considered as of suitable strength when, after repeated pumping over the scrubber, it has attained a maximum content of ammonia. A gas liquor (A) produced in a dry scrubber before the purifiers contained the following quantities:—

In One Litre of the Liquor.		
NH_3	CO_2	SH_2
36.21 gr. = 47.46 litres.	39.2 gr. = 19.8 litres.	14.8 gr. = 9.7 litres.
$\text{CO}_2 + \text{SH}_2$		
54.0 gr. = 29.61 litre.		

47.46 litres of ammonia, therefore, took up 29.6 litres $\text{CO}_2 + \text{SH}_2$, so that the gas liquor contained a considerable quantity of acid salt; the ammonia present had been in this case well used up.

* Direct experiment proves that even passing a stream of carbonic acid through a solution in water of ammoniac carbonate cooled down to 0°C , it is exceedingly difficult to obtain a solution of pure acid salt, only a large admixture of acid salt with neutral salt being produced. From this it would seem that the acid salt, when dissolved in water, is decomposed even at 0°C . Berthelot has observed a similar result in this sequi-salt.

* The author has not indicated the thermometric scale he uses, but it is, of course, the Centigrade.—Ed. J. G. L.

From preliminary experiments it appears that in the process of regeneration known as Hills's process, about four-fifths of the carbonic acid contained in the gas liquor and three-fourths of the sulphuretted hydrogen are removed, one-fifth and one-fourth respectively of these gases (CO_2 or SH_2) remaining in the regenerated liquor. The quantities of these two gases expelled by regeneration can be re-absorbed by the ammonia water; that is to say, the regenerated ammonia water is capable of taking up at least three times the volume of carbonic acid and sulphuretted hydrogen that it still contains when used in the scrubbers.

If liquor of the above strength is used for purifying gas, the following proportions are established:—

Contents of the Liquor before Regeneration—in one Litre.

47.5 litres NH_3 and 29.6 litres ($\text{CO}_2 + \text{SH}_2$).

After regeneration, with 10 per cent. loss of ammonia, which, though lost for purifying, may easily be recovered as a sulphate, and is replaced by using liquor of the proper strength in the scrubbers:

In one Litre of Liquor.

42.75 litres NH_3 and 7.4 litres ($\text{CO}_2 + \text{SH}_2$).

Therefore 22.2 litres $\text{CO}_2 + \text{SH}_2$ have been removed.

These 7.4 litres $\text{CO}_2 + \text{SH}_2$ are combined in the ammonia water with 14.8 litres NH_3 as neutral salts. Therefore, 42.75 - 14.8, or, in round numbers, 28 litres NH_3 , are free, and will fix at least 14 litres $\text{CO}_2 + \text{SH}_2$, or 1.4 per cent. per cubic metre of gas of these impurities.

One litre of ammonia water of the above-named strength will therefore remove 1.4 per cent. of $\text{CO}_2 + \text{SH}_2$ from each cubic metre of gas passing through the scrubber. This is on the assumption that the most thorough contact possible of the gas liquor with the current of gas is established by appropriate arrangements; further, that the gas enters the scrubber free from tar, so as to permit a uniform wetting, and also that the gas liquor is always pumped in an opposite direction to the stream of gas. And only the formation of neutral salt has been assumed, whereas, in fact, more carbonic acid can be absorbed, and acid salt formed, in proportion to the concentration of the solution. A daily production of 1000 cubic metres would, therefore, require one cubic metre of gas liquor to be pumped over the scrubbers. But, for continuous operation, an equal quantity of gas liquor must, during the same time, be regenerated, to supply the place of the first when saturated; therefore, 2 cubic metres of gas liquor of the above strength would be required for each 1000 cubic metres of gas.

The results are still more favourable if a stronger ammonia liquor can be used. According to a communication from Mr. Hunt to the British Association of Gas Managers at their meeting in 1876 (see JOURNAL OF GAS LIGHTING, vol. xxviii., p. 15) gas liquor was produced in the purifiers of 1.060 specific gravity, containing per litre 58 grains CO_2 and 8.9 grains SH_2 .

Liquor of this strength may be employed again for purifying, after regeneration, without any further process.

The weights above given correspond to—

In One Litre of Liquor.

29.9 litres CO_2 and 5.9 litres SH_2 .*

The gas liquor (B), therefore, contains in one litre 35.8 litre, $\text{CO}_2 + \text{SH}_2$.

After regeneration this liquor still contained, roundly, nine litres of both gases, so that 27 litres ($\frac{3}{4}$) had been removed, and this quantity can be again absorbed when passing through the scrubbers.

Each litre of this gas liquor will therefore absorb 27 litres $\text{CO}_2 + \text{SH}_2$, while A was only capable of absorbing 14 litres; the effect of B, therefore, is 1.9 times as great as A, apart from the greater energy manifested during absorption.

If, as in the preceding case, 1.4 per cent. of $\text{CO}_2 + \text{SH}_2$ is to be removed from the gas, every cubic metre of gas produced would require $\frac{1}{1.93} = 0.52$ litre, or rather more than 0.5 cubic metre per

1000 cubic metres of gas, to pass over the scrubber, or 5.3rds as much ammonia water as is formed in producing this quantity of gas.

Under equal conditions, therefore, by employing gas liquor of the strength B, only half as much ammonia water would require to be regenerated, pumped over, or reserved, as with the strength A. The saving in fuel, labour, and plant is obvious.

For 1000 cubic metres of gas produced, and a content of 1.4 per cent. ($\text{CO}_2 + \text{SH}_2$) in the gas entering the scrubber, or the removal of this amount from the gas, to work continuously rather more than one cubic metre of ammonia water of about 76 litres, or 58 gr. NH_3 per litre, is required. For a maximum production in 24 hours of one million cubic feet = 28,000 cubic metres, about 30 cubic metres of gas liquor of the above strength would be required; † one-half, or 15 cubic metres, must pass the scrubbers every 24 hours, the other half, with a reserve, being regenerated during the same time.

If only a portion of the gas impurities (sulphuretted hydrogen or carbonic acid) is intended to be removed, the carbonic acid will be chiefly absorbed, although a simultaneous absorption of sulphuretted hydrogen, in nearly the same proportion as the two gases exist in the gas liquor, cannot be avoided.

As each volume of sulphuretted hydrogen absorbed by the ammonia

water prevents the absorption of an equal volume of carbonic acid, it will depend upon circumstances, and especially upon the relative proportions of the sulphuretted hydrogen and carbonic acid contained in the gas, how far the carbonic acid can be absorbed without a simultaneous removal of the sulphuretted hydrogen. The views formerly expressed by Patterson as to this proportion, therefore, require correction.

(To be continued.)

EXPERIMENTAL EXAMINATION OF GAS COAL.*

By T. O'CONOR SLOANE, A.M., E.M.,

Chemist of the New York Gaslight Company.

In estimating the value of a coal for the manufacture of gas, we have to take into consideration six principal elements:

1. Gas yielded per ton of coal.
2. Quality of gas at maximum yield.
3. Quality of gas at standard yield.
4. Pounds of coke per ton of coal.
5. Bushels of coke per ton of coal.
6. Quality of the coke.

All these may be determined directly by subjecting a given weight of the coal to the regular operation of gas-works, and examining the products so obtained.

Experimental gas-works are constructed upon different scales of magnitude. One which I have used for several seasons, with the most satisfactory results, receives for its charge 224 pounds, or one-tenth of a ton of coal. I shall give some of the dimensions of this apparatus, and then describe the method of working. It is a complete miniature gas-works, wanting only the exhauster.

The retort is of cast iron, 7 feet 4 inches long, and \square -shaped in section. It is closed with a lid, which is self-sealing; no luting is required—its place is supplied by lead. The retort is heated by its own furnace; and as this furnace has no office to perform except that of heating this one retort, the temperature may be varied, and results obtained under any desired conditions. The stand-pipe rising from the mouthpiece is 6 inches in internal diameter. I would never use one of less size. On the top of the furnace is the usual hydraulic main. Beyond this point, 3 and 4 inch connexions are sufficient.

From the main the gas passes through a small multitubular condenser, 4 feet long, 15 inches wide, and 6 feet high, and then through a scrubber. This is 2 feet in diameter, and 6 feet high. Water is distributed from its top by a rose jet, and it contains below a layer, about 1 foot thick, of stones, some 2 inches in diameter.

Four purifiers, arranged with dry centre seal, follow. They are 30 inches square, and 2 feet deep.

The meter comes next. It has a capacity of over 7 feet per revolution. The water indicator is connected from its upper end with the inlet of the meter. Thus it shows the level of the water inside of the drum. As long as this is kept constant, the meter will register correctly. The meter I have tested very carefully, and so determined for myself its true water-line. By means of two valves the gas may be made to pass from the meter into the experimental gasholder, or into one of the regular working holders.

The experimental gasholder is of 1500 cubic feet capacity. The tank containing it should be so deep that when the holder is down the top will be 8 inches below the curb of the tank. But the inlet and outlet pipes have to rise above this point, and, were no allowance made for them, would interfere with the descent of the gasholder. So, over each of them, the holder top is higher than elsewhere—is carried up so as to rise some 12 inches above the rest. Then the sides of the holder are also carried up, so as to be always above the curb. The top must be, as nearly as possible, flat.

It is evident that when the holder is down all the gas will be expelled, except the small quantity—2 or 3 cubic feet—contained in the bonnets that are over the two rising pipes.

It will be seen, too, that the top forms a tank. Now the holder is so nearly counterbalanced by weights that its pressure is very slight. This pressure can be increased to any ordinary extent by filling the tank or "water top" with water.

I use a hose for filling it, one of $1\frac{1}{4}$ inch internal diameter. It is attached permanently to a pipe by the side of the holder.

The other end receives a piece of inch iron pipe, bent so as to form a hook. When it is to be used for filling the water top, this pipe is hooked on the edge, so that the water flows through it into the receptacle.

The water is removed by other pieces of hose, two of $1\frac{1}{4}$ inch diameter, and one of smaller section. They are used as syphons; the large ones carry off most of the water, and the small one removes nearly all that they leave.

Throughout the whole apparatus the connexions are so arranged as to leave out any part of the condensing or purifying apparatus, or the meter.

Some of these omissions may be desirable in certain cases.

Another connexion is made with the gas, uncondensed and unpurified, from the regular gas-works. This enters the experimental apparatus just before the condenser, and is extremely convenient if it be desired to try any new apparatus or purifying material. If the existence of an obstruction in the pipes or elsewhere be suspected, gas may be turned on here in an instant, and the apparatus be so tested. Otherwise it would be necessary to put in a special charge of coal, or to run gas backwards through the apparatus from the experimental or working holder.

Finally, it is supplied with all the regular syphons, self-acting or

* The content of ammonia cannot be ascertained from the information furnished; for it appears that Twaddell and ounces, if they mean anything else than specific gravity, refer to the ammonia ascertained by distillation and titration after being liberated by lime or potash. But for purification, only $(\text{NH}_4)_2\text{CO}_3$, and $(\text{NH}_4)_2\text{S}$ come into question, not sulphocyanides of ammonium, &c.

† The contents of the gas liquor tanks at the Munich Gas-Works are 204 cubic metres.

* We have been favoured with advance sheets of this article, which has been written for the American Chemist.—Ed. J. G. L.

pumping, a self-acting tar-valve for the hydraulic main, and water inlet and outlet pipes for the meter.

To obtain from a coal its regular gas, either at maximum or standard yield, two charges must be carbonized during the day. The first charge is called the preliminary charge; it is run through the apparatus for the purpose of cleaning out all old gas which remains in it from former charges.

I shall describe, first, a day's working where gas at maximum yield is to be obtained.

Two hundred and twenty-four pounds of coal have been weighed out the night previous, and are in the scoops ready to be charged. The holder is down; it was run down the previous afternoon. The valves are so adjusted that the gas from the apparatus will run into the working holder. The heat must be high.

At seven o'clock, or thereabouts, the charge is introduced. The meter reading was also taken on the preceding afternoon. When the charge has made from 1050 to 1100 cubic feet, it is drawn. The assumption made is, that the purifiers and other apparatus are now filled with gas, practically corresponding in quality to what will be left in them by the next charge. If the heat has been good, and the coal of average quality, it will be drawn between ten and eleven o'clock. The coke is extinguished with water and saved.

At any convenient time before the drawing of this charge, all will have been prepared for putting in the regular charge. The holder top will have been syphoned free of water, and the coal weighed.

The weighing I conduct as follows:—The scoops are placed on an ordinary platform scales and weighed; 224 lbs. of coal are then weighed into them. The floor is now swept up, and the scoops are placed on iron supports in front of the furnace. Thus, if any coal falls from them in the course of this removal, it can be swept or picked up and replaced in the scoops.

During the drawing of the coke, and introduction of the coal, the water-pan under the grate of the furnace must be covered with a plate of iron. No coke or coal can then fall into it. The floor just in front of the bench after the drawing may be again swept up. This is for the same purpose, to facilitate the saving of any coal which may fall out of the scoops.

The valves are changed, communication with the working holder is closed, and the valve of the experimental holder is opened. On account of the reduction of pressure which this causes, the meter-hand moves forward two or three feet. The meter reading is then taken, the charge introduced, and the time taken.

This charge remains in the retort until almost all the gas which can be produced from the coal has been evolved. When two or three minutes are required for the production of a cubic foot, it has gone far enough; the gas contained in the experimental gasholder may be assumed to represent the maximum yield.

Connexion with the holder is now closed, the meter reading and time being again recorded. Immediately on closing the valve another valve is opened, which permits the rest of the gas to escape into the air, but registered by the meter.

This will be done at about two o'clock. Then water is run into the holder top until a proper working pressure is obtained. After it has stood for an hour, and has become thoroughly mixed, it may be subjected to any desired experiments, its specific gravity, sulphur, and illuminating power determined. Then on the same afternoon the gas is run out of the holder.

All this time the charge has lain in the retort, and has been slowly making gas. At four or five o'clock it may be drawn, and the coke saved.

The gas collected in the experimental holder has been subjected to any desired examinations, under the supposition that it represented the full yield of gas. The figure for the maximum yield in feet is taken, however, from the last reading of the meter.

The holder top may be syphoned free of water the next morning during the carbonization of the first charge.

The standard yield of a gas coal is 10,000 cubic feet. This is, to a certain extent, conventional; it is rather a high working result.

To obtain the quality of gas at this yield, two charges are run through the apparatus—one preliminary and one regular charge. The first one is drawn when it has made 970, the second when it has made 1000 cubic feet. The coke from both is saved. Instead of drawing the second charge when it has reached the limit, it may be drawn from the retort, so as to obtain the maximum yield.

In this case the gas is shut off from the experimental holder when the standard yield has been reached, and the rest of the gas is permitted to escape into the air after its registry by the meter.

All the detail of the work is the same as it is in carbonizing a coal for maximum results, except that the time of carbonization is shorter—2½ hours to 3½ hours is the proper period. The interval between the drawing of one and charging of the other charge need not exceed ten minutes.

If the results are concordant, I make two determinations of quality at maximum yield, and three of quality at standard yield. If they are not, I obtain enough results to give a good average.

The coke is all saved. At the end of the work it is weighed and measured. This gives the pounds and bushels of coke per ton of coal, the fourth and fifth elements of valuation.

The coke is burned in the furnace of the experimental works, and its quality—the last of the six elements—so determined.

The value of the proximate analysis of coal is a much debated question. The analysis referred to is that conducted by Hinrich's method. (*American Chemist*, vol. i., pp. 412, 460.)

I have been in the habit of subjecting all coals tried in this apparatus to this analysis. I have instituted a comparison between the value of coals (deduced respectively from this determination of

volatile combustible matter, and from the experimental results), which is contained in the following table:—

Comparison between Values of Coals deduced from Determination of Volatile Combustible Matter, and from Results obtained with Experimental Apparatus.

A. Per Centage of Volatile Combustible Matter.	B. Per Centage of Volatile Combustible Matter in Total Combustible Matter.	C. Maximum Yield.	D. Candle Power of Gas at Standard Yield.	E. Product of C and D.	F. Candle Power of Gas at Maximum Yield.	G. Product of C and F.
30.72	37.1	12,120	14.89	1805	13.92	1687
32.49	36.4	12,510	17.38	2174	15.36	1922
34.53	37.4	12,290	17.39	2137	15.81	1943
34.64	38.6	12,300	16.74	2059	14.97	1841
34.80	40.2	11,255	16.69	1878	16.79	1894
35.24	38.0	12,340	17.51	2161	16.37	2020
35.68	40.8	12,060	16.45	1983	16.10	1942
36.12	40.0	11,740	16.44	1930	14.69	1725
36.76	39.4	11,520	16.75	1930	16.00	1843
37.56	40.3	13,010	18.14	2360	16.75	2179
37.95	41.2	12,960	17.93	2324	15.93	2068

The results are anything but encouraging. We must accept either column E or G as the true exponent of the value of the coals. Accepting either as such, the errors in columns A and B will be found, in some cases, very high. It would seem unsafe to accept the analysis as at all conclusive within a variation of 2 per cent. of volatile combustible matter.

Another deduction is that the volatile combustible matter should be referred to the whole weight of the coal, and not to the weight of carbonaceous matter only. The last appears so plausible a way of arriving at the information sought, but is no better than the first.

The same precautions required in all gas-works have to be observed in the experimental one. The syphons must be kept charged, the purifiers tested from time to time with lead paper, and the purifying material renewed. The whole time of two men—one in the day and one at night—is required. In addition to these, half the time of another man is required in the daytime; and, for charging, the services of a third man have to be called upon.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

AITKEN AND YOUNG'S PROCESS OF GAS MANUFACTURE.

SIR,—In your issue of May 15, you make a few remarks on the Aitken and Young process of treating gases, as conducted at Hamilton Gas-Works, which might mislead your readers. Your description of the process would somewhat resemble the application of it when common coal, or other cheap poor gas-producing material could not be got at a reasonable price, and when, therefore, water gas would be the cheapest carrying medium for the hydrocarbon vapours. This, however, is not the case at the Hamilton works, situated as they are in the centre of the Lanarkshire coal-field.

The process, as there conducted, is applied solely to the treatment of coal gases, the steam being employed simply to keep the tars, up to the last moment of their contact with the gases, at a temperature sufficiently high to liberate to the gases the naphthas they contain; in short, the process is just subjecting the tars to fractional distillation in the presence of the gases, thus combining in one simple operation both the tar-distilling and the gas-condensing.

It is, I think, an undisputed fact, that when the tars are distilled and the naphthas, in their separate or rectified state, are brought back and presented to the gas, the gas will take them up in the form of gas or vapour, and convey them in a state of diffusion to the point of combustion.

The advantages, therefore, of thus conducting both operations at once are, that the naphthas are, so to speak, rectified into the gases during the process of condensation, and the gases are much improved in their illuminating power at a comparatively trifling expense. This is rendered at once evident by a reference to the results of the experiments made at the Hamilton Gas-Works by the committee of the West of Scotland Association of Gas Managers, where it is shown that by distilling the naphthas from the tars (amounting to only one-third of a gallon per ton) during the process of condensation, an increase of some 20 per cent. of illuminating power was obtained; and as the conjoined distilling of the naphthas and condensation of the gases acts as a sort of naphtha washer, the gases are left perfectly free from tarry matter, and are much more easily and more perfectly treated for the extraction of the gaseous impurities, and, consequently, there is less lime required for its purification.

You appear to be of opinion that those gains will, in many cases, be neutralized by the diminished value of the tars. I question if this will be found to be the case. There are at present enormous quantities of tar sold after it has been deprived of its naphtha, and that at a price considerably higher than when it contained the naphthas; indeed, there is a good demand for these boiled tars. Now, the tars, as they flow from the analyzing condensing process of Aitken and Young, are identical with those sold by the tar distiller as boiled tars; and I am certain they could be disposed of by gas companies quite as readily as the tars they at present sell with the naphthas in them. Of course, should the process be generally adopted, it would, by reducing the supply of naphthas, increase their value enormously, and then it would become a question of whether this process would be a paying one or not; but so long as the naphthas remain at their present prices (or even three times present prices), I am satisfied it would pay a gas company

better to employ this process, and sell their naphthas as illuminating gas, than to sell them in the tar to the tar distiller; and in either case it is evident that the gas companies will be gainers by the adoption of this process, whether from the increased value of the naphthas, or from the increased amount of illuminating power.

As all coal tars, as ordinarily condensed from the gases, contain naphthas, so I think it may be affirmed that this process will be of benefit wherever coal is employed in the manufacture of illuminating gas; and as it is a well-known fact that naphthas in the gas prevent the deposit of naphthaline, I think that, seeing this process leaves in the gas the whole of the naphthas, and that the gases during the process of condensation are subjected to a series of washings with heavy naphthas and tars, it is very likely that the process will prove a panacea for the troublesome deposit of naphthaline in mains and services.

In short, this process, as conducted at the Hamilton Gas-Works, in my opinion, will be found to completely accomplish what has long been aimed at by the most enlightened gas manufacturers—viz., to convert everything obtainable from the coal into illuminating gas, whether by improved means of carbonization or condensation, the residuals being a secondary consideration.

Coatbridge Gas-Works, May 19, 1877.

ROBERT MITCHELL.

Miscellaneous News.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held at the London Offices, 4, Great Winchester Street, on Thursday, the 24th of May—D. T. Evans, Esq., in the chair.

The SECRETARY (Mr. W. Marshall) read the notice convening the meeting, and the following report and statements of account were presented:—

Your directors have pleasure in submitting to the shareholders a statement of accounts, duly audited, for the half year ending the 31st of December last.

The condition of the company is satisfactory. The gas and meter rental shows a decrease of £851 15s. 11d. This is mainly due to the reduction in the price of gas to private consumers, and was not unexpected, considering that the corresponding half of the previous year comprised the profits made by the extraordinary consumption incident to H.R.H. the Prince of Wales's visit to Bombay. The prices realized for coke have been somewhat less, owing to the fall in the price of coal in Bombay, which to a certain extent affects them. But on the other hand this is more than compensated by the reduced cost of coal carbonized.

The half year now closed is the first under the new contract with the Municipality, and the reduced charge for gas to private consumers. Your directors are happy to report that these important changes have been found to work satisfactorily.

Your directors have charged £1000 to revenue account, being the balance standing at the debit of exchange equalization account. There have been no remittances during the half year.

The accounts show a net profit of £10,419 8s. 9d.; and after appropriating £500 to the reserve-fund and writing off from the same £236 6s. 2d. for depreciation, &c. (raising the reserve-fund to £8295 6s. 3d.), your directors recommend the shareholders to declare a dividend of 4 per cent. for the half year, free of income-tax, making 7½ per cent. for the year. This will absorb £9600, and leave a balance of £256 14s. 3d. to be carried forward to the credit of next half year.

The directors who retire by rotation are William Swainson Stuart and Warine Bayley Marshall Lysley, who, being eligible, offer themselves for re-election.

The auditors, Edward George Bradley and Robert King, retire from office, and, being eligible, offer themselves for re-election.

The dividend will be payable on and after the 1st of June next.

Dr.	General Balance, Dec. 31, 1876.	Cr.
Capital authorized— (50,000 shares, at £5 each— £250,000.)		Construction account . . £203,206 2 9 Added this half year . . . 189 7 11
40,000 shares, £5 paid . £200,000 0 0		£203,395 10 8
10,000 „ £4 paid . . 40,000 0 0		Less written off preliminary expenses account . . . 200 0 0
Debitures . . . 11,550 0 0		£203,195 10 8
Amount owing by the com- pany . . . 7,406 17 9		Retort account . . . 870 9 9
Reserve-fund £8,031 12 5		Goods in transitu . . . 5,778 15 10
Added this half year . . . 500 0 0		Stocks, viz.— Chandeliers, brackets, &c., . 5,433 2 10
£8,531 12 5		Brass & iron goods, tubing, &c. . . 5,182 7 4
Written off for depreciation & from prelimi- nary expenses 236 6 2		Materials, mains, & services . 1,708 1 10
Insurance-fund . . . 1,494 3 4		Meters . . . 2,447 14 6
Passage-fund . . . 383 17 11		Coal . . . 18,562 8 0
Balance to general revenue account . . . 9,856 14 3		Coke . . . 30 10 0
		Tar . . . 96 7 1
		Tools and sundries . . . 633 16 11
		Amount owing to the com- pany . . . 5,180 1 10
		Cash at bankers, on deposit, and in hand, viz.— In Bombay . . . 25,525 15 3
		In London . . . 4,341 17 8
		£278,986 19 6
		£278,986 19 6
		Profit and Loss Account.
Coal carbonized . . . £7,436 12 6		Gas and meter rental . . £18,613 19 7
Wages . . . 1,201 4 11		Coke, tar, fittings, &c. . . 5,033 12 3
Purifying . . . 68 9 6		Interest . . . 283 18 8
Maintenance of retorts . . 174 2 0		
Trade and general charges . 888 15 11		
Salaries and collectors com- mission . . . 1,623 0 5		
Rents, rates, and taxes . . 325 11 5		
Directors and auditors remu- neration . . . 626 5 0		
Bad debts . . . 67 17 6		
Law charges . . . 100 2 7		
Exchange account . . . 1,000 0 0		
Net profit . . . 10,419 8 9		
		£23,931 10 6
		£23,931 10 6
		General Revenue Account.
Dividend for half year ending June 30, 1876. . . £8,400 0 0		Balance, June 30, 1876 . . £8,779 15 6
Interest on debentures . . 442 10 0		Net profit for half year end- ing Dec. 31, 1876 . . . 10,419 8 9
Amount carried to reserve- fund . . . 500 0 0		
Balance carried down. . . 9,856 14 3		
		£19,199 4 3
		£19,199 4 3
		Balance brought down . . £9,856 14 3

when we have had the first fruits, so to speak, of the first six months working under our new contract with the Municipality of Bombay. There has been, perhaps, never a meeting of this company so interesting in its results—I will not say so assuring in every particular—as the present. For, having tested our new contract for six months, we find that, upon the whole, it has worked satisfactorily. It was a very anxious time the board had to go through in negotiating that contract, as you may suppose. The effect of it is that it has extended our privilege of lighting Bombay for 14 years to come. It has given satisfaction, as we believe, to the Authorities there, because it is a fair and reasonable contract, and has proved remunerative to us, so that both sides have derived advantage. As regards the public lighting under it, I may state that we have supplied during the last half year 750 additional lamps, making the total 3150, and they have consumed 5,814,600 cubic feet of gas more than in the corresponding period of the previous year. With reference to the private consumers, you are aware that we have reduced the price to small consumers 1s. per 1000 cubic feet, and to large consumers 1s. 6d. I must candidly confess that this reduction has not resulted in that increase of consumption which we hoped for, and indeed expected. On the contrary, there has been a decrease in the private consumption. Contrasting the private consumption during the last six months with the corresponding period of 1875, the falling off has amounted to about 2½ million cubic feet; but, from this, 1½ million must be deducted (that being the quantity consumed for the illuminations during the visit of the Prince of Wales in the year before), so that the actual diminution is about one million cubic feet. This, of course, is a very serious diminution, and difficult to account for; but I am happy to say that we appear now to have “turned the corner,” and that for some months past there has been a steady, though not a large increase in the private consumption. The only way that we can account for the diminution is the dullness of trade, and the necessity for retrenchment. Every one is complaining, and we have had advices from our manager that banks and other institutions have reduced their consumption. Possibly, too, the famine may have had something to do with it. Deducting the decrease in the private lighting from the increased quantity of gas supplied to the public lamps, the net increase in the last six months is 3,183,000 cubic feet. This additional quantity of gas was produced with 179 tons of coals more carbonized; but the cost of coal during the half year, as compared with the corresponding period of 1875, is £299 less—a result which I think you will say is most satisfactory. You will probably ask how it is, if there has been an increase in the quantity of coal consumed, there has been a decrease in the cost under this item in the profit and loss account. My reply is simply that we have been burning cheaper coal. I am happy to state that the leakage, which in the corresponding six months of 1875 was a very serious matter, being as large as 20 per cent., has been reduced, by a careful examination of the whole of the mains and services, to 7½ per cent. I now come to the important matter of coke—I say important, because it is in the sale of residual products especially that we have done so well, and indeed have been far more fortunate than many other companies in the East. The result in this respect has been favourable. We have sold 273 tons more coke during the last half year, and although it has realized a smaller price per ton, it has given us £567 increased profit. As regards tar, there is an increase of 5000 gallons, representing about £70 more in the half year's account. Looking to the item of fuel—by which I mean the coke we burn under our furnaces in the distillation of gas from coal—there has been a saving of 4 per cent. during the half year. In the “Fittings” account, which, as you remember, was for a long time a source of little or no profit to us, I have now to report a profit, during the six months, of £520. So that the favourable position which the company occupies is due—first, to economical working; secondly, the good sale of coke and tar; thirdly, the reduced cost of the coal carbonized. Now, if you look to the balance-sheet, and contrast it with the corresponding half of the previous year, you will find that the stock of chandeliers shows a decrease of £466; brass and iron goods, a decrease of £908; materials, mains, and services, a decrease of £3316; meters, a decrease of £50; coals, £859; coke, £1371; tar, £64; tools and sundries, £117; making a total decrease of £7151. Turning to the profit and loss of the year 1876, as contrasted with the year 1875, you will see that the coal carbonized last year cost £7436, as against £7735 in the previous year, being a decrease in amount of £299. There is a slight increase in wages, the figures being £1201 last year, as against £1120 in 1875—increase £81. In “Purifying” there is an increase of £56; maintenance of retorts, a decrease of £70; trade and general charges, a decrease of £123; salaries, a decrease of £29; and rents, rates, and taxes a decrease of £18. The item “Directors and auditors remuneration” is the same; and in bad debts there has been an increase of £32; but when you come to look at the fact that upon the year's working our bad debts only amount to £67, upon an income of not far from £40,000, I think you will say that great credit is due to the management at Bombay for the vigilance and closeness with which the money owing to us is collected. There was, during last year, a slight increase of £52 in “Law charges,” and a decrease of £200 on the exchange account. You are aware, from the report, that we have written off the £1000, standing to the debit of that account, out of the revenue of the last half year. There was a loss of £5537 upon the exchanges last year, off which we had previously written £1537; we have now charged to revenue the balance of £1000, which, I hope you will agree with me has been prudently done, and shows a very favourable state of things. I am happy also to state that, inasmuch as during the six months under review we brought no money home, there has been no loss on exchange during that period; and here I may add that, although since the accounts were made up we have had some large remittances, we have not suffered severely thereby—a matter upon which we may well congratulate ourselves, seeing that the rupee was at one time in value only 1s. 6d. During the last twelve months we have paid off £3300 of debentures; next January we shall pay off £5000, and in the following year £6500, and then we shall have wiped off the large sum which we borrowed for working capital when we were in straits. The question of coal is a very important one to us, as it is out of that mineral that we make our profits. I may inform you, therefore, that on the 31st of December last we had 9786 tons of coal in stock, and since that time we have thrown in 4000 tons, so that we have now, in stock and afloat, a supply sufficient for two years, at the end of which time I hope the troubles of war will be over. We have bought our coal at low prices, and have secured freights at low rates. As to the condition of our works, our manager reports that they are in a most satisfactory state. (The chairman read several extracts from the manager's report to the directors on this subject.) In the present half year, so far as it has gone, I think we may safely say that it promises fairly. The manager informs us that he is continually busy at work with fittings. I repeat that the private consumption shows monthly an increase. Before I close my observations, I should make some acknowledgment of the zeal, energy, and ability with which our manager in Bombay has carried on our works. Indeed, the whole conduct of the business out there reflects honour and credit on the officials in our employ. Having made these remarks, I now move—“That the report and accounts be received and adopted, and that a dividend for the half

year ending Dec. 31, 1876, of 4 per cent., free of income-tax, be declared payable on and after the 1st of June next."

Major SUART seconded the motion.

Mr. STOKES said he thought the shareholders might congratulate themselves upon the satisfactory report just presented. There was only one point upon which he desired information. The chairman stated that there had been a reduction in the stocks during the half year, and perhaps he would be good enough to state to what extent this reduction applied to the old chandeliers and brackets. With reference to leakage, he could not help thinking even 7½ per cent. was a large amount; still, he was very glad to learn that it had been reduced from 20 per cent.

A SHAREHOLDER remarked that the debenture debt was last year about £14,000; now it appeared as £11,550 in the accounts, and the chairman held out hopes that next year it would be still further reduced, and in the year following extinguished. Out of what funds was this money being paid off?

The CHAIRMAN said it was paid out of money that had been invested in fittings and in coal. The company borrowed £20,000 some time ago, and were now repaying it. In reply to Mr. Stokes, he remarked that the old stock had been reduced to this extent that the manager was continually indenting for new. The directors had had some of the surplus stock brought for sale to this country, but they met with indifferent success in disposing of them. They had now given instructions to the manager to go again over the stock, and see whether anything further could be eliminated from it. As to the question of leakage, the manager reported that the excess, which showed itself during the first half of 1876 caused him great anxiety. It commenced immediately after the general illuminations, which took place at the time of the Prince's visit. A careful examination of the mains, services, and all the connexions was immediately made, and everything done to remedy the evil. An immense amount of labour was expended before the leakage was reduced, but it was satisfactory to find that, although there were upwards of 17 miles of new mains under pressure, it had been reduced in the half year to 7½ per cent. Leakage, he might explain, included all unaccounted for gas, and all the gas burnt on the works, and he believed, upon the testimony of good engineers, that 7½ per cent. was a very moderate rate. As to the debentures, he would further state that £3300 was paid off on the 1st of January last; the directors proposed to pay off another £5000 in next January, and the remaining £6500 in the January following.

Mr. SEWELL said he could only express surprise that the leakage was as low as 7½ per cent. In many other companies he knew it was considerably more, and, therefore, he concluded that the distribution of gas in Bombay was well looked after. He was heartily glad to hear that they were getting to the end of the old chandelier stock, and he would suggest that if any portion of the remainder was absolutely unsaleable in India, it should be sent home. He asked whether it was the policy of the board, in reference to "Exchange," to open and maintain an exchange account so as to provide for contingencies in the future.

The CHAIRMAN said they would have to meet the difficulties in this matter as they arose in the future as they had done in the past. The £5500 which stood to the debit of exchange last year had been got rid of by paying £4500 out of the revenue last time, and £1000 on the present occasion.

Mr. H. P. STEPHENSON wished to add one word in answer to the shareholder who inquired from whence the money came to pay off the debentures. Probably the gentleman who asked the question was not a shareholder when the company had £30,000 locked up in gas-fittings. That stock had been from time to time reduced till it now stood at something like £15,000. The directors had, therefore, had £15,000 placed at their disposal, not out of profits, but out of the expended capital converted into cash, and it was with that money, which formed part of the £29,867 in hand when the accounts were made up, that they were enabled to pay off a portion of the sum due on debentures. Mr. Stokes had brought up again from the grave his old friend the fittings account. He (Mr. Stephenson) hoped it would be for the last time, because the fittings had now been reduced to such a point, that it might be said practically the stock in Bombay was now an efficient stock.

A SHAREHOLDER remarked that, inasmuch as no remittances had been made during the half year under review, it was to be supposed there had been a saving to the company in the matter of exchange. But he would like to ask what became of the accumulation of cash in Bombay. He hoped it was not lying there in idleness.

The CHAIRMAN said it was not; it was productive by arrangement with the bankers. The directors waited for favourable exchanges to bring it to England; meanwhile, it lay at deposit and bore interest.

The motion was then put and carried unanimously.

On the motion of the CHAIRMAN, seconded by Mr. R. KING, the retiring directors were re-elected, and Major SUART and Mr. LYSLEY returned thanks.

On the motion of Mr. STOKES, the retiring auditors were re-elected, and Mr. KING acknowledged the compliment for himself and colleague.

The CHAIRMAN, in responding to a cordial vote of thanks to the chairman and directors, said: I beg, on behalf of my colleagues and for myself to make our best acknowledgments to the shareholders for this mark of their approval. I can only add that we shall continue in the future, as we have done in the past, to give our services for the good of the company, and I do most fearlessly assert that your interests are most zealously watched over.

Mr. SEWELL moved, and Mr. STOKES seconded, a vote of thanks to the secretary and to the staff of the company in India, for the able manner in which their duties had been discharged.

The motion having been carried unanimously,

Mr. MARSHALL said: Allow me to acknowledge the compliment you have bestowed on me, and on the staff generally. Your vote of thanks is very encouraging, and I am sure it will be as much appreciated by the staff in Bombay as it is by me personally.

The proceedings then terminated.

WELLINGTON (NEW ZEALAND) GAS COMPANY, LIMITED.

The Annual General Meeting of Shareholders was held at the Offices, Courtenay Place, Wellington, on Monday, Feb. 5th—when the following report and statements of account were presented:—

The directors have to report that the business of the company has increased considerably during the past year.

The profit for the year is £4966 13s. 1d. Of this amount an interim dividend was paid in July last, amounting to £1909 7s. 6d.; with the remainder, the directors propose to pay a dividend for the last half year at the rate of 7½ per cent., to place £500 to the reserve-fund, and carry forward the balance.

The price of gas was reduced on the 1st of October last to 15s. per 1000 feet, with a discount of 3s. per 1000 feet for prompt payment.

The new gasholder was completed and in work last winter.

The increase of the company's business has rendered necessary further extensions of the retort-house and purifying plant, the necessary material for which is now on the way, and the cost complete is estimated at £2000.

The mains have been extended during the year about 1½ mile, and a further supply of main-pipes has been ordered.

The total number of consumers is now 670. During the year 160 new services have been laid on, being equal to about 1400 burners.

Two of the directors retire by rotation—viz., Messrs. J. Burne and W. H. Levin—who, being eligible, offer themselves for re-election.

Dr.	Balance-Sheet, to Dec. 31, 1876.	Cr.
Capital, viz.—		
2000 shares, fully paid up .	£20,000 0 0	
1000 shares, £7 paid up .	7,000 0 0	
	£27,000 0 0	
Reserve-fund	2,000 0 0	
Bills payable	179 5 3	
Bank of New Zealand . . .	598 0 11	
Profit and loss, balance . .	3,057 5 1	
	£32,825 11 3	
		Immovable property, viz.—
		Land, buildings, plant, and services .
		£29,286 19 1
		Moveable property—Stock of meters, tools, and sundries .
		975 5 0
		Stock of coal, products, &c. .
		639 18 0
		Stock of goods
		548 3 10
		Debts due for goods
		210 4 1
		Gas-rates, 1876, not yet paid .
		829 9 8
		Products, 1876, not yet paid .
		253 16 1
		Cash in hand
		81 15 6
		£32,825 11 3

Dr.	Profit and Loss Account.	Cr.
Dividend, 1875, per report .	£1,776 18 0	
Reserve-fund, per report . .	500 0 0	
Amounts written off	89 12 6	
Interim dividend, 7½ per cent., June 30, 1876	1,909 7 0	
Cost of coal, wages, &c. .	£7,022 5 5	
Less stock of coal, &c.	639 18 0	
	6,382 7 5	
General expenses—		
Salaries	525 0 0	
Directors	75 0 0	
Auditors	10 10 0	
Annual licence and Government charges	22 5 0	
City rates	51 15 8	
Insurance	15 14 3	
Printing, advertising, and stationery	63 5 10	
Interest	100 9 0	
Sundries and petty charges .	104 9 4	
Balance	3,057 5 1	
	£14,683 19 1	
		Balance
		£2,407 2 8
		Gas-rates and meter-rent . .
		11,321 17 11
		Products
		684 13 2
		Goods
		254 17 0
		Fees
		0 16 0
		Interest
		14 11 8
		£14,683 19 1

CHRISTCHURCH (NEW ZEALAND) GAS, COAL, AND COKE COMPANY, LIMITED.

The Annual Meeting was held at the Company's Offices, Gloucester Street, Christchurch, on the 1st of March—Mr. W. H. LANE in the chair.

The SECRETARY (Mr. C. W. Bishop) read the directors report, which was as follows:—

The report which your directors have to place before you at this meeting shows that the operations of the company during the past year have not been so profitable as heretofore, which is chiefly accounted for by the fact that during the past nine months a great reduction has been made in the price of gas, and partly by the expenditure of a large amount of capital in extensions which have not yet become remunerative.

Your directors have had constantly before them the growing requirements of the public for gas, and have taken the necessary steps to meet the rapidly increasing demand.

Your directors herewith submit the usual annual statement of accounts. The profit for the past year—with £34 17s. 4d. brought forward—amounts to the sum of £4392 12s. 1d. An *ad interim* dividend at the rate of 7½ per cent. per annum was paid in August last, and the sum of £1992 12s. 1d. is now available for distribution. Your directors recommend that a further dividend, at the rate of 5 per cent. per annum, be now paid, and that the balance be carried forward.

Dr.	Balance-Sheet, Dec. 31, 1876.	Cr.
Capital, viz.—		
4000 shares of £10, paid up .	£40,000 0 0	
4000 shares of £10, no call made	40,000 0 0	
Debts due by the company . .	397 18 9	
Bills payable	870 12 1	
Deposits at call	4,141 7 11	
Insurance-fund	100 0 0	
Bank, New South Wales . . .	84 8 4	
Balance	1,992 12 1	
	£87,586 19 2	
		Immovable property—land and buildings .
		£3,758 9 11
		Additions and improvements during the year .
		758 4 1
		Moveable property, being plant .
		37,525 16 10
		Capital available by call . .
		40,000 0 0
		Unpaid calls
		85 10 0
		Office furniture
		86 9 7
		Funds invested on mortgage .
		1,700 0 0
		Shares in Permanent Investment and Loan Association .
		100 0 0
		Debts due to the company . .
		1,429 19 4
		Remittances against plant to arrive .
		890 0 0
		Stock on hand—Coal and purifying materials
		924 1 8
		Ditto—Gas-stoves
		27 16 9
		Cash in hand
		300 11 0
		£87,586 19 2

Dr.	Revenue Account for the Year 1876.	Cr.
Stock—		
Coal, purifying material, &c., Jan. 1	1,721 15 6	
Subsequent purchases . . .	3,868 1 2	
	£5,589 16 8	
Stock on hand, Dec. 31 . .	924 1 8	
	£4,665 15 0	
Stock of gas-stoves, &c., Jan. 1 . .	£40 11 3	
Stock on hand, Dec. 31 . .	27 16 9	
	12 14 6	
General expenses, viz.—		
Wages—Working of plant and lamp lighting	1,872 19 1	
Salaries and fees	1,275 5 0	
Rent, taxes, and insurance .	201 5 1	
Tools, materials, and repairs .	145 18 0	
Stationery, advertising, and printing	81 18 8	
Miscellaneous	217 10 7	
Discount and interest . . .	1,101 14 7	
Bad debts marked off	35 3 5	
Balance to profit and loss from working account	4,356 9 9	
And from sale of stoves . . .	1 5 0	
	£13,967 18 8	
		Sale of gas and rent of meters .
		11,659 8 4
		Sale of coke, tar, and sundries .
		2,228 16 10
		Certificate and transfer fees .
		65 14 0
		Sale of gas-stoves
		13 19 6
		£13,967 18 8

The CHAIRMAN, in moving the adoption of the report, said that there had been a great many improvements made in the works since the arrival of the new manager, and consequently there had been more expense than in previous half years. However, considering the reduction made in the price of gas, the operations had been very successful.

Mr. W. P. COWLISHAW seconded the motion. He pointed out that by the last reduction in the price of gas, the company now supplied it lower than many parts of New Zealand. In doing this of course they had to submit to their dividends being smaller this half year than before, but this would cure itself as the population increased.

The motion was agreed to.

Mr. C. R. BLAKISTON moved—"That the sum of £1992 12s. 1d. be distributed as a dividend at 5 per cent., as recommended by the directors."

Mr. GOULD seconded the motion, which was carried.

Messrs. Blakiston, Wright, and Cowlishaw were re-elected as directors, and Messrs. H. E. Alport and B. Walton were elected as auditors for the ensuing year.

On the motion of Mr. TIPPING, £50 was voted to the chairman, and £150 to the directors for the ensuing year as honorarium; to be divided according to attendances.

In answer to Mr. FISHER, the CHAIRMAN said that the directors were considering the advisability of making a call on the new shares during the ensuing year, but nothing had yet been finally decided upon.

The meeting then terminated.

WATER SUPPLY OF THE METROPOLIS.

[Extract from the Annual Report for 1876 of the Metropolitan Board of Works.]

By the Metropolitan Water Act, 1871, the Board is empowered to call upon any water company to give a constant supply of water in any district, and the companies themselves have the power, if they think it desirable, to initiate a constant supply, after giving due notice of their intention. The Board has explained, on previous occasions, the grounds upon which it has thought it expedient to refrain at present from exercising the power given by the Act of calling upon the companies to give a constant supply, and has also stated that two of the companies—the East London and the Kent—have themselves taken the initiative in the matter. The East London Company is still proceeding in this direction, having in October last given notice of its intention to give, on and after March 1, April 1, and June 1, respectively, a constant supply in certain districts comprised in the parishes of Bethnal Green and Mile End Old Town. The Board has received no notice from the Kent Company during the past year of any new district intended to be brought under the constant service system.

Reference has been made in previous reports to the fact that the Board, in November, 1873 upon being called upon by the Kent Water Company, under sec. 32 of the Water Act of 1871, to state what hydrants or plugs, for the supply of water in case of fire, it required the company to provide in certain parts of Rotherhithe and Deptford which had been brought under the constant service system, required the company to place thirty plugs and hydrants on the mains, by way of experiment. The results of the experiment, however, were not such as to encourage the hope that hydrants could at present be brought into general use in the Metropolis as a means of extinguishing fires without engines. When, therefore, the Kent Water Company, in December, 1875, informed the Board that a constant supply was being given in parts of the parishes of Woolwich, Deptford, and Charlton, and called upon the Board to specify what hydrants it would require to be placed on the mains, the Board deemed it advisable not at present to make any specific requirement, but to wait until the general question of the use of hydrants in London, which was then under consideration, had been decided. A suggestion was accordingly made to the company that the formal notice given by it to the Board should be withdrawn, and the matter postponed for a time. The company declined to consent to this proposal, and stated its intention, in the event of the Board not specifying what hydrants it required within the two months named in the statute, of providing such plugs or hydrants as should seem necessary, and charging the Board with the cost thereof. This intention was carried out by the company, notwithstanding a protest on the part of the Board, and 61 hydrants were laid down, at a cost of £204 3s. 6d., which was paid by the Board.

In two new streets made by the Board during the past year, Northumberland Avenue and Great Eastern Street (the latter leading from High Street, Shoreditch, to Old Street), The Board on receiving notice from the New River Company that a constant supply of water would be given to the houses in the streets, required the company to lay down hydrants. Some provision had necessarily to be made for obtaining water in case of fire, and it seemed desirable, as new pipes were about to be laid which would be constantly charged with water, that hydrants should be placed on them. The Board required the company to place five hydrants in Northumberland Avenue, and ten in Great Eastern Street.

It was stated in the last report that the Board had had under consideration the question of the expediency of providing fire hydrants throughout the Metropolis, and that an extensive series of inquiries had been made into the conditions which prevailed in several towns in the north of England and in Scotland in which hydrants were made instrumental for the extinction of fires without the use of engine power. Manchester and Liverpool, which were selected for special inquiry, were visited by a sub-committee of the Board, and the conditions of the water supply, its quantity, pressure, and distribution, were thoroughly investigated. In each of these towns the water supply is in the hands of the municipal authorities; it is abundant in quantity, and, flowing from a high source, the pressure is sufficient to enable the water to be thrown to a great height without pumping. Hydrants are therefore of great value in Manchester and Liverpool, and, if water were supplied under similar conditions in London, there might be good reasons for the Board to place hydrants throughout the Metropolis. The conditions are, however, far from being the same. The water supply is not in the hands of the local authorities, the pressure is by no means so great or so certain, being derived, not from gravitation from a high source of supply, but, generally speaking, from being forced through the pipes by pumping. The Board, wishing to ascertain as nearly as possible what the ordinary condition of things was in the Metropolis, as regards the pressure in the water-mains, instructed its engineer to make a number of observations in various parts of the districts of the different companies, and at different levels. An extended series of observations was accordingly made, and it appeared from these that the height to which water issuing from a stand-pipe could be thrown depended upon so many conditions that it was difficult to determine it with any exactness. Sir Joseph Bazalgette, however, distinctly gave it as his opinion that hydrants for the purpose of extinguishing fires would not be of real practical advantage to the Board unless a sufficient pressure of water were ensured, and this could not be the case so long as the management of the water supply was under the independent control of the different companies. The chief officer of the Fire Brigade expressed himself to the same effect.

The whole question received the most careful consideration, and the conclusion arrived at was, that the placing of hydrants throughout the Metropolis would not at present be of such public utility as to justify the Board in incurring the immense expenditure which the operation would entail.

The general question of the water supply was under the consideration of the Board early in the year [1876], a committee having been instructed to prepare a Bill, after conference with the Corporation of London and the Water Companies, to provide for a more equitable system of charging for water supplied for domestic purposes. A sub-committee of the Board had several meetings with a sub-committee of the Corporation on the subject, and the conclusion came to, after making full inquiry, was that, instead of attempting legislation with reference to the water companies charges, it would be better for the two authorities to propose at once that

the water supply should be in the hands of the municipal authorities. It may be mentioned that in the report made in the year 1869 by the Royal Commission on Water Supply, presided over by the Duke of Richmond, the present Lord President of the Council, the opinion was expressed that the constant service system could not be effectually introduced in London so long as the supply remained in the hands of private companies, and that the future control of the water supply should be entrusted to a responsible public body.

The Parliamentary Committee of the Board was accordingly instructed to confer further with the Corporation of London, and to ascertain from the Home Secretary whether the Government would support a measure to the effect suggested if it were introduced by the Board and the Corporation. The resolution of the Board was communicated to the City authorities, and they were asked to make the Board acquainted with their decision upon the question. A reply was received to the effect that the subject was still under consideration, and the Board still awaits a definite communication of the views of the Court of Common Council.

STREET LIGHTING IN NEW YORK.

[From the *American Gaslight Journal*.]

The recent prices for lighting the street-lamps in New York City seem to have excited considerable discussion in various parts of the country. We are in receipt of letters from all parts of the continent upon this subject, and we give the following for the information of our readers. There are in the city of New York five gas companies that have, for some years past, been supplying gas to the street-lamps. This does not include the 23rd and 24th wards, north of Harlem River, which were recently annexed, and where old contracts, made for a term of years with companies situated therein, are still in force. Of the five companies above referred to, the New York Gaslight Company's district includes that portion of the city below Grand street; the Manhattan district extends from Grand street to 34th street, and from North to East River; the Metropolitan district extends from 34th to 79th streets, and from river to river; the Harlem district from 79th street to Harlem River and Spuyten Duyvel Creek. The works of the New York Mutual Company are situated at 11th street and East River, and their mains are laid through many of the streets of the first three mentioned districts, and their business is in competition with that of those three companies—viz., the New York, the Manhattan, and the Metropolitan. Previous to the recent "letting" the New York Mutual lighted all the lamps on the line of their mains. In making bids for the public lamps for nine months, from April 1, the New York and the Manhattan Companies offered to light all the lamps in their respective districts for the sum of 12-40 dols. per lamp—this to include lighting, extinguishing, and cleaning. The bid of the New York Mutual, for so many of the same lamps as were situated on the line of their mains, for the same time, was 22-25 dols. per lamp. The Metropolitan Company bid only for the same lamps that they were previously lighting, and offered to light for 21 dols. per lamp. The Harlem, with no opposition gas company, bid for all the lamps in its district, and offered to do the work for 24-75 dols. per lamp.

One fact must be remembered with reference to the Harlem Company's mains. Many of them they have been obliged, by order of the Common Council in years gone by, to put down for miles and miles, in some cases through rock, where there was not, and is not now, a single consumer, simply for lighting streets. Undoubtedly, the reason for doing this was the fact that plenty of light is the cheapest and the best police. Another fact, with reference to this district, is that the expense for distribution must necessarily be greater here than in any other section of the city, owing to the conformation of that portion of New York Island.

At the same time a proposition was made by the New York and New Jersey Globe Gaslight Company, Limited, to light, &c., not to exceed 2000 lamps, in any part of the city, with naphtha, for the sum of 20 dols. per lamp, for 9 months.

The awards were made, as stated in this *Journal*, on March 16, giving the New York and Manhattan Companies all the lamps in their respective districts, and the other companies not being in competition, were awarded the same lamps they had before at the prices bid, with the exception of the Harlem Company, from whom 2000 lamps were taken and assigned to the Naphtha Company. This company manufacture their light on each lantern from naphtha contained in a small receiver, placed on one side, at the top. As this arrangement was to take effect April 1, there has not been time yet to fully determine the practical value of these latter lights; but the same arrangement has been in use quite generally in New England, for outlying districts where there was no gas; and when they do not blow out, or get the lanterns too smoky, they answer the purpose intended better than oil lamps, perhaps. The price, however, is not much less than the average price bid for gas at the last "letting" in New York City—which would be 20-20 dols.

It seems to us that the whole business of lighting New York street-lamps is on a wrong basis. In the first place, the burners are too small, being required to burn only three feet an hour, under one inch pressure at the burner. Bearing in mind that the light derived from different sized burners varies not directly with the consumption of the burner, but very nearly as the square of the amount of gas consumed, it would seem much better policy, if economy has to be practised in so essential a thing as light, to diminish the number of posts, and burn not less than five feet of gas an hour in each one that is used. If the city were to pay for the same amount of gas as it gets now, it would get more than double the amount of light, if the gas were burnt in this way.

In the next place, all gas, whether burnt in street-lamps or elsewhere, should be sold in the same way—viz., by the 1000 cubic feet—and all labour of every kind attending the lighting, extinguishing, cleaning, repairing, &c., should be paid for separately as labour. In this way a definite idea could be obtained of the price charged for the gas itself, and it would not be mixed up with a dozen different items of labour, &c., which would puzzle a Philadelphia lawyer to separate and charge to their proper accounts.

THE SEPARATION OF NAPHTHALINE FROM GAS.

By THOMAS CURLEY, Wilmington.

[A communication to the *American Gaslight Journal*.]

The products of the distillation of coal are classed under three heads—namely, the gaseous, the liquid, and the solid. Among the latter, naphthalene takes its place, by reason of the large amount of carbon which its atom contains, and which precludes its retention in a gaseous or vaporious state, except through the agency of a solvent substance; but in the absence of such solvent it will follow the law of its nature, and crystallize.

This substance, in its (present) crystallized condition, was unknown to our predecessors, but with the era of clay retorts, high heats, and the general desire of the manufacturer to keep pace with other branches of industry, and produce gas at the lowest possible cost, we have it in abundance. The question having been discussed at the various meetings of the American Gaslight Association, the results are known to the profession. It was seriously recommended to keep the gas in contact with the tar much longer than usual, and thereby allow the tar to absorb (out of the gas) these

naphthaline vapours. Again, it is recommended to reduce the temperature of our retorts, or, in other words, go back 20 years again; to use steam and solvents, or solvents alone; to saturate lime with naphtha; and to make oil gas. The four latter systems or suggestions, or any one of them, may be taken relatively as to their cost and their practical application, in other words, will the extra amount of gas produced pay for the expense incurred by their use?

The proposition to keep the gas in contact with the tar as long as possible in the ordinary way is, according to chemical science and practice, a backward step in the science of gas manufacture, and very few, I dare say, will be found to adopt it, it being essentially a system which deprives the gas not only of its naphthaline vapours, but, unfortunately, will deprive it of a large quantity of the light hydrocarbon vapours whose presence in the gas adds so much to its illuminating power.

Knowing that the benzol and naphtha series of hydrocarbons are powerful solvents of naphthaline, and knowing furthermore that the coal tar contained more or less of these oils, the question suggested itself, why not expel these oils from the tar, where they are of no use, and utilize them as solvents for the naphthaline, by their mixture with the gas in a vaporous state, thereby neutralizing the tendency of the naphthaline vapours to crystallize and the enriching of the gas by their presence to the extent of from 10 to 15 per cent.?

The system which I have the honour of presenting for your consideration, and which has occupied my mind for some considerable length of time previous to its adoption, particularly in relation to its mechanical arrangement, simplicity of details and inexpensiveness, is this: I cause the ammoniacal liquor and tar to run directly from the hydraulic main into a box, say 12 by 18 by 36 inches, placed just below the level of the main; here the tar is separated from the ammoniacal liquor, the tar flowing into an adjoining tank, 3 feet in diameter and 3 feet high, made of No. 10 iron. In this tank I have a small coil of steam-pipe, and by the agency of steam, or exhaust steam, I keep the tar at such a temperature as will expel the light hydrocarbon vapours, which the tar holds in solution, and their subsequent mixture with the gas. The result is what I anticipated—the non-appearance of naphthaline crystals, and a vastly increased illuminating power of the gas. The ammoniacal liquor may be conducted from the separator to any desired place. The overflow from the tar-tank conveys the tar to the tar-well, if found necessary; I, however, convey it to the furnace, where it is consumed instead of coke. I use no coke whatsoever in the tar furnace. Even the expense of pumping the tar for consumption in the furnace is obviated, and the flow of tar to the point of combustion is more steady, consequent upon its uniform temperature.

In reference to the cost of tank and separator, I would say that for our works their cost was less than 80 dollars. The tank and separator here described are sufficiently large for works producing from 40 to 60 million cubic feet per year.

MODERN DEVELOPMENT OF WATER-PRESSURE MACHINERY.

At the Meetings of the Institution of Civil Engineers, on Tuesdays, the 8th and 15th of May—Mr. G. R. STEPHENSON, President, in the chair—a paper by Sir G. W. ARMSTRONG, C.B., F.R.S., V.-P. Inst. C.E., on "The History of the Modern Development of Water-Pressure Machinery," was read.

The author's attention was first called to the subject of water pressure as a motive power, by noticing the waste of power exhibited by mountain mills in the Craven district of Yorkshire. He was thus led to devise a water-pressure engine, which combined the use of pistons with the continuous rotation of a water-wheel. A large working model of this wheel was tried in 1839, by connecting it with the street water-pipes in Newcastle, when it gave a high co-efficient of effect. About the same time he pointed out that a stream of rapid descent might generally be conveyed in a nearly level cut along one of its banks, until it attained a great elevation above the valley, and until a point was reached where the fall could be rendered available by a pipe of moderate length. Also that there were many precipitous streams which were capable of furnishing a surprising amount of power, especially if combined with flood-water reservoirs to equalize the supply. He likewise argued that the water supplied to towns for domestic purposes could, in many cases, be advantageously employed for working all kinds of machines. He showed that it would be more economical to use water for the cranes of a given weight of merchandise than hand labour, and that it would result in greater expedition. The principle, too, was enunciated that, when water was lifted by a pumping-engine, it became the recipient of the power exerted in raising it, and that if the same water were used as a motive power in descending to its original level, it would render back the power conferred upon it by the engine; so that the power of the pumping-engine might be transmitted to a distance, and be distributed in large or small quantities as required. A crane was then designed, in which the lifting was performed by the single stroke of a piston, multiplied by folding the chain over sheaves in the inverted order of pulley-tackle, the slewing motion of the jib being effected by a separate cylinder, the piston of which was attached to a rack working into a circle of teeth at the base of the crane. By a suitable valve the water was admitted into the lifting cylinder, when the weight on the chain was to be raised, and suffered to escape when the weight was to be lowered. To avoid dangerous jerks by the sudden closing of the outlet when the weight was being rapidly lowered, a small clack valve was applied, opening upwards against the pressure in the supply-pipe, so as to permit the pent-up water in the cylinder to be pressed back in the supply-pipe, whenever the compression in the cylinder exceeded the pressure of the water in the pipe. The slewing cylinder was also fitted with an appropriate valve for admitting the water to either side of the piston, while it allowed an escape from the opposite side. Relief valves were likewise applied at each end of the slewing cylinder, to save the machinery from being broken or strained by the momentum of the jib when the regulating valve was suddenly closed. In 1846 a crane on this principle was erected at Newcastle, and speedily attracted the attention of engineers. The late Mr. Jesse Hartley was induced to order cranes and hoists for a portion of the Albert Dock, Liverpool, to be worked by the pressure from the town water-pipes. These machines, when first erected, answered perfectly; but the pressure of water soon became so variable, that the extension of the system was considerably checked, until the alternative method of employing a steam-engine to generate the pressure was introduced. Hydraulic cranes for railway stations were first adopted in 1848, by Mr. Harrison, Past-President Inst. C.E.

Up to 1849 all the cranes and hoists which had been erected derived their power from town reservoirs; but about that time the author substituted an air vessel for an elevated tank. In 1849 the late Mr. Rendel consulted the author as to employing hydraulic pressure at the Grimsby Docks, not only for working cranes, but also for opening and closing the dock gates and sluices. To obtain the necessary pressure, a tower 200 feet in height was erected, to carry a reservoir, into which water was pumped by a steam-engine. The machinery came into operation in 1851. In 1850 Mr. Fowler, Past-President Inst. C.E., decided to apply hydraulic pressure for the cranes in the goods sheds of the New Holland Ferry Station, and also for raising and lowering two platforms to

communicate between the railway and a floating landing-stage on the river. As local conditions prevented the erection of a water-tower, the author was led to the idea of the present accumulator.

Until 1849 the author had met with no opportunity of realizing his original idea of utilizing mountain rills; but he was then consulted by Mr. Sopwith, M. Inst. C.E., as to substituting water-pressure engines for over-shot water-wheels at Allenheads. The water was collected in reservoirs at elevations of 200 feet, and all the purposes to be served required rotative motion. Reciprocating engines were, for various reasons, adopted. Each engine had two cylinders placed at an angle of 90° to each other, and working upon the same crank-pin. Balanced cylindrical valves were used, and the passages were large, to keep down the velocity of the water. Relief valves were applied to prevent shock at the end of the stroke. An extension of hydraulic machinery, involving the use of accumulators, was made later in the vicinity of Allenheads.

In 1851 the late Mr. Brunel proposed the application of hydraulic pressure to turn tables, traversers, and hauling capstans, and an extensive plant of such machinery was erected at the Paddington Station of the Great Western Railway.

By the end of 1851 the principle of transmitting and distributing the power of a steam-engine through the medium of water stored in an accumulator had become thoroughly established. The original idea of utilizing mountain torrents, which was the progenitor of the accumulator system, had only been partially realized; but although the cascades and rapids in many unfrequented districts were still generally neglected as sources of motive power, and might continue to be so while coal was plentiful and mountain valleys remained difficult of access, yet it could hardly be doubted that the descent of water from elevated land was destined, at some future day, to become an important source of motive power. The transmission of the power might be facilitated by employing the prime moving column to pump water into accumulators, and by conveying the highly pressed waters in a comparatively small pipe to situations where its value would be appreciated. The engine required would be a mere intensifier of pressure, and would be of the simplest description, consisting mainly of a press ram and a pump ram, in direct connection with each other, and having their areas proportioned to the acting pressure on the one side, and the resisting pressure on the other. Even falls of small height, sufficient only for water-wheels and turbines could be employed for giving a high pressure to water for the purpose of transmission, and this had actually been done near Allenheads; and it had lately been proposed to utilize, in a similar manner, the First Cataracts of the Nile.

The author then proceeded to describe the various forms of water-pressure machines which had come into use under the heads of hydraulic engines, hydraulic cranes, moveable cranes, moveable jiggers, hydraulic hoists, coal-discharging apparatus, coal-loading machinery, hydraulic machines for docking ships, sluice machines, swing-bridge machinery, drawbridge machinery, hydraulic applications to gunnery, and corn-warehousing machinery. He explained the modifications and improvements which had been progressively made, and showed the state of development at which water-pressure machinery had arrived.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

(Continued from page 787.)

Mr. D. BRUCE PEEBLES read a paper

ON THE APPLICATION OF ELECTRICITY TO PEEBLES'S SYSTEM OF CONTROLLING THE ACTION OF GAS-GOVERNORS AND ITS ADAPTATION FOR GIVING FLASH-SIGNALS FOR LIGHTHOUSES, RAILWAY SIGNALS, &c.

Last year I had the honour of bringing before the North British Association of Gas Managers, a new system of controlling the action of gas-governors by making a small portion of the inlet gas flow into and out of the bell or diaphragm chamber of the governor, a small governor being employed for establishing an invariable outlet pressure for station purposes, and a stopcock for adjusting a minimum day pressure for district purposes.

The ease and certainty with which a large volume of gas can thus be controlled led me to think that a simple electrical arrangement could be got to bring about an automatic action, which would increase or diminish pressure at any time or times which might be wished or required, so that in lighthouses where coal gas is used as the illuminating agent, flash-signals might be given with unerring accuracy, and by simple and inexpensive means.

I am aware that a system of flash-signalling by a gas apparatus has already been in use, the idea of which I believe originated with Mr. Thomas Stevenson, of Edinburgh, who has done so much to improve lighthouse illumination. I understand that his apparatus consists of a continuously revolving stopcock, which may be arranged to give flash-signals, with periods of darkness between the flashes, of any duration that may be required, and I have learned that Sir William Thomson also made an apparatus for the same purpose, the action of which depended on the opening and shutting of a pipe by a mercurial seal.

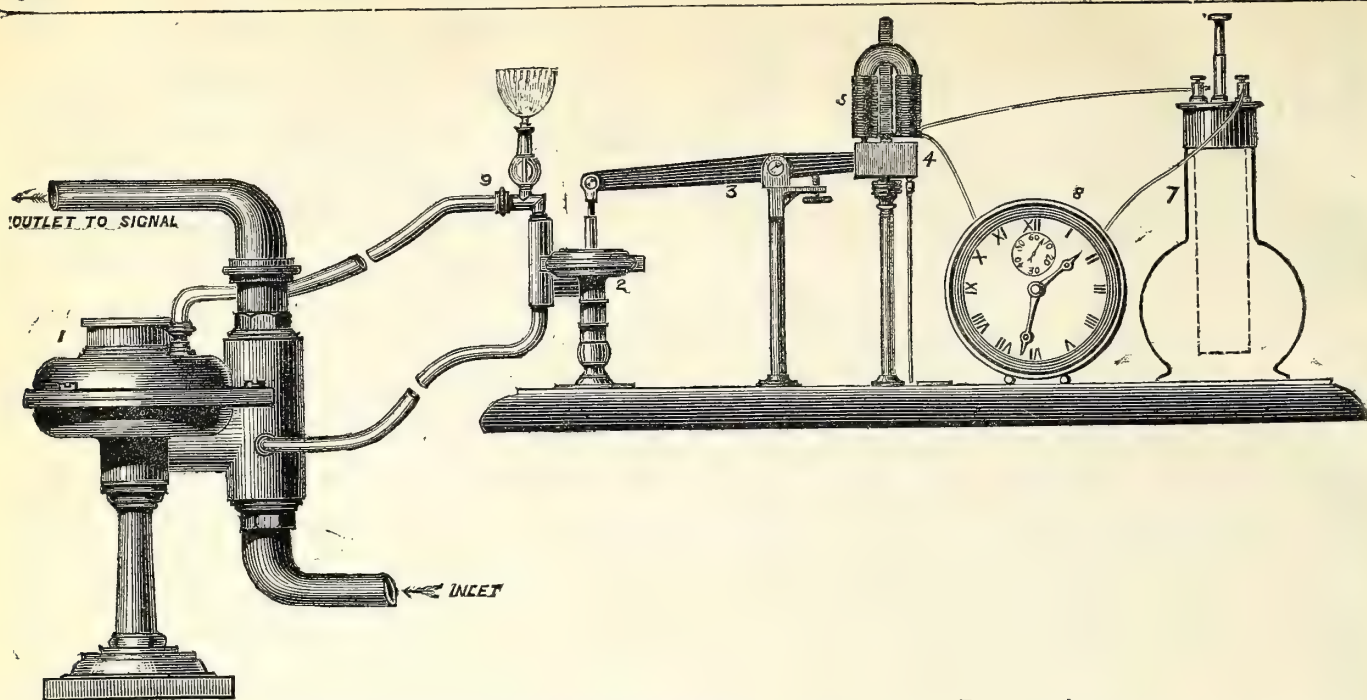
With either of these methods, if the volume of gas be large, a tolerably strong motive power must be required to work the apparatus, and I bring forward this new method in the hope that it may be found simple, accurate, and cheap, and able to control the largest volume of gas that could ever be required.

In the London JOURNAL OF GAS LIGHTING, dated Aug. 29, 1876, a description and illustration were given of a large gas-lantern, designed by Messrs. Edmundson and Co., London, for a lighthouse off Galley Head, on the south coast of Ireland. I quote from the article as follows:—"There are four burners—Wigham's patent—placed one above the other, and so constructed that the heat of each causes more perfect combustion in the whole. Each burner contains 108 jets, but is so constituted as to form burners of 28, 48, 68, 88, and 108 jets respectively, by the removal or addition of rings of jets, each of which can be removed or added in a moment. The light to be exhibited is Wigham group flashing-light. The beam of light, which is transmitted every minute from each of the lenses, is broken up into a succession of six or eight rapid flashes, followed by an interval of darkness. It is evident that, in the periods of darkness, when the gas is shut off, it is economized. The illuminating power which this lantern is capable of encasing is very great, the illuminating power of each of the gas-burners when at its maximum strength being equal to 2923 sperm candles. When four are lighted the light is therefore equal to 11,692 sperm candles."

The article goes on to state some of the advantages of gas for lighthouse purposes, and the ease with which the light may be increased to meet thickening weather.

I wrote to Messrs. Edmundson and Co., asking them to oblige me by giving some particulars regarding the method they had adopted for turning on and shutting off the gas, and they stated in reply that the gas was cut off and admitted by means of vertical valves, actuated by clockwork.

The apparatus I have the pleasure of exhibiting to you to-day consists of an ordinary gas-governor (1)—the one we have here is a dry governor, but it may be either of the wet or dry kind; it is entirely enclosed—and a small controlling governor (2) arranged to throw the pressure of the inlet



PEEBLES'S ELECTRIC FLASH-SIGNALLING APPARATUS FOR LIGHTHOUSES, RAILWAYS, &c.

gas upon the bell or diaphragm of the larger or supply governor, thus opening the valve. A small stream of the inlet gas flows into and out of the diaphragm, or bell chamber, and may be let away through an orifice, either into the main outlet or by a separate outlet-pipe, thus allowing the governor to be easily controlled, and weights being put on or taken off, the small governor opens or closes the valve of the large one, all as explained in my former paper.

The electric controlling apparatus is shown on the drawing, and its action will be understood by the small working model we have here.

The small governor (2) is loaded to give a supply of gas just sufficient to keep the burners lighted, or this may be done by means of a by-pass, with regulating stopcock; and a separate weight, sufficient to give a maximum supply of gas, is connected to one end of a lever (3), the other end of which is fitted with an armature (4) in a position to be acted on by a small electro-magnet (5). When the electric circuit is closed, the magnet causes the lever to lower the weight on to the small governor diaphragm and open the valve; but the weight is suspended from the lever by a loose link (6), so that only the pressure of the weight acts upon the governor. When the electric circuit is broken, the lever, having its armature end sufficiently heavy, lifts up the weight from the governor, and closes the valve. We see, therefore, that the small governor acts on the large one, by loading or unloading the bell or diaphragm with pressure instead of weights; and this principle may be modified and carried out in several ways. The electro-magnetic action is got from a small bichromate battery (7), and the small timepiece (8), which makes and breaks contact, is arranged to give six flashes each minute—but any other reasonable number of flashes can be given, if required—while 1000 lights can be as easily acted on as the seven we have here. For lighthouse purposes, or wherever a timepiece is employed to work the apparatus, it may be considered preferable to dispense with electricity, and place the lever (3) in a position, so that it may be acted on directly by the clock, and this can readily be done by a simple mechanical arrangement, as a very small amount of power is required to lift the lever and lower the weight on to the small governor. We now put the apparatus in action, and it will be observed that the flashes are given with a precision that leaves nothing to be desired. It will be readily understood that, while the rapidity of the flashes can be greatly increased, the duration of the flash can be prolonged, if necessary. The small current of controlling gas may either flow into the main outlet-pipe, or into a separate pipe, as before stated; but it is advantageous in this case to make the outflow pass through the small orifice by a separate pipe (9), as by increasing or diminishing the size of the orifice the flashes may be made sharp or sluggish, as wished, without in any way altering the pressure of the gas supplying the signal-lights.

This method of flash-signals may also be applied to railways, and a train may be made to give a visible signal of its approach at any distance from the station. A powerful gaslight might be placed at any central point which could easily be seen from any part of the station where the train is expected, and it would only be necessary to get the wheels of the engine or carriages at a mile or two miles distant, as the case might be, to touch a spring, make contact, and close the circuit, when the light would at once flash forth at full power, warning those at the station that the train was approaching.

The light could either be allowed to go down after the train had passed the contact spring, or remain as a signal until some of the officials at the station released the catch-pin, thus letting the gas down again to a minimum.

The system might also be used for giving a visible time-signal all over a city, say, at nine o'clock every night, so that in every house in which gas is used, the time could be obtained by noticing the gas-flame, which would be lowered for a second or two at the particular hour agreed upon. This could easily be done by acting on the station-governor at the gas-works, and correct time would be ensured by using one of Mr. Frederic Ritchie's regulated clocks, a number of which are now in use in Edinburgh and other places.

It seems well adapted also for Professor Jenkins and Sir Wm. Thomson's system of eclipse signalling by the Morse alphabet, the dot and dash being represented by long and short period of darkness.

A method of balloon signalling might also be established wherever a supply of gas could be obtained. The balloon would carry up flexible gas-tubes, and the flame would be protected by a lantern and wind-guard. In such a case, if used for war purposes, a cypher would be fixed on for giving the messages, and the gas might be compressed and transported to any suitable place for giving the signals.

There is yet another purpose it might be applied to. A small apparatus of this sort might be attached to the gas-pipe of any licensed houses whose landlords were suspected of setting Forbes Mackenzie at defiance. It would, in such a case, be set to turn off the gas at eleven o'clock p.m., and put it on again, say, at six a.m. The authorities would only have to see

that the clock and battery were attended to once a week, and might then rest assured that, so far as gas was concerned, no supply would be had after the legal hour of closing.

Lastly, it could be attached to the station-governor of any gas-works, and adjusted so as to give the day and night pressure at any hours the manager wished, so that, if all of us here who have station-governors had also a controlling apparatus such as this, we might have set it before leaving home to-day, with a certainty that the night pressure would be put on in our absence at the exact hour we arranged the timepiece to make contact.

Other applications of the system may be found, but those I have mentioned might, I think, be easily carried out, and would not disappoint expectations if applied practically.

The President proposed a hearty vote of thanks to Mr. Peebles for his interesting paper, the arrangement suggested by Mr. Peebles being, he said, both beautiful and ingenious.

Mr. YOUNG: Perhaps some members of the Association would like to make a few remarks upon this invention. It is scarcely fair to close up a discussion in this way. I think we are deeply indebted to Mr. Peebles for the many improvements he has introduced in gas-governors. This invention of his of regulating the governor by the pressure of the gas actuating the diaphragm or governing gasholder by means of a small supplementary gasholder or governor is both novel and ingenious, for which we are solely indebted to Mr. Peebles. It is one of the most beautiful adaptations of the gas-governor we have got, and I believe it will ultimately be very generally adopted throughout the world. All the applications he proposes I believe to be practicable and valuable. However, there is one of the applications of this arrangement, upon which I would like to have a little information, that is, of signs communicated through gas-pipes to a distance. We know that if we have a house lighted with gas, we may have every light burning well, with the exception of one bracket, and in that bracket there may have lodged a little water, so that if we light that bracket we find that every other light in the house begins to blink. Now I have imagined that a small interval of time elapses between the blinking of the bracket and distant lights in the house. The water in the bracket, in fact, reacts on the gas throughout the whole house. Now this difficulty suggests itself to me in reference to the use of gas for marking time. Will it not take an appreciable time between the application of the pressure and the indication of time to the consumer? I should like to know whether it is subject to the law which governs the transmission of sound, whether it is instantaneous, or whether it follows any other known law?

Mr. PEEBLES: In regard to the question, the only practical knowledge I have on that subject I obtained from Mr. John Reid, of Leith. In transmitting pressure he set his watch exactly to the governor at Canonmills. His dwelling-house is in Ferry Road, and he was remarking to me the extraordinary fact that at the exact moment that he arranged with the man at the works to put on the pressure it was transmitted to his house. In the transmission there must be some appreciable time lost, but I have never had an opportunity of thoroughly testing that. It would be interesting to know whether, like electricity, the transmission was instantaneous, or whether there was a perceptible difference, as in the case of sound.

Mr. STEWART: I can confirm what Mr. Reid has said, because I have a connexion with our works where the pressure is taken—three miles away. I have a man who takes the pressure and sends word every hour what the pressure is in Greenock, and if he says it is rather low, and we put it on, in an instant the man wires back that he has the pressure on, and I have no doubt that you could telegraph through a main if you chose just as well as through a wire.

Mr. MARTIN (Kilmalcolm): In regard to the water in the bracket affecting the other lights in the house, I think that this may be so if the water in the bracket is between the meter and the other lights, but it will not affect the other lights if the bracket containing the water is farther away than them.

Mr. MITCHELL: It is almost a necessity that water in a bracket will affect the other lights in the house, because the pulsation in the bracket will be communicated to the centre lights, although it may not be so noticeable in the centre.

Mr. MARTIN: The pipe must be too small, then, because, if it has plenty of size this will not occur.

Mr. PEEBLES: I think that is quite right, because I have one jet affected in my house, and the others are not. I think the water must be in the pipe, between the supply meter and the lights, when it affects the whole house.

Mr. JEFFREY: I tested that just last week, and I found that, if a jet is affected at the far end of the house, it will throw the pulsations back on the meter.

Mr. MITCHELL: In regard to the governor, I would like to ask Mr. Peebles if his remarks were applicable to a governor situated three-

quarters of a mile from the works. That is the position in which I will be placed in a short time, and, if the apparatus is to be of practical value, I certainly will take it into consideration.

Mr. PEEBLES: I believe if it was twenty miles from the works it would be all the same. Of course it would require more galvanic power to transmit the magnetic action.

Mr. MITCHELL: Is there any mode of causing the pressure to be let on gradually, not with a sudden jerk?

Mr. PEEBLES: As I explained, by altering the size of the orifice of the small burner, the flashes can be made sharp or sluggish as required; and for station and district purposes the action can be regulated in a similar manner, by the combination of the stopcock and small controlling governor, which act on and modify the flow of the inlet gas.

Mr. MAYER: Perhaps you will allow me to say that I introduced this matter to Sir William Thomson, and I can assure you he expressed himself highly delighted to know that his scheme of using the Morse alphabet in telegraphing by flash-signals was going the length of the gas managers, and it will give him still more pleasure to learn that Mr. Peebles's paper has been one of great interest.

Mr. PEEBLES: Allow me to express my thanks for the cordial way in which you have received the motion proposed by the president.

TWENTY-CANDLE GAS THE NATIONAL ILLUMINATING STANDARD FOR SCOTLAND.

The next item in the programme was the discussion of Mr. L. Monk's paper on the above subject, read at the last meeting.

Mr. M'GILCHRIST: Perhaps Mr. Stewart, who holds an opinion on this subject, would lead off the discussion.

Mr. STEWART: Mr. Monk has proposed to reduce the quality of the gas in Scotland to 20 candles. I have not heard of any equivalent which is to be given for this. If you reduce the quality 25 per cent., and do not make a similar, if not a greater, reduction in the price, the public will be disappointed. But there is no necessity for a reduction in quality, and I do not see why we should reduce it. When coals become scarcer we will be driven to an inferior coal, but until then my minimum would be 25 candles, and in the meantime I do not see why we should go below that. The desire for a reduction in the quality arises from the necessity of economizing the first-class canals. There is a mistaken idea abroad that we use large quantities of first-class coals to produce the high quality of gas supplied in Scotland, but the proportion of first-class canals we use, as a rule, is very small, seldom more than a fourth—in my own case, a fifth of the whole quantity annually carbonized; and now that we have the analyzer introduced, a very much smaller proportion of any first-class coal will be required. Splint coals, and the inferior canals that would be used if 20-candle gas were the maximum, are about the same price as the better qualities of second-class canals, the difference being in the better value of the coke, so that no advantage would be got as regards first cost of coals. As the public burn gas for the purpose of getting light, if we reduce the quality we must increase our works and mains. Managers of English works find our works very small as compared with works in similar sized towns in England, for the reason that from the high quality of gas we supply we do not require works of more than half the size of the English ones, to produce the same quantity of light. If it were possible, it would be a greater public advantage to increase the quality to 40 candles instead of reducing it to 20; it would be less deleterious to the health, especially in rooms where large quantities are burned. Instead of reducing the quality, we should try to improve the methods of consumption. We should, as gas managers, institute inquiries as to the quality of burners, and I think we, as an Association, should draw up a set of rules for the guidance of gas consumers with reference to the burners used, and the advantage of burning with a low pressure, and such other matters as are familiar to ourselves. You will find many educated, and even scientific, men who are profoundly ignorant of the proper methods of consuming gas, and who in consequence talk great nonsense about gas. They seem to think that gas suppliers are doing all they can to cheat them; in fact, they do not mind saying so. These people never give any attention to the consumption of gas. Therefore, instead of endeavouring to raise the question of how to reduce the quality of gas, I would recommend that we should rather give our attention to the efficient consumption of gas, and if we do that we will confer more benefit on the consumers than by any attempt to reduce it.

Mr. ROBERTSON (Campbeltown): I had occasion to lower the illuminating power this year, and I know what was the consequence. Some of the accounts were doubled, and there was general dissatisfaction. The people said that if they got good gas they would pay for it, but they would rather go before the sheriff than pay these accounts.

Mr. BLACK (Old Kilpatrick): I agree with Mr. Robertson. I reduced the quality of the gas in the summer, and the accounts were larger, and there was more dissatisfaction than when they were paying a high price. Twenty-eight candles is the lowest that I can stand.

Mr. FAIRWEATHER: I think the reason why the gas is not what it should be is because of the fittings. If there were special fittings and a special burner there would be less complaint.

Mr. HALL: I believe more lies in the fittings than anything else, and if gas managers direct their attention to this they will find it to be the case.

The PRESIDENT: Since the experiments with the condensing process at Hamilton I have altered my opinion, and I have become a convert to a 28-candle gas. I do not now see that there is any necessity for reducing the standard, and I have to withdraw all my arguments in favour of the reduction.

Mr. STEWART: Oh, what will the JOURNAL OF GAS LIGHTING say to that?

The PRESIDENT: I agree with Mr. Stewart that it is desirable to adopt a national standard, and, as he mentioned, I think 25 candles should be the minimum, so that we might make proper arrangements for heating, illuminating, and cooking.

Mr. STEWART: I think we ought to encourage the fixing of a maximum standard, as well as a minimum one; it would be quite as valuable. Gas managers make gas as good as possible, but there ought to be a fixed specified illuminating power, and managers would know what they were doing.

Mr. MARTIN: I think as gas managers we should go further. Gas-fitters ought to pass an examination, or have a licence from a company, before they are allowed to put pipes into a house, in order to see that they know something of their trade.

The PRESIDENT: I propose that Mr. Stewart's recommendation be adopted, and that there should be a minimum illuminating power of 25 candles and a maximum of 28.

Mr. YOUNG: I would rather question with Mr. Stewart, "What will the JOURNAL OF GAS LIGHTING say to that?" The president had a great many arguments in his previous paper about the great advantage of having a poor gas for cooking purposes; and in his opening address to-day he referred to the exhibition of apparatus in Shields, the purpose of which was to employ gas for heating and cooking. It is a great advantage to have a poor gas for that purpose, because it is easier to consume without smoke, and gives more heat. If it was possible to get a supply of rich gas for lighting purposes, and of poor gas for heating purposes, it would be a great advantage. But we are the creatures of circumstances, and we cannot do that. We, here in Scotland, are so placed that we have an

abundant supply of material for producing rich gas, and so long as we have this, I do not think it is likely we will have a reduction of the illuminating power. All English gas managers are not in such a good position as we are for manufacturing a high quality of gas, and have to be content with a lower illuminating power, or convey rich canals from a long distance to bring up their standard, and perhaps, from their point of view, the JOURNAL OF GAS LIGHTING is not far wrong in advocating a 20-candle standard for Scotland. Indeed, I think our president was scarcely justified in taking up the position that he did, as I believe there is a good deal to be said on both sides of the question. There are advantages, as I have already said, in the use of both qualities of gas. It has been argued that a greater amount of light can be got in the ordinary consumption of 20-candle gas than can be got by a higher quality, because, in order to lower the quality as used, and, consequently, to lower the price charged, a larger quantity can be consumed at one light, and a higher per centage of illuminating value obtained. For instance, in Scotland it is seldom that an ordinary light consumes more than 2½ to 3 feet, and here, by consuming at this rate, it will not give to within 25 to 30 per cent. of the illuminating power which can be obtained from it when consumed at the rate of 5 cubic feet an hour. Whereas in England, at the low price charged, they can afford to consume 5 cubic feet, and, consequently, are obtaining the maximum illuminating power from the gas they are consuming. On the other hand, in order to consume a poor quality of gas profitably, it is essential that it be consumed at a very low pressure. This necessitates that the flame is soft and easily affected by currents of air; whereas our Scotch gas can be consumed under considerable pressure, and, therefore, is better able to resist currents and give a better illuminating power under conditions where currents are liable to affect gas, which is more or less the case wherever gas is consumed. Then, again, we have the application of gas for heating and cooking purposes, and, in this respect, there would be an advantage in employing a low quality of gas. Indeed, as I have already said, there is a good deal to be said on both sides of the question, and I think it would be more advantageous to leave the question an open one. Of course it is in my interest to keep up a high standard if possible.

After some further remarks, the discussion was brought to a close without any motion being put to the meeting.

Mr. BLACKIE (Edinburgh) exhibited and explained to the meeting the working of Sugg's patent Illuminating Power Meter, and a short conversation ensued on the subject of Copp's Anti-dip Pipes.

Mr. DALZIEL then gave a short description of his patent meter. He said: This meter is designed to prevent consumers defrauding gas companies by tilting the meter forward, and thus obtaining gas without the quantity being correctly indicated. The effect of my improvement is, in the event of the meter being tilted, the gas is at once totally shut off; at the same time the arrangement is such that the water cannot be withdrawn. It flows back into the measuring chamber, thereby preventing loss of water; and consequently, on the meter being brought into its original position, the meter at once registers correctly.

On the motion of the PRESIDENT, a vote of thanks was accorded to Mr. Blackie, Mr. Dalziel, and Mr. Warner (South Shields), for their exhibits.

THE NEXT MEETING.

On the casting vote of the president, it was resolved to hold the next meeting in Helensburgh—the vote being as to whether the meeting should be held in Glasgow or Helensburgh.

DINNER.

In the afternoon the members of the Association dined in the "Star and Garter" Hotel, Mr. M'Gilchrist in the chair, and Mr. Levi Monk and Mr. Blackie discharging the duties of croupiers.

PICNIC.

On the following day (Friday), a number of the members with their friends visited the grounds of Hopetoun—the Earl of Hopetoun's—where they enjoyed a pleasant day.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

Owing to the Whitsuntide holidays there has been very little business done here this week. Hardly any of the iron and steel works recommenced operations before Thursday, and many of them remained closed during the whole of the week. Under these circumstances it will be readily inferred that the state of trade has ruled very quiet, and all accounts agree in stating that the outlook for the immediate future is of a very cheerless nature. In no case in this neighbourhood are iron producers what may be called fairly busy, and in numerous instances the works are merely kept going three days or so weekly by the orders which may chance to come in by the post from day to day. This precarious mode of going on has its disadvantages, but, on the other hand, wages and fuel are now so low that it would hardly be possible to produce iron more cheaply, nor is there any temptation either for buyers or sellers to overstock the market by indulging in speculative transactions. I, therefore, find pig iron very quiet all round, the best brands being fairly well upheld in price, whilst some of the commoner kinds are being forced off at a shilling or so per ton under last week's rates. In the finished and manufactured iron branches there is no alteration for the better, and prospects are so bad that at several Derbyshire and South Yorkshire establishments numbers of workmen are being discharged. The annual report of the directors of the Parkgate Iron Company, Limited, near Rotherham, shows a loss of over £3000 on the year's working, and says that there appears to be little prospect of the rail mill again being profitably used. It is believed that at least one other local concern is working, or at any rate going on, with similarly unprofitable results.

As at the iron-works, so also at the collieries, has the week been of a non-working description, the colliers being apparently able to go pleasure taking, notwithstanding the unprecedented depression of trade. Some of the pits, however, managed to get coal for two days at the latter end of the week, and it is stated that at one or two this present week will be better than for some time past, owing to the improved demand for steam coal, and the continued sales of house coal by reason of the cold weather.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is very little to report in connexion with either the coal or iron trades this week, except that business since Tuesday last has been almost entirely suspended in the immediate neighbourhood of Manchester, in consequence of the Whitsuntide holidays, and both pits and iron-works have been closed for the greater part of the week. Nominally, prices are without change; but in the absence of business, quotations are scarcely worth giving, as they will be no index as to actual values.

There are a considerable number of inquiries in the market for gas coal and for good screened qualities; at the pit's mouth the prices asked range from 8s. to 9s. per ton, and 8s. 6d. may be taken as about the average price at which coalowners are prepared to take contracts for the better sorts. In other classes of coal there is no material change to notice; a little extra

push is being caused by the threatened stoppage of the pits in West Lancashire, but no higher prices are at present being asked.

A strike against the reduction of 10 per cent. in miners' wages in West Lancashire seems now to be inevitable. Fresh notices, which expire on the 6th proximo, have been posted at the collieries, and the men have already ordered a special levy to support the miners in resisting the reduction.

There has been little or no inquiry for any description of iron, and the forges in many cases have been closed this week for a longer period than usual.

I understand that the works of one of the local iron-making companies which have recently been in the market, have passed into the hands of a private firm, who are now working the concern.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

During the past ten days there has been a manifest falling off in the shipment of gas coal from the Tyne. The dulness incident to this trade in the early months of the summer is gradually stealing on, and a quiet business will be done during the next two months, no doubt. The price of best gas coal is from 8s. to 8s. 6d. per ton; seconds, 6s. 6d. to 7s. 6d. a ton.

There was likely to be a misunderstanding in the Durham coal trade with the mechanics employed at the collieries, but arbitration has determined a reduction of 10 per cent. on wages, which will be accepted by the men, and the dispute is settled. Affairs are more unsatisfactory, however, in the Northumberland steam coal trade; a strike seems impending, and if it occurs it will throw the entire coal trade of the North into confusion. A day or two will determine. In the meantime there is no very special demand for steam coals. House coals are less inquired after, but coking and manufacturing coals are more in demand, as is usual at this time of the year.

Coasting freights in the gas coal trade are without alteration; the collieries are sending a good few coals off in their own boats. The current rates for steamers to load coals for London are from 4s. 6d. to 4s. 9d. per ton. Sailing ships are paid from 5s. 9d. to 6s. per ton, to discharge small cargoes at the wharves. These rates with other coasting ports in proportion are likely to be maintained for some time. Turns for gas coals have been about three colliery working days. No ships will be taken on for steam coals until the threatened strike is settled. The coal trade to the Baltic and Mediterranean is quiet. There is no extra stir anywhere.

The iron trade continues to be in a depressed state. There is little demand for the home trade or foreign consumption.

Chemicals are extremely dull. The trade was scarcely ever so depressed, or prices so low, as now. Some of the smaller factories have closed, and others will have to do so soon, as the manufacturers are losing several shillings upon every ton of soda they make.

There is no special inquiry for fire-clay goods, fire-bricks, or articles of that description; in fact, the general manufacturing trade of the North of England shows very few signs of animation. The foreign demand is extremely poor, and steamers load up badly.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Mr. William West Watson, the Glasgow City Chamberlain, has just completed his annual report on "The Vital, Social, and Economical Statistics of Glasgow for the Year 1876," and in the course of his many valuable data, which may be of great use for future historians, he refers to the production of gas under the Corporation Gas Commissioners, the total quantity made last year being 1,738,376,000 cubic feet. It would be worth while to know if, with the exception of London, there is any other city in the kingdom where the annual production attains to such a great extent. Mr. Watson puts down the population within the municipality at 550,000. Of course, there are most extensive suburbs, certain portions of which have independent gas supplies. If the latter were conjoined with that of Glasgow proper, and the whole population taken as estimated, at 697,775, or practically 700,000, it is questionable if any other city, either at home or abroad, with the exception of London, deals so largely in coal gas as the commercial metropolis of Scotland, or, as its citizens frequently style it, the "Second City of the Empire." Referring to the same subject in his annual statement on the Corporation Accounts, Baillie Collins, who is expected to be elected as the Lord Provost for the next three years, says that the corporation revenue from gas manufacture amounts to £364,895; and as the expenditure has been greatly reduced, owing to the fall in the price of coals, a balance is carried to next year's account, amounting to not less than £28,736.

The quality of the Glasgow gas is now being kept up to a pretty high average. In the week ending the 19th of May, the average illuminating power was in no case under 27.33 candles, and it was up as high as 28.52 at one of the testing-stations. The maximum ranged from 28.44 candles to 30.45 candles.

Mr. J. F. King, city analyst, reported to the meeting of the Edinburgh Town Council held last week, that at his last analysis of the gas supplied to the city on Tuesday, the 15th inst., he had found that of the Edinburgh Company to have an illuminating power of 26.90 candles, while that of the Leith Company was up to 27.30 candles.

The Annual General Meeting of the Stonehaven Gas Company was held on Monday, the 21st inst., when the report, balance-sheet, &c., were submitted and approved of, and a dividend at the rate of 2s. per share was agreed to be paid to the shareholders on the 1st of June. The chairman and directors were all re-appointed for the ensuing year. At a meeting of the directors subsequently held, it was resolved to raise the price of gas from 5s. to 5s. 5d. per 1000 cubic feet. If I mistake not, this is the first advance made in the price of gas in Scotland since coals were at the famine prices.

Under the 73rd section of the Galashiels Water Act, provision is made for the laying of pipes and firecocks, and connecting them with the water-mains for the purpose of meeting the emergency of fire at public works. With the view of practically putting this section of the Act in operation, Mr. S. B. Wilkins, firemaster, Edinburgh, who is the inventor of a patent hydrant, was on Friday last invited to meet the Corporation and a number of the influential citizens of Galashiels. In compliance with this request, Mr. Williams, accompanied by Mr. Alexander Leslie, C.E., met the Provost and a number of officials, and mill and property owners interested in the new water-works in course of construction for the use of the town. On account of the extra supply of water, it was resolved to lay down firecocks in the streets for the extinction of fires, and it was decided that Wilkins's patent hydrant should be the only one used for that purpose.

At a meeting of the Innerleithen Police Commissioners, held on Monday, the 21st inst., it was unanimously resolved to introduce a supply of water from "Bold Burn," and also to carry out a system of drainage within the burgh, conformably to plans and specifications, prepared by Mr. J. Buchanan, of Edinburgh. The point of intake is about 700 feet above the level of the sea, and the gathering-ground is about 800 acres of fine pastoral land. It is calculated that the present flow will be about half a million gallons per day, the half of which will not be required for the present population.

The total length of the cast-iron pipes and mains will be about 10,000 yards. It is intended to have the works proceeded with immediately.

Speaking of the Glasgow water supply in the report formerly referred to, Mr. West Watson says: "I need scarcely vary to any important extent the phraseology of my annual remarks regarding our supply of water, which remains practically unlimited in quantity, and actually unequalled in purity. The quantity supplied during the year 1876 has averaged almost exactly 33 million gallons a day, and the consumption has thus amounted to the rate of some 46½ gallons per head. It would appear that the rigid measures which have been adopted to repress waste (for our people seem to have become reckless in their seemingly exhaustless wealth) have been so far successful, since the supply required has fallen off by about four gallons a head since the previous year."

The negotiations connected with the water supply scheme for the parish of Carluke, in the middle ward of Lanarkshire, have now been concluded. The water is to be brought from a distance of about four miles.

On Saturday week another very serious burst occurred in the line of the Lintrathen water-pipes, at a spot about 16 miles from Dundee. The pipe which gave way was 1½ inch thick, and on examination it was found to be of very unequal casting.

The pig iron warrant market was steady during the past week, or rather on the three days that any meeting of the "trade" took place, for there were two holidays—Whit-Monday and the Queen's birthday. Prices closed on Friday at 54s. 4½d. buyers, and 54s. 6d. sellers.

There is nothing new to say regarding the coal trade, except that there is a probability of the miners being able to get an advance of wages to the extent of 6d. per day; indeed, some have already got it.

CHILD'S HILL GAS-WORKS.—The gas-works which have for many years, and under various circumstances, supplied the district of Child's Hill, Cricklewood, and the Hyde, are now finally closed as a gas factory. The whole of the mains, which are nearly ten miles in length, being connected with the vast network of the metropolitan gas supply, and under the control of The Gaslight and Coke Company, who now supply the consumers lately served, and well served, by Messrs. Skoines and Co. The change was perhaps inevitable from the natural tendency of the extension of the Metropolis, and the extinction of the local manufactory is probably more than compensated for to the inhabitants generally by the reduction in price which the larger company will be able to offer, thus giving the same advantage to this rather scattered district which is enjoyed by the denizens of the densest portions of London, and which, of course, a local undertaking could not possibly offer. We have only to express a hope that Messrs. Skoines will not give up their premises for any other purpose than such as will be of benefit to the neighbourhood generally. We have noted that although clamour is sometimes raised on the introduction of gas-works into a new locality, on account of alleged nuisance, loss, and damage to adjoining or surrounding property, there have been for many years no better fruit, flowers, and vegetables in the neighbourhood than have been grown close to the works, and in some cases greenhouses built against the boundary walls of the gas-works yard. This circumstance tends to show that such suspicions are merely the offspring of ignorance and prejudice, for we are perfectly assured that never have Messrs. Skoines' gas-works been the cause of injury or annoyance to the health and comfort of either residents or their property, and we hope that in many points other gas proprietors will imitate the business example which has been so eminently successful in the latter existence of the gas-works whose fires are now extinguished for ever.—*Hendon Times*.

THE ACCIDENT TO A GASHOLDER-TANK AT MIDDLESBROUGH.—At the Town Council of Middlesbrough, on the 8th inst., the following report, with reference to the collapsed gasholder-tank, was submitted from Mr. Cail, of Newcastle, who had been called in to give his opinion on the best method of repairing the accident:—"I beg to hand herewith the plans and sections I have prepared for the gasholder-tank proposed to be built in the marsh, within the walls of the present tank. The drawings show two designs. No. 1 shows brick cylinders for foundations (which is common to both plans); all the work above being formed of concrete, except the coping, and to be 34 feet deep. The estimated cost of this is £7894. No. 2, with the same foundation as No. 1, but to have a cast-iron casing, as instructed by the committee, 1½ inch thick, with flanges, ribs, and bolted together, and a brick wall 2 feet 3 inches thick, set in cement, I estimate to cost £12,569. If the cast-iron plates were made ¾-inch thick, the flanges, &c., being the same as before, also all the other work, the cost would be £10,851.

	Diameter.	Height.	Contents.
The original tank was	182 feet	by 30 feet	780,060 cubic feet.
No. 1, as proposed	160 "	" 34 "	688,264 "
No. 2, as proposed	167½ "	" 34 "	747,034 "

In all cases exclusive of the cone." Mr. Brentnall moved the confirmation of the minutes of the Gas Committee, which recommended that Mr. Cail's No. 1 plan should be carried out. Mr. Bulmer objected, and urged that in his opinion the cost, instead of being £7894, would be about £13,000. He also strongly disapproved of the new tank being erected on the site of the tank that had fallen in, and suggested land at Linthorpe as a suitable site. Considerable discussion followed. After several amendments to the minutes had been proposed and withdrawn, it was finally agreed, on the motion of Mr. Sadler, that that portion of the minutes alluding to Mr. Cail's No. 1 plan be referred back to the Gas Committee, with a recommendation to consult Mr. Livesey, or some other eminent gas engineer, on the subject. It was further agreed, that after the result of the consultation had been obtained, a special meeting of the council be held to consider the question fully.

Register of New Patents.

1277.—G.WYNNE, J. E. A., Essex Street, Strand, London, and COLLINSON, H., Reading, "Improvements in the construction of retort-lids, man-hole covers, valves, sluices, and such like apparatus." Patent dated March 25, 1876.

This invention relates to improvements in patent No. 3260, Sept. 17, 1875, and its object is to provide a means of making an air, gas, water, or steam-tight joint door, valve top, or lid to openings of any kind without the use of packing or luting, and to clean the joints or faces of valves, lids, or such like openings, as in gas-retort lids or valves where thick adhesive or dirty accumulations are deposited by the action of opening and shutting, and to prevent radiation of heat through the heads and lids of retorts.

The invention consists, first, of a lid having a true flat face, so constructed that, whilst being screwed down, or forced against the seat, or unscrewed or removed from the seat, it receives a rotating and sliding or eccentric motion, thus cleansing the seat or face against which the lid or valve is permanently brought in contact.

The manner in which a gas retort-lid is constructed, according to this invention, is as follows:—The retort mouthpiece is made of iron, with a turned face round the opening quite flat and smooth, having on its inner edge a projecting rib, or stop, or rim, to prevent the tools or coke or coal from damaging the face or seat, and arranged in such a way that when

the lid or cover is held firmly against the seat, an air or gas tight joint is obtained. A hinged cross-bar or other suitable support is secured by a hinge lug in any convenient way to the retort-head or mouthpiece, and this bar is fastened by a latch, cam, lever, or other fastening, to the other side of the casing. A spring is attached to the lever so as to put a pressure on the lid, and bring it in contact with the retort-face while it is being turned round. A screw passes through the hinged bar, and has its inner end secured in any desired manner to an eccentric head or cam of any required dimensions. This head or cam is seated in a recess in the lid, and the lid itself is eccentric to the head or cam, so that, upon turning the screw inwards, it forces the retort-cover or lid against the seat, while, at the same time, by means of the eccentric head, and the eccentricity of the lid itself, it slides, or scrapes, or shifts the face of the lid or cover over the surface of the seat in a circular and irregular path, so that the entire surface is cleansed. The action of the parts is such that the cover or lid is brought into the closest contact with the seat, and, in fact, grinds for itself a joint, each time removing all foreign matter that may be adhering to either the lid or the seat. This action of the double eccentrics secures a new seat each time between the faces of the valve-lid and the retort-head, for, in addition to the retort-lid turning gradually round, the whole face is moved in its position upon the ground face of the retort-head, and rarely, if ever, do the faces come together on the same spot. As there is no dead point or stop to the lid, should a leak at any time appear, a few turns of the valve on its face will secure a tight joint, and this without any luting or packing, and with much less pressure between the valve and face than is necessary with other retort-lids. The spring, which may be of any convenient shape, and which is connected to the end of the lever or hinged bar, or in any other suitable position, is intended to throw a pressure on the lid while it is being turned round and unscrewed or screwed home, so that the lip scrapes, or grinds, or slides over the face of the retort-seat both during the process of opening and closing of the retort, and the faces against which the air or gas tight joints are made are thus always kept clean and flat, and in the best condition for making a tight joint. Instead of a spring, a weight, lever, or any other mode of securing a pressure between the faces may be substituted. The inner lid is kept in its place by a ring, or other suitable contrivance fastened to the outer lid in any convenient way.

The rubbing or sliding motion may be given to retort-lids, to valves, man-hole covers, sluices, doors, &c., in several ways; for instance, by the use of one eccentric instead of two, by the use of gearing-levers, cams, helicals, ovals, or other irregular shapes, by placing an eccentric on the screw, or making the ring eccentric, or in any other convenient way. Preference, however, is given to the double eccentric, as securing the greatest variation in the seat-joint and faces.

Valves for gas, water, and other fluids are constructed in such a way that the faces forming the joint are caused to rotate, and thus rub and grind against each other by the use of a spring, which throws them into action, and keeps them in contact while being rotated, screwed, or unscrewed, both in the process of closing and opening the valve or lid. Where desired, and where found advantageous, there is introduced a moveable scraper or brush, which can be thrown out of the face, and thus add additional cleansing power to the rotating faces.

1302.—CARPENTER, W. T., West Minster, Kent, "*Improvements in apparatus used in the manufacture of gas.*" Patent dated March 27, 1876.

The object of this invention is to facilitate the charging and discharging of the retorts or ovens used in gas-works for the manufacture of illuminating gas by the aid of machinery, and to diminish the amount of manual labour attendant thereon. It is based upon one for which the present inventor received provisional protection, dated March 13, 1869, and consists of retorts, or ovens, of a round, oval, or other convenient shape, in transverse section. The anterior portion of each retort is somewhat conical, and of an increasing diameter, for about one-third of its length towards the back, the remainder of the retort being parallel. The back of each retort is open to, and communicates with, an oven or chamber, common to a part or the whole of each setting. Near the bottom of this oven or chamber is a conducting-pipe, so arranged that it is capable of carrying off the gas evolved from the coal being carbonized. At or near the top of the oven or chamber rises another pipe to carry off the gas, when it is preferred that it shall pass that way instead of through the lower pipe. The two pipes are connected together, and have valves, so that the gas may be compelled to travel in either direction. To each retort there is fastened a mouthpiece, which is made conical at its posterior end, and is furnished with a short Archimedian screw attached to a shaft, which passes through the mouthpiece, and has there fixed to it a worm-wheel, which is made to revolve by any suitable power through the intervention of a worm. To the top of each mouthpiece rises a pipe or shoot, fitted with a valve, and connected to a hopper, bunker, or other receptacle for containing and conveying coal down to the mouthpiece.

The bottom of the oven or chamber is provided with one or more mouthpieces for the discharge of the coke, each being furnished with a hinged lid having a bevelled edge, which fits into a corresponding bevel in the mouthpiece, or the mouthpiece and lid may be faced, the lid being closed by means of a lever or levers acting upon a cam, cams, or eccentrics, or, by preference, with a worm and quadrant, or other suitable means.

The retorts may be set horizontally, but it is preferred to set them at such an inclination that but little power shall be necessary to push the coke from the retort into the oven or chamber. An angle of about 20° to 25° from the horizontal is found to be suitable. The retorts may also be set back to back, the chamber or oven intervening.

1310.—HOCKING, J., Redruth, Cornwall, "*Improvements in pumps for raising water from mines, and for other such like purposes.*" Patent dated March 27, 1876.

According to this invention tubular pump-rods, which serve also as delivery-pipes, are used, and the rising column of water passes through them. Motion is given to the rods from the motive power by two side links, which may be connected at any point.

For a fixed drawing lift there is placed at the bottom of the pump-rods a turned cylinder, hollow and open at the bottom, with a valve or clack fitted at its upper end. This turned cylinder works through a stuffing-box at the top of a stationary barrel, which is furnished at the bottom with a valve or clack closing the mouth of the suction passage. The column of pump-rods is continued to the required height, and is counterpoised. The water when being delivered may be discharged through a hose or into a cistern, of a depth rather in excess of the stroke, the upper length of the pump-rod working through a stuffing-box in the bottom of the cistern.

For a plunger lift the plunger pole is connected to the pump-rods on one side near their lower ends. To permit the water from the plunger barrel rising through the column of pump-rods, the barrel is connected with a fixed cylinder having a stuffing-box at its upper end, through which the lowest length of the pump-rods works. The suction and delivery valves are near the bottom of the fixed cylinder, and the connexion with the plunger barrel is between the valves. In this case the pump and column of water will balance each other. Or in place of connecting the

plunger pole at the side of the pump-rods it may be connected directly beneath them, and a branch from the hollow pump-rods is then provided to work through the stuffing-box of the fixed cylinder.

1316.—TURNER, E., Birmingham, "*Improvements in means for lighting illuminating gas.*" A communication. Provisional protection only obtained. Dated March 27, 1876.

The objects of this invention are to simplify the construction of the apparatus described in patent No. 3782, Nov. 2, 1874, and to render such apparatus more efficient in action.

In the former patent the apparatus was described as igniting, by percussion, buttons of fulminate placed at equal distances apart on a tape or band of paper coiled in a box attached to the burner, such apparatus being set in action by the turning on of the gas-tap, a further movement of which in the same direction cut off the supply. It is now proposed to connect the apparatus with a tap which has the ordinary forward and back motion, and thus to make its action more easily comprehensible.

Within the box which carries the coil of tape prepared with fulminate is fitted a washer, which is slotted at its centre to receive the squared end of the gas-plug, and ensure its turning with the plug. The screw which retains the plug in place serves also to secure the washer. Fitted loosely to this washer is a cranked spring, which passes through a saw-cut in the perimeter of the tape-box, and has a tendency to press inwards against a standard forming a portion of the casting of the burner, its object being to feed the tape carrying the igniting composition up to the hammer which is to ignite the fulminate. This cranked spring has at its lower end a lateral projection, which enters an eccentric hole formed in the washer, and acts as a loose crank-pin, raising and lowering the spring as the plug of the burner is turned to the right or left. Attached to the tape-case is a spring hammer which extends upwards to an inclined surface of the standard, near the top of the burner, and serving as an anvil. The cranked spring or feeder and the spring of the hammer are so shaped relatively to each other that the hammer spring which overlies the feeder will, as the feeder is moved up, be thrust backwards until the contact shoulders of the two springs get clear of each other. The hammer will then fly forwards, and strike the fulminate that is presented to it down upon the anvil, and effect its ignition; this will take place at the time that the gas is issuing from the burner, and it will therefore become ignited. When it is desired to turn off the gas, this can be done by giving the tap a quarter turn backwards; the feeding spring will then be drawn down to its lowest position, ready to advance the tape up to the hammer as before. In making this back movement the springs will press laterally against each other, and the hammer spring will yield to allow the feeder to pass under it; thus the feeder will regain the position requisite for effecting the back motion of the hammer.

1355.—HILLE, F., Chiswick, Middlesex, "*Improvements in treating sewage.*" Patent dated March 29, 1876.

According to this invention, for places near the sea the following materials are used for precipitation, and defecation and deodorization of sewage, namely:—Lime and tar, and sea water if possible from the incoming tide. These ingredients are mixed in the following manner:—The lime is slaked with a sufficient quantity of sea water, so as to produce the greatest possible heat. When so heated, and in the form of a paste, the tar is added to the slaked lime, and both are worked together until they are intimately mixed and the mass is all through of the same colour. The paste is then dissolved or diluted with sea water, and the disinfecting milk thus obtained may be used for the treatment of the sewage. By preference this is prepared in the following way, and in the following proportions:—For every 100 lbs. of lime is added the necessary quantity or weight of pure sea water for slaking the lime, and 5 lbs. of tar to the lime when hottest; when a paste as above described has been formed, 1 lb. in weight of the paste may be dissolved in from 15 to 20 lbs. of pure sea water. The disinfecting milk so obtained should be used in the proportion of from $\frac{1}{4}$ lb. to 1 lb. for every 100 gallons of sewage, or more or less, according to local circumstances. The effluent water from sewage thus treated and allowed to subside, may be without offence or nuisance discharged into the sea or into a river.

1405.—ALLAN, A., Scarborough, "*Improvements in pressure and vacuum gauges.*" Patent dated April 1, 1876.

This invention comprises improvements in pressure and vacuum gauges of the kind described in patent No. 2332, dated Oct. 19, 1858.

In pressure-gauges of the kind referred to a quantity of air is confined in a vessel which, or part of which, is conical or conoidal, and it is by the extent to which the air is compressed in such vessel that the pressure to be indicated is ascertained, the pressure being applied to the confined air through the medium of water or other suitable liquid. The conoidal part of the vessel may be of glass or metal, but when it is of metal there must be fitted in connexion with it a glass tube, or glass must be fitted in an opening in it to admit of the height of the liquid being seen. A scale of pounds or other suitable measure of pressure is marked or otherwise applied close beside the part where the indications of the liquid level are visible, and when the conoidal vessel is properly shaped, the divisions on the scale may be at equal distances apart for equal differences of pressure per square inch or other unit.

One of the present improvements consists in forming an enlargement at or in connexion with the smaller end of the conoidal space, a plug being provided which is adjustable in an opening in such enlargement so as to vary the internal capacity. When a separate indicating glass tube is used, it is entered down into its place through a hole made for the purpose through the head of the metal parts of the instrument. Below the conoidal vessel and indicating tube is fitted a conical stopcock-plug contrived to answer the purposes of clearing the gauge and renewing the air spring.

1426.—HOLMES, J. M., Birmingham, "*Improvements in gas-stoves or gas apparatus for heating and cooking.*" A communication. Provisional protection only obtained. Dated April 3, 1876.

This gas-stove or apparatus consists of a foot or stand supporting a vertical pipe, which conducts a mixture of gas and atmospheric air to the burner. A horizontal supply-pipe opens into the base of the vertical pipe, the gas being delivered into it by a fine slit or opening, by which the gas is spread out, so as to expose a large surface. Around the vertical pipe, and at a point just above that at which the gas enters, holes or perforations are made, through which atmospheric air enters the pipe, and mixes with the gas. At the top of the vertical pipe conveying the mixture of gas and air is an open gallery or support, on which the article to be heated rests, and having on its under side a collar constituting the burner. This collar is screwed internally, and screws upon the exterior of the top of the vertical pipe. Around the part of the short collar, near where it joins the gallery or support, is a series of holes through which the mixture of gas and air rising up the vertical pipe issues, and at which it is ignited, the mixture issuing from the holes in the form of a series of radial jets, which by playing upon or about the central part of the gallery or support rapidly heat it, and also the vessel or article placed upon it. A notched or undulating ring outside the burner directs the radial jets of the mixture as they issue from the burner.

1466.—LAKE, W. R., Southampton Buildings, London, "*Improvements in the manufacture and utilisation of combustible gases, and in apparatus therefor.*" A communication. Patent dated April 6, 1876.

According to this invention bituminous or gas-producing coal is placed in a distilling retort and subjected to distillation. The rich hydrocarbons are eliminated therefrom in the form of gas, but when that stage of distillation is reached at which the sulphurous and phosphoretted gases are disengaged from the coal the gaseous products of the retort are diverted from the previous and purer product and are passed into water or carried to the furnace in order to aid, by their combustion, the heating of the retort. After the hydrocarbon gases first evolved from the coal leave the retort they are passed by means of a fan blower or equivalent forcing apparatus through one or more hydraulic tanks, which separate and eliminate from the gas any tarry or ammoniacal impurities which may exist therein. This done, the gas passes through a showering bath or chamber which ensures a thorough washing of the gas from any residue of the last-named impurities that may still linger therein. After this the gas is passed to one or more purifiers, preferably of oxide of iron, in which any traces of sulphur that may have accidentally been retained therein are separated. From the purifiers the gas passes to the gasometer, the latter forming one element in the system of apparatus employed for carrying this invention into full effect. At this stage of the proceedings the gasometer contains a remarkably pure hydrocarbon gas.

From the gasometer the gas is passed to a retort filled with broken fire-brick or other fire-resisting material, which is kept at a heat sufficient to cause the separation of the carbon from the hydrogen of the gas as the latter is passed through the retort. The carbon being deposited upon this broken material in a form analogous to that of the crystalline carbon commonly found in the interior of gas-retorts, while the hydrogen is set free, and passes off in a pure condition. As the hydrogen is thus separated from the carbon it assumes the volume peculiar to this gas, and several times greater than that of the hydrocarbon gas from which it is derived. There is thus passing from the retort a steady stream or inlet of pure hydrogen gas, which is utilized in various ways; for example, in the manufacture of iron the hydrogen is introduced at the bottom of a suitably constructed blast-furnace in conjunction with a suitable inflow of air, or the ordinary air-blast is used, the cupola or blast-furnace being supplied with alternating layers or strata of ore and purified coke.

Another mode of utilizing the hydrogen is in the manufacture of illuminating gas. For this purpose the current of purified hydrogen is carried from the retort in which it is separated from the hydrocarbon gas into any suitable or proper form of carburetters so termed, meaning thereby an apparatus in which an aeriform body of any suitable kind may be passed through, or in contact with naphtha, benzole, or other like hydrocarbon oil, and becoming saturated therewith will carry off a heavy percentage of hydrocarbon oil mechanically suspended or held in the aeriform body. By thus saturating the purified hydrogen with hydrocarbon oil, the hydrogen while retaining its greatly increased volume as compared with the volume of hydrocarbon gas from which it is derived becomes highly carbonized, and consequently has given to it an illuminating power even exceeding that which the hydrocarbon gas from which it was derived originally possessed.

1486.—YEO, E., Newton Abbot, "*Improvements in the treatment of yarns for packing purposes.*" Patent dated April 7, 1876.

These improvements consist in treating yarn by boiling it in a mixture of black lead, French chalk, tallow, oil or grease, and Lustleigh shining ore, and twisting it in strands of equal size, drawing them through a tube, and placing one of the strands in the centre as a core, and encircling it by the others, so that in the event of the packing thus formed becoming twisted the reverse way, the core thereof may serve as a guide to keep in proper order the encircling lubricated strands. The improvements can be performed by using yarn spun from fine dressed long Rhine hemp, and boiling it in a mixture of about the following proportions, viz.—1 cwt. of grease, oil, or tallow, 14 lbs. of French chalk, 14 lbs. of black lead, and 7 lbs. of ore thoroughly mixed; the strands can be formed and twisted, then passed through a tube or tubes of the ordinary kind.

1499.—LOUTTIT, K. M'L. P., Greenwich, "*Improvements in the manufacture of gas for heating and lighting purposes.*" Patent dated April 8, 1876.

The object of this invention is to give heating and illuminating properties to ordinary steam, air, or vapour, so as to obtain the greatest quantity of gas without any deposition of carbon, thus producing a gas of great purity and brilliancy.

The method of converting ordinary steam into lighting gas is to pass the steam through a superheater, and thence into retorts, ovens, or chambers, preferably vertical, containing carbonaceous matter in an incandescent state. These retorts form part of a bench of retorts, ovens, or chambers, vertical and horizontal, containing carbonaceous matter. In the neck of the vertical retorts, and preferably at an angle, is introduced a pipe, through which is passed non-superheated steam or air, also a pipe, through which is passed an oil, of no matter what gravity, or any hydrocarbon oil or spirit. These enter into the retort when it is at a degree of heat which will decompose the least quantity of oil with the non-superheated steam or air, and, joining the carbonic oxide and hydrogen produced from the vertical retorts, pass by a horizontal retort, or a series of horizontal retorts, into a condenser, and, when necessary, by a purifier into a gasholder. Vertical retorts may be used, either closed or open at each end, as may be found most desirable, the lower end of each open retort being submerged in water or other fluid.

The process of manufacturing lighting gas from atmospheric air and any hydrocarbon oil or spirit is to propel the air by the aid of steam, or otherwise, through a superheater, and thence into a retort more or less heated, according to the gravity of the oil used. Oil or spirit is then introduced into this retort, preferably so as to join the highly superheated steam at an angle, and pass with it through one or more other retorts, and thence to the condenser and gasholder. The retorts are filled with blocks of carbon, or pieces of brick, so as to obtain a great surface, over which the air and the oil, or spirit, travel in forming in their passage to the condenser an illuminating gas which passes thence into a holder, and is stored for use.

1520.—WIRTH, F., Frankfort-on-the-Maine, "*Improvements in gas-engines.*" A communication. Patent dated April 10, 1876.

This invention relates to engines for obtaining motive power from the explosive combustion of gas and air, and consists in employing an elongated cylinder open at one end, and provided with two pistons. The one termed the working piston is connected in the usual way to a crank on the main shaft, which is provided with a fly-wheel. The other, termed the loose piston, has a rod passing through the cylinder cover and through two friction cheeks mounted on levers in such a manner that they admit of the free movement of the piston-rod in the one direction, but its movement in the opposite direction is stopped by its causing the cheeks to embrace the rod tightly until relieved by the action of an eccentric at a certain point in each revolution of the crank-shaft. At the side of the cylinder near the middle of its length is an opening fitted with a slide, which is worked by a cam on the crank-shaft. In this gas-slide and in its jacket are provided passages for the ingress and mixture of air and inflammable gas, and of a

kindling flame. On the opposite side, and fixed somewhat higher up, is an opening from the cylinder provided with a valve opening outwards for the discharge of the products of combustion.

1532.—SCRATTON, REV. G., Stickney, Lincolnshire, "*Improvements in apparatus for raising water, the same being applicable as ship-pumps.*" Provisional protection only obtained. Dated April 11, 1876.

This invention relates to certain combinations and arrangements of apparatus and mechanism by means of which water can be raised in a continuous stream, the same being especially applicable to pumps for raising water out of the holds of ships.

A reservoir or cistern, constructed of any suitable materials, and of any suitable form, is provided for the purpose of being placed above the body of water which it is desired to raise, the same having inlet-valves placed therein to allow of the entrance of the water when the apparatus is in action. The reservoir or cistern is furnished with a cover or lid connected to it by means of a broad belt of leather, varnished canvas, vulcanized india-rubber, or other suitable waterproof material, capable of being collapsed or expanded like the sides of bellows. A vertical shaft is attached to the upper part of the lid or cover, by means of which, upon the requisite power being applied thereto, it can be alternately raised and depressed. This action is effected by means of mechanism and gearing, the primary motive power being derived from what may be termed a "horizontal windmill"—that is to say, an arrangement of fans or sails placed around a vertical shaft or axle capable of rotating, upon the surfaces of which fans or sails the wind impinges, and causes the axle with the series of fans or sails to rotate.

1547.—WILDY, W. L., Camden New Town, London, "*Improvements in cocks and valves.*" Provisional protection only obtained. Dated April 11, 1876.

The object of this invention is to obtain a more economical consumption, or to control the passage of gas or other fluid, of which sometimes a full and sometimes a partial supply is required, and consists in placing in the pipe by which the fluid is conveyed, or in a fitting connected thereto—such, for example, as an elbow, swivel joint, or boss—a cock or valve of which the rotating plug is so made that when turned in one direction the supply is full on, and when turned in the other direction the supply is reduced to a very small uniform quantity. The control of the supply is obtained by providing a circumferential groove or passage in the rotating plug or valve, which groove communicates with the principal orifice or passage of the plug, and forms a bye-pass for the fluid when the main passage is turned off. The same result might be obtained by a screw plug screwing into its socket, and fitted so as to leave a space between the plug and its seat for the minimum supply.

1568.—ALLEN, T., Southsea, "*Improvements in cisterns.*" Provisional protection only obtained. Dated April 13, 1876.

This invention comprises the constructing or providing cisterns, with a moving bucket or chamber, which may be tilted mechanically when desired, and its contents delivered to a discharge or flushing pipe, the bucket or chamber being provided with one or more openings or orifices for filling from the water by which it is surrounded, or partly surrounded, when it falls back or is brought to its normal position within the cistern. The number and size of the openings or orifices will afford the means of adjustment or regulation of the time to be intentionally occupied in filling, to prevent the waste which might otherwise occur by a too frequent tilting or use of the apparatus. The apparatus is more especially intended for domestic water-closet service, and is to be of metal, slate, or any convenient material, with a partition dividing it off into a main chamber and a flushing chamber, or having a separate flushing chamber provided. A discharge-pipe is furnished to the flushing chamber, and the top of the dividing plate, or partition, to be at the intended (feed) level of the water-bucket, is furnished with pivots, on which it swings, and is fitted in grooves, from which it can be readily lifted or replaced.

APPLICATIONS FOR LETTERS PATENT.

1734.—EYTON, W. C., Weston, Herts, "*Improvements in pressure and vacuum gauges.*" May 4, 1877.

1764.—WESTINGHOUSE, G., jun., Pennsylvania, U.S.A., "*Improvements in and in apparatus for lighting railway carriages.*" (Partly a communication.) May 7, 1877.

1772.—SCOTT, H. Y. D., Ealing, Middlesex, "*Improvements in the treatment of faecal matters and other ammoniacal compounds, and the production of manures therefrom.*" May 7, 1877.

1774.—BURBRIDGE, T., Penge, Surrey, "*Improvements in valves for regulating or controlling the supply and discharge of water or other fluids.*" May 7, 1877.

1805.—LÜLKEN, A., Dusseldorf, Prussia, "*A new mode of constructing water-meters, capable of serving at the same time as prime movers.*" May 9, 1877.

1810.—HOWE, H., Blackfriars Road, London, and RUSSELL, R., Manchester, "*Improved arrangements for water-supply purposes whereby waste is prevented and regulation effected.*" May 9, 1877.

1814.—KIRKHAM, T. N., C.E., Westminster, HULETT, D., High Holborn, and CHANDLER, S. and J., Newington Causeway, London, "*Improvements in apparatus for the purification of gas.*" (Complete specification.) May 10, 1877.

1815.—HOSKING, J., Camborne, Cornwall, "*Improvements in pumping machinery.*" May 10, 1877.

1822.—MILNE, J., Edinburgh, "*Improved appliances to railway and tramway carriage gasholders, whereby they may be automatically charged.*" May 10, 1877.

1918.—CORT, J., Old Kent Road, London, "*Improvements in the construction of valves.*" May 16, 1877.

1946.—BRUCE, T., Shotley Bridge, Durham, and ROBB, J., Stepney, London, "*Improvements in rotary engines and pumps.*" May 18, 1877.

1954.—GUBBINS, R. R., Upper Thames Street, London, "*Improved apparatus for raising or forcing water, air, or other liquids or fluids.*" May 18, 1877.

1962.—STEPHENS, J., Stonehouse, Gloucester, "*Improvements in pumping machinery.*" May 19, 1877.

1982.—FENTON, J., Batley, York, "*A new or improved method of and apparatus for defecating and deodorizing sewage.*" May 19, 1877.

2024.—DAY, J. J., Kentish Town, London, "*Certain improvements in the construction of ball valves.*" May 24, 1877.

2033.—LAKE, W. R., Southampton Buildings, London, "*Improvements in gas-meters.*" A communication. (Complete specification.) May 24, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

4576.—MATHIESON, C. F., Mincing Lane, London, "*Improvements in the manufacture of gas.*" Nov. 25, 1876.

259.—TASSIE, P., Manchester, "*Improvements in means or arrangements for closing the mouthpieces of gas-retorts, and in tools for applying the same.*" Jan. 20, 1877.

641.—RIGNALL, R., Hull, Yorkshire, "*An improved adjusting pipe-tongs.*" Feb. 16, 1877.

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HOUSE OF COMMONS COMMITTEE.

TUESDAY, MAY 1.

(Before Mr. D. R. PLUNKET, *Chairman*; Mr. FOLJAMBE, Mr. STARKEY, and Mr. COURTNEY.)

CRYSTAL PALACE DISTRICT GAS BILL.

(Continued from p. 816.)

Mr. Henry Palfrey Stephenson, examined by Mr. PAULI.

I am a member of the Institution of Civil Engineers, and deputy-chairman of the Crystal Palace District Gas Company. I have been a director of that company since their origin, about 23 years ago. We have come here after mature consideration, and, as we consider, in the interest of the public. Previously to 1873, we were under no obligations to purify from sulphur compounds, the only restriction in our Act of 1858 being with regard to sulphuretted hydrogen. We were specially exempted from the restrictions contained in the Metropolis Gas Act of 1860, after opposition on our part. Excepting for the 17th clause of the Act of 1873, we should have no restriction imposed upon us with regard to sulphur compounds other than sulphuretted hydrogen.

Mr. PAULI: When you heard that limit imposed, you had no idea of the difficulty, or expense, or nuisance that would be involved in carrying out the duty?

Witness: I consulted with another engineer who was in the room, and, looking to the fact that we had made a considerable increase in the area of our purifying power of late years, and not at all anticipating the difficulty which would arise from the waste lime and the foul lime, we were under the impression that we should have no great difficulty in purifying from the sulphur compounds, according to the limit then mentioned. We were anxious to obtain our Bill, and, therefore, we did not raise any objection to the clause, anticipating that we should have no difficulty. Before 1873 we used lime to absorb both carbonic acid and sulphuretted hydrogen. We were not then alive to the necessity of taking the carbonic acid from the gas before the sulphuretted hydrogen. We used a very small quantity of lime in proportion to what we are now using. As soon as we tried to carry out the provisions of that section, we found that our limits as to those sulphur compounds were frequently exceeded, and that it was necessary largely to increase the area of our purifiers, and also the quantity of lime used, and that involved a considerably increased expense. About the year 1867, I think, the area of purifying power was rather over 1000 cubic feet, 16 feet deep; by the year 1873 we had increased it to over 3530 square feet, 6 feet deep; and we have since 1873 increased that by about 50 per cent., or 1750 feet. The sulphur compounds sometimes increased in such a manner that we could not account for them, unless possibly it arose from the waste lime itself giving up some sulphur compounds to the gas instead of taking them from the gas. We now use a process which may be described as two very large lime purifiers, and four oxide purifiers, working the lime purifiers separately—the first one to take out the carbonic acid—and, in the second one, the sulphuretted hydrogen, being driven forwards, forms an artificial sulphide of calcium, which has been found by Mr. Patterson—or was pointed out by Mr. Patterson—to be the material which ought to be used for purifying the gas from sulphur compounds other than sulphuretted hydrogen. After the second purifier the gas passes into the oxide of iron purifiers, of which we have four. We have some lime in the bottom trays of the oxide purifiers, as a sort of safety-valve or guard against any other sulphur compounds passing the sulphide of calcium purifiers. After that long and complicated process, we generally keep the amount under 20 grains, but at first we had considerable difficulty in doing so. With regard to the refuse lime, it becomes very foul and exceedingly offensive. We first used to bury it in the works; but for fear of fouling the stream which is in the neighbourhood, and in consequence of complaints and a memorial from the inhabitants, we found it necessary to give that process up. We then carted it away to an old brickfield, about a mile distant from the works, but after a storm some of the refuse was washed into the river Pool, and so into the Ravensbourne, and it made a great nuisance, causing great complaints. We also had complaints from the inhabitants of the district through which the stuff was carted, and since then we have arranged to send it away by railway trucks, at a cost of about 5s. per ton, which entails upon us for that alone from £200 to £250 per year. We send it away in railway trucks especially kept for the purpose, and bought by our company, because the railway company objected to their waggons being used for the foul stuff. We brought a siding up alongside the purifiers, so as to load the trucks direct when we empty the purifiers, so as to avoid causing a nuisance. I have a plan here showing the purifying works, as we had them in 1873, and as we have them now. Before 1873, this being our retort-house [pointing to the plan], the gas was conducted from the retorts along a pipe, called a horizontal condenser, and in travelling along that pipe it travels with the tar and ammoniacal liquor and gas all mixed together. Here it is freed from naphthalene and tar and ammoniacal liquor, and all the liquid elements, and then it travels along this pipe to what we call the battery condenser, and at this point the liquor there is admitted, and the tar proceeds into the tar-well. Then the gas passes through this battery condenser, which is a huge box with horizontal pipes through it, and it is there cooled down to about 65° at this point. Passing from that it comes into the two scrubbers, which are round vessels made of cast iron, filled with breeze, or with boards, or with broken bricks, about 24 feet high. It is washed in those scrubbers by ammoniacal liquor travelling through the brickbats as the gas proceeds upwards. It is then taken along this pipe

to the exhauster, which is for the purpose of pumping the gas through the different apparatus. It then goes into the washer, which is filled with water, and then commences the purification. Before 1873 we had those two smaller lime purifiers of 20 feet by 22 feet; the gas passing through these deposited some of the carbonic acid and sulphuretted hydrogen, we not distinguishing, at that time, whether it was carbonic acid or sulphuretted hydrogen that was taken out of the gas. Then it proceeded to the four oxide purifiers, which took out the sulphuretted hydrogen. In this case, which is since 1873, the purification by the horizontal condenser and the other condensers is the same. We pass now, however, through the washer first, instead of through the scrubber, and then we pass through two scrubbers, in one of which we scrub with ammoniacal liquor, and in the second with very weak ammoniacal liquor; then we pass either to those two purifiers or to this purifier [pointing to the same]. Supposing these two to be used, we use that one to take out the carbonic acid, and that enables the sulphuretted hydrogen to flow into this one, where the sulphide of calcium is formed, which then becomes the purifying agent for the sulphur compounds. When this one is changed, to remove the lime filled with carbonic acid and partly with the sulphuretted hydrogen, then we use these two. As soon as that is changed and refilled with pure lime, then we shut off those two, and proceed to use these two, and those four are, as before, the oxide purifiers, with the exception that we have a bottom tray, or large square boxes with lids upon them, which have a bottom tray filled with lime as a sort of extra safeguard against any sulphur compounds coming over when we are using those two purifiers. There is a difference of area of about 50 per cent. Those two large purifiers are 50 per cent. of the area of these purifiers.

By the COMMITTEE: If we obtain this Bill, we shall use all these oxide purifiers, and, of course, it will save us the erection of some oxide purifiers in the future. If we do not obtain our Bill, I think it exceedingly likely that we shall be compelled to erect large purifiers in place of those two. If we obtain our Bill, we shall only use a very small portion of lime, principally in the trays.

By Mr. CRIPPS: There is nothing exceptional in the form of the purifiers, but there is a little exception in the mode of using them; we work them according to a plan pointed out by Mr. Patterson some few years ago, about which there has been a Chancery suit in two courts.

Mr. CRIPPS: In which you were fortunate enough to succeed.

Examination resumed: The lime, when thoroughly saturated with sulphuretted hydrogen, becomes sulphide of calcium. I have no doubt the effluvia which is smelt arises from the sulphuretted hydrogen, which is very deleterious. I should not like to live in an atmosphere of that kind. We have had, from time to time, a great number of complaints, in particular one in 1875 from 20 inhabitants of the district surrounding the works.

Mr. PAULI read the memorial, which was as follows:—

To the Chairman and Directors of the Crystal Palace District Gas-Works.

Gentlemen,—We, the undersigned inhabitants and householders of Lower Sydenham and Perry Hill, desire to call your attention to the great and increasing nuisance caused by the stench arising from your works, which we believe can at a small expense to your company be considerably mitigated, if not entirely abated. We are given to understand, and believe it to be the fact, that the smell complained of is partially caused by the increased quantity of lime used in purifying, but there is no reason why this should be allowed to become a nuisance; as it should be carted away in closed receptacles, a system adopted by the metropolitan works. The noxious fumes arising from your works have become so intolerable, that they will considerably depreciate the value of house property in the neighbourhood, for several inhabitants of the district have been so often awakened in the night, almost suffocated with them, that unless your engineer adopts measures to prevent a repetition of them, they will be compelled to leave their houses. We appeal to you, as gentlemen connected with a wealthy company, to extend us your sympathy, and to give such instructions to your officers as will afford us relief.

The CHAIRMAN: I gather that that was rather a protest against the practice of storing lime than against the use of it.

Mr. PAULI: It was a protest against the increased use of the lime. They say, certainly, that it would be decreased if it could be carted away in closed vessels.

Examination resumed: However we deal with the lime, we shall always have a considerable amount of offensive smell, particularly at the time of changing the purifiers, or in damp and foggy weather, with the wind in certain directions. Sulphuretted hydrogen is given off the moment the purifiers are opened, and particularly when the foul lime is stirred up. By the time it is put into the vans the smell would have escaped. I understood from Mr. Stevenson's evidence yesterday that at some of the works they take considerable care in sending it away, and yet there is a large amount of smell and nuisance. I do not personally know how the metropolitan companies get rid of their foul lime. Many of them have water carriage, and yet find great difficulty with their lime. I do not think they inquire where it goes to if they get rid of it.

By the COMMITTEE: It is said that it is pitched into the water at the mouth of the river, but I do not know whether that is so or not.

Examination resumed: I have made a very accurate calculation showing the increased cost arising from the extra use of lime which has been imposed upon us. I have taken 3½ years before the passing of our Act of 1873, and 3½ years since the passing of that Act. The cost before the passing of the Act was 0·318 of a penny, and since 0·875 of a penny. But during 1876 we had still further to increase the quantity of lime, and the cost was 1·166 of a penny. The net result to the consumer, taking into consideration the interest, and so on, is a cost of 1d. per 1000 feet, and that would represent about £1500 a year upon the amount sold. During the 3½ years before the passing of the Act, we used 807 cubic yards of lime; but during 1876 we used 1576 cubic yards in that one year, which almost amounts to one bushel per ton of coal carbonized.

By the COMMITTEE: During the whole 3½ years, after the passing of the

Act of 1873, we used 4449 cubic yards. The increase in the quantity of gas did not make an increase in the quantity of lime, but for the purpose of taking out the sulphur compounds we increased the quantity of lime so as to do so more effectually. During the first $3\frac{1}{2}$ years we carbonized 93,720 tons of coal, and during the next $3\frac{1}{2}$ years we carbonized 125,865 tons, but the quantity of gas made does not affect the cost of purification per 1000 feet of gas. During the first $3\frac{1}{2}$ years we used 0.180 bushel of lime per ton of coal carbonized; during the second $3\frac{1}{2}$ years we used 0.742 bushel; but during the last year we used 0.832 bushel, or four times as much as the average of the $3\frac{1}{2}$ years.

Examination resumed: Having regard to the suburban character of our district, it may be assumed that the consumption will increase from year to year, and that therefore more lime will have to be used. We have had nominal penalties imposed on two occasions. We find that if we try to reduce the quantity of lime, then we run the risk of penalties under the Act; but if we increase the quantity of lime, then we run the risk of complaints from the neighbours, and there is a local press, so we get it hot both ways. We have understood that our company have been considered an exemplary one. We have a maximum charge of 6s., but we only charge 3s. 11d. to the general public, and 3s. 7d. to large consumers and the public lamps. In 1873 our illuminating power was raised from 10 to 14 candles, but we did not object to that. In our Act a certain number of hours notice is required previous to testing, but we have waived that with the parish officers. I have never heard of any approximate advantage which has been derived from reducing the sulphur compounds from a little below 30 to, say, 20 grains. I think we should still have to use a considerable quantity of lime with a limit of 30 grains—enough to create a nuisance. I think the great fault among consumers is, that their rooms are not sufficiently ventilated, and very often bad burners are supplied to them, and in consequence a great deal of imperfect combustion takes place.

Cross-examined by Mr. CRIPPS: There was a very strong attempt made to bring us under the Act of 1860, but it was not successful, because we were exempted from the provisions of the measure. When we applied for our Act, in 1873, we asked Parliament for power to raise £150,000 at 7 per cent., but that capital is not yet issued. When it is issued it will only be with a certain amount paid on it, so that we could not take the premiums that the fully paid-up stock of the London companies would take. I should think, if we issue those shares with £2 paid, they will take a premium of from 25s. to 30s., or, perhaps, £2, in the market. The ordinary premium of 7 per cent. stock is about 50 per cent., and that amount will be divided amongst our shareholders as a bonus when it is called up. It must be remembered that when we obtained our original Act we had power to raise £100,000 at 10 per cent., but we only took £50,000 at 10 per cent., and the other £50,000 at 7 per cent., thereby denuding ourselves of £2000 a year.

Mr. CRIPPS: I am not talking about your old Act, but about the Act in which this particular disadvantage, as you term it, was imposed upon you. You did get that £50,000, which, when you want to issue it ultimately among your shareholders, would be worth to them 50 per cent. premium?

The CHAIRMAN: I am not sure I follow the drift of your cross-examination. You do not propose to set off any advantage gained by the shareholders, under this Act of 1873, against the nuisance they would be to the public, do you?

Mr. CRIPPS: I intend to set it off most materially against anything like a complaint of its causing any extra expense in gas-making.

Witness: I do not complain of the cost.

Mr. CRIPPS: It will cost rather more than you have paid at the present time to get rid of that difficulty; but I am now particularly upon the Act which gave you that undoubted benefit on which you first accepted this liability. The population of your district within the metropolitan area is, of course, the part which has been increasing most materially since 1860, and since this prohibition was first introduced?

Witness: I would not say that, because the whole district has been increasing. It is not within my knowledge that the clause complained of was proposed with a number of other clauses by the Metropolitan Board of Works, some of which were put in and some not. My belief is that it came out in the examination or cross-examination of Mr. G. W. Stevenson, and we accepted it under the belief that we could comply with it. The effect of that clause was to impose upon us the same prohibition which had been put upon all the other metropolitan gas companies. The great reason we bring this Bill forward is the nuisance that it commits to our neighbours. The trucks in which the lime is sent away are not closed, but open. The greatest amount of nuisance occurs when the purifiers are opened and the stuff is being thrown into the trucks. On a large scale, there is no way of purifying that lime before it comes out of the purifiers. As a chemical process, if you put a small portion of waste lime into a retort and burn it, I dare say you will throw off all the noxious vapours from it. I very much doubt if it could be done by simply admitting the atmosphere, but I would rather not give an opinion on a chemical point like that. I have heard there were one or two explosions caused by that method being adopted. Whatever of that kind was to be done would, of course, be an increased expense for us.

The CHAIRMAN: With reference to this suggestion of purifying lime by airing it, at what stage of the process is that attempted?

Witness: I have not used it myself.

Cross-examination resumed: When I spoke of being summoned on two occasions, I referred to being summoned, under the Act, for having an excess of sulphur compounds, other than sulphuretted hydrogen in the gas. I do not think we were summoned on the question of nuisance. The Lewisham Board wrote to us complaining very much of the foul water from the brick-field flowing into their stream, but I do not recollect that we were summoned upon that question. The extra penny of expense involved in this matter has not been any detriment of our dividend, because it is paid by the consumer.

Mr. CRIPPS: You mean you would be able to reduce the price to the consumer if you made your gas cheaper?

Witness: I believe so.

Mr. CRIPPS: Do you know whether the consumer is particularly anxious to have this amount of sulphur compounds poured into his room in order to get his gas cheaper?

Witness: I think the consumer is under a misapprehension that he is poisoned by sulphur.

Mr. CRIPPS: Have you had any applications from the consumers to state that they would be willing to take this increased quantity of sulphur as against paying a little less?

Witness: No.

Mr. CRIPPS: You have mentioned the largely increased quantity of lime you had consumed in your works since you undertook this liability, but does not that involve a decrease of the quantity of oxide used?

Witness: I should think not. We sell the spent oxide at a profit, so that we should not object even if we required a little more. We have removed our lime by means of the railway trucks for about seven or eight months, but that was not the plan which was adopted at the time the memorial was addressed to us.

Re-examined by Mr. MICHAEL: The only way in which this expense

affects us is that we are, as it were, handicapped as against the surrounding companies. At Croydon they are not under any restriction as to sulphur compounds, and therefore we are obliged to charge 1d. more for our gas than they are. If we were relieved from an obligation of this kind it is the consumers who would be benefited. No process has ever been brought to our notice by which we could discharge the sulphur from the gas without creating a nuisance. If it had, we should have adopted it, unless it was at an enormous expense.

By the COMMITTEE: The large purifier takes one day to empty out, and one day to refill, with 20 men, so that it may be said there are 36 hours during which the stuff is exposed. The actual process takes about 24 hours, but there is the time during which it is waiting in the train to be taken away. During the winter time we change our lime purifiers once in every 12 days. If the purifiers are changed on a day when the wind is blowing directly away from the houses, there would be no complaint on such a day as that; but, in the depth of winter, with the wind blowing in the direction of the houses and villas on the height above our works, then, of course, the smell is noticeable on those days.

Dr. William Odling, examined by Mr. MICHAEL.

I am a Fellow of the Royal Society, and a Professor of Chemistry in the University of Oxford. For the last 20 years I have devoted very considerable attention to the question of gas purification and manufacture, and was one of the Gas Referees during the years 1873 and 1874. When gas is produced it contains gas in a form which may be described as sulphuretted hydrogen, and also as sulphide of carbon; it is not, chemically speaking, the latter, but that is the description generally. Sulphuretted hydrogen is a gas with an exceedingly offensive smell, and it exists to a very considerable extent in crude gas—I believe about 400 or 500 grains in 100 cubic feet, and the retention of that amount would be a very objectionable thing. It is very easily recognized by a test paper, if any is left in the gas. The gas ought to be supplied to the consumers absolutely free from sulphuretted hydrogen, and is so in that supplied by the London companies. A piece of bibulous paper is saturated in a solution of acetate of lead, and is kept constantly suspended over the gas in all good gas-works, so as to enable the engineer in charge at once to detect if any sulphuretted hydrogen exists in the gas, and records are kept of that test. In addition to the sulphuretted hydrogen, there is a proportion of sulphur existing in the gas which has not the property of affecting test-paper. In this residuary sulphur, which is generally spoken of as "sulphur other than sulphuretted hydrogen," there exists undoubtedly sulphur in the form of sulphide of carbon. In the Crystal Palace Gas Act of 1873, a maximum of 20 grains of sulphur compounds was allowed to remain in the gas, but it was to be perfectly free from sulphuretted hydrogen. There had been restrictions in the Metropolitan Gas Acts for years, but up to 1872 or 1873 there were no means known for reducing the sulphur other than the sulphuretted hydrogen to any extent at all. There is now only one process, so far as I know practically, and that consists in the use of lime in the manner described by Mr. Livesey and Mr. Stevenson, although a great many proposals have been made. I am aware that an experiment has been tried of introducing into the purifier atmospheric air, in order to see whether that would not to a great extent remove the nuisance complained of when the purifiers were opened, but I have not seen the operation. It would be difficult to say what is the extreme power of lime in reducing the quantity of sulphur other than sulphuretted hydrogen in gas, but I believe, in a practical operation, it will reduce the amount to about half. I think it is a matter of scarcely any importance whether there are 15 or 30 grains in 100 cubic feet. One hundred cubic feet of gas would weigh from 3 to 4 lbs.; therefore, if you have 30 or 40 grains of sulphur in 3 or 4 lbs., that would be about 10 grains in the pound; and if you halved that it would be reduced to about 5 grains in the pound, or if it is put as a per centage, the amount, of impurity, which originally is one-seventh per cent, would be reduced to one-fifteenth per cent., and that is practically a matter of no consequence whether the gas is burnt in the open air or in rooms. In conjunction with Dr. Russell, I have instituted a series of experiments, in which gas has been burnt with a known quantity of sulphur, our aim being to have all the conditions which ordinarily exist. The room employed for the purpose was one of the offices of the South Metropolitan Gas Company, and the experiments have been going on for three or four months. The room was 18 feet 10 inches in length, 17 feet broad, and 12 feet high, and that would give a capacity of about 3800 feet. It had two windows and a door, and was furnished as an ordinary sitting-room, lighted by means of a chandelier, hung from the centre of the ceiling, having three lights fitted with Sugg's bat's-wing burners, at a height of 7 feet from the floor, and each of them burnt with great regularity 5 cubic feet an hour; they were also provided with governors and tested by meters. There was a moderate fire maintained in a grate to keep up the ordinary conditions, and the door was continually kept shut; but people came in and out as they pleased, and there were one or two persons usually in the room. The gas which we burned was some which had been prepared without having been purified with lime. It was tested 23 times, as I am informed by the official tester, who found it to contain, as the mean of his 23 observations, 33 grains of sulphur in 100 cubic feet. We lighted the gas some hours before beginning our experiments, and we ascertained, by a considerable number of experiments, that if the gas had been lighted for four or five hours the atmosphere of the room underwent no further alterations, either in chemical composition or temperature; but after four or five hours we got it up to the maximum of heat and impurity, and beyond that the continuous burning had no further effect. In commencing the experiment, measured quantities of air were sucked through aqueous ammonia, to absorb the sulphurous products, and we satisfied ourselves, by preliminary experiments, that in this way were absorbed the whole of the sulphurous products that were in the air—in fact, we used a very much greater amount, practically, of absorbing power than was necessary—and then were estimated the amount of sulphurous products. I also took the atmosphere after the gas had been kept burning continuously for 20 hours, and in some cases 48 hours, but there was no sensible variation. We took the air first of all from a height of 1 foot 6 inches from the ceiling; we had previously ascertained that the products of gas combustion aggregated very largely in the upper part of the room. Then we also took it at the height of about 5 feet 6 inches from the floor, which represents about a man's ordinary breathing height; and we took it at a height of 3 feet 6 inches from the floor, as representing a man's ordinary breathing height sitting down. At 1 foot 6 inches from the ceiling, the mean of three experiments, gave us 16 grains of sulphur in 10,000 cubic feet of air, or 160 in 100 cubic feet. At 5 feet 6 inches we found the result rather less than at 3 feet 6 inches, but that arose from the fact that the latter series of experiments was a mean of three, whereas the 5 feet 6 inch series was a mean of two, by reason of an accident, one portion being thrown away. Those experiments were compared with that of a room in which the gas had been burnt for two hours, and in that case, whereas formerly we had 16 grains in 10,000 feet, we had now only 10 grains, but with reference to the 5 feet 6 inches and the 3 feet 6 inches there was no substantial difference. We also took the air of a room in which gas had not been burnt at all, and in place of the 10 grains we found there was only between one-tenth and two-tenths

of a grain. A minute quantity of sulphur is invariably found in the air, from the combustion of coal which is going on. The quantity of sulphur compounds found in the air would certainly not have any appreciable effect upon health or life; it only amounts to about one part in the third of a million up at the ceiling, and one part in about three-quarters of a million at the breathing height. There is no doubt that in rooms that are heated by gas, the hangings, books, and furniture, in the upper part of the rooms, do suffer very considerable deterioration, and it has been alleged that that is due to the sulphurous particles of the gas; but that, I say, is not the fact, for two reasons—first, other conditions are amply sufficient to account for it, and secondly, the sulphur itself is not capable of doing that amount of injury. The following are the results obtained by myself and Dr. Russell:—

Grains of sulphur per 100 cubic feet of air, found in the air of a room of 3800 cubic feet capacity, in which gas containing 33 grains of sulphur per 100 cubic feet had been burnt at the rate of 15 cubic feet of gas per hour for upwards of five hours continually.

	I.	II.	III.	Means.
At height of 1 foot 6 inches from ceiling .	0.184 ..	0.123 ..	0.173 ..	0.160
At height of 5 feet 6 inches from floor .	0.056 ..	0.037 ..	— ..	0.046
At height of 3 feet 6 inches from floor .	0.058 ..	0.032 ..	0.088 ..	0.059

Gas Burnt for Two Hours only.

	I.	II.	III.	Means.
At height of 1 foot 6 inches from ceiling .	— ..	0.135 ..	0.076 ..	0.106
At height of 5 feet 6 inches from floor .	0.040 ..	0.070 ..	0.045 ..	0.052
At height of 3 feet 6 inches from floor .	0.039 ..	0.050 ..	0.037 ..	0.042

Not any Gas being Burnt.

	I.	Mean.
At height of 1 foot 6 inches from ceiling .	0.020 ..	0.020
At height of 5 feet 6 inches from floor .	0.010 ..	0.010
At height of 3 feet 6 inches from floor .	0.009 ..	0.009

We find the air in the upper part of a room is prejudicial, in the first place, from its high temperature. After the gas has been burning in a room for four or five hours, we find that the temperature in the upper part, 12 feet high, would increase by some 20°, whereas the temperature of the breathing height will only increase some 5° in the course of a few hours. In using the three Sugg's burners, the illuminating power was about 50 candles. There is no doubt, when gas is burnt, that the products of combustion and heated air have a much greater tendency to concentrate themselves in the upper part of a room when the light is aggregated together than when the same amount of light is obtained from a number of small jets, as is the case with candles. The oppressiveness which people experience in rooms lighted with gas depends not only on the high temperature directly, but also upon the high temperature indirectly; because, having an accumulation of heated air at the upper part of the room, that part of the room is virtually cut off for the purposes of respiration. In the room in which we are now assembled, the hot breaths ascend into the air above; but if the room were cut off at the height of the door, we should find the room much more oppressive. If instead of the room being cut off at the door, it was filled with hot air, or so hot that it could not mingle with the lower stratum, the room would be virtually cut off at that height. By the combustion of gas there is a certain amount of water formed, and, therefore, the absolute amount of water in the air is increased relatively to the amount of water that the air is capable of taking up. It is decreased—that is to say, the air is less saturated with water after the gas has been burnt in it than it was before. This is shown by the fact that the wet bulb of the thermometer indicated a difference of 10°—there was that difference between the wet and dry bulbs of the thermometer near the ceiling, and only a difference of 5°, 6°, or 7° below. That showed that the upper part of the room was not only hot but dry, and that would have a great influence upon books, pictures, and various articles exposed to its influence. We also examined the gas with regard to the other impurities produced by combustion. The amount of carbonic acid existing in the open air may be taken at 4 volumes in 10,000 volumes. In the room in which we experimented, this proportion rose to upwards of 40 volumes near the ceiling, above the chandelier, and to 20 volumes below; that is to say, it increased ten times near the ceiling, and five times at about the respiration level. It is generally considered that the presence of a large amount of carbon in the atmosphere in any form is prejudicial to health and life. The volume of carbonic acid gas furnished by the carbon of gas coal may be taken as at least a thousand times greater than the volume of the sulphurous products produced by the burning of sulphur. Carbonic acid has no smell; and everybody knows that on going into a gas-lighted room there is a certain amount of smell and chokiness which is not due to carbonic acid at all, but it has long been attributed to the products of imperfect combustion. If gas is burnt in a room where the amount of air and gas are not exactly regulated, either the gas is under-burnt or over-burnt, and in either case strong-smelling offensive products are formed. We have taken some trouble—I believe for the first time—to get some idea of the proportion of these products, and they are, I may say roughly, that where the amount of carbonic acid in the air of the room has been so far increased as to amount to from 1½ to 3 grains in a cubic foot, we find those other impurities resulting from the imperfect combustion of gas—which give rise to that choking sensation—amount to from half a grain to a grain in a cubic foot in addition. The difference between 20 grains and 40 grains of sulphur would not alter the carbon compounds in any degree whatever. If a room is properly ventilated, a small proportion of sulphur does no harm in any way; but if it is not properly ventilated, the removal of it will do no practical good, by reason of the large amount of carbon products. We know that so much sulphur is capable, when it is burnt in a certain way, of yielding so much sulphuric acid, and it may be taken that the amount of sulphur contained in the gas which would be burned in an ordinary room in the course of a week, is an amount which would be capable of yielding enough sulphuric acid to destroy all the furniture; but the fact that the furniture does not get destroyed in a week, a month, or a year, shows that that amount of sulphuric acid is not the point at issue, which is to determine the amount of sulphuric acid, if any existed, in the room in which gas was being burned; all other modes of determination have no bearing upon the question. I am quite of the opinion that the removal of the restriction which exists will not enure to the disadvantage of the public. With regard to the alleged injurious effects of this small proportion of sulphur, it is not the result of observation, but it is the result of a notion that it must produce sulphuric acid when it is burnt, and that sulphuric acid, when it is burnt, is a very dangerous thing. I say that the evidence that this is not the case, is shown by the fact that sulphur is very largely used for bleaching silk and woollen goods, and also for the purpose of disinfection—not merely sulphur as sulphur, but sulphides of carbon. It is common to burn a quarter of a pound of sulphur per 1000 cubic feet of space, so that in the very room in which we were experimenting, they would burn about a pound of sulphur, and burn it till the air became so opaque, it could not be seen through. The room would be closed for a couple of hours at least, and then the windows would be opened, and the room ventilated, and the furniture would be found not to have suffered any inconvenience; and that would show that any injury experienced by rooms in which gas was burned was not due to the exceedingly minute proportion

of sulphur contained in the gas. Taking the maximum quantity of sulphur which we find in the room in which we now are, a person would have to go on breathing for six or eight hours in order to take into his lungs, in the course of respiration, as much as the twentieth of a grain of sulphur, from which no bad result would follow. Supposing no other process than oxide of iron were used, so far as sulphur is concerned, I am not prepared to say what would be the maximum quantity of sulphur left in the gas, but on an average it would amount to about 30 grains, or a little over. No other purifying material than oxide of iron is used in Manchester, Birmingham, or Liverpool, nor yet Paris, and that has been adopted after considerable inquiry as to whether or not other means should be adopted.

Mr. MICHAEL: We have it from Mr. Livesey's own observation; but the general question I wish you to satisfy the committee upon is this: Supposing oxide of iron to be used as a means of purification, under any circumstances, do you know whether there would be any prejudicial amount of sulphur other than sulphuretted hydrogen in the gas?

Witness: No; and I base that partly upon all these observations and experiments, and partly on the fact that it is not found to be prejudicial in such towns as Paris, Liverpool, and Birmingham.

Cross-examined by Mr. CRIPPS: My experiments have all been made for the Crystal Palace District Gas Company.

Mr. CRIPPS: Your experiments go to filling the room once with gas, and then trying the results; but you would hardly compare that with the case of a room where gas was burnt continually every day and every night for years and years?

Witness: Of course every day would add to the injury. My experiments were made in a room 12 feet high, but taking London, the rooms in artisans dwellings are generally very much lower than that. I think there is a distinct difference between the air which is above the chandelier, if there be one, and that which is below. There is no absolute impossibility to supply gas with less than 20 grains of impurity in 100 feet, but it is entirely a question of expense—to use a common expression, whether it is "worth while."

Mr. CRIPPS: Do you really suppose that the public of London, who know that they have been protected for years past from impurities, will be satisfied when they find the alteration has been made?

Witness: I should say there is not the slightest proof as to the presence of sulphuric acid.

Mr. CRIPPS: But the sulphurous acid may become sulphuric acid by the addition of another element, oxygen?

Witness: With so much sulphur, if you please you may make so much sulphuric acid; the only question is whether it exists in a room lighted by gas.

Mr. CRIPPS: But what they are breathing and what they are having enter their rooms may be ultimately sulphuric acid?

Witness: No; I dispute that.

By the COMMITTEE: Sulphurous acid would become sulphuric acid by the admixture of oxygen. There is abundance of oxygen to supply it; the point is whether the amount of sulphur that is found in the room actually gets converted into sulphuric acid or not. I say the thing is quite conceivable, but the question of whether it does or not can only be tried by experiment.

The COMMITTEE: You mentioned the burning of a pound of sulphur; how long a period of continuous gas-burning would that represent?

Witness: A pound of sulphur would be 7000 grains. It would require about 20,000 feet of gas to yield that amount of sulphur, and at the rate of 15 feet per hour would have to burn for over 1200 hours. I only made that statement as an illustration that there might be a very great amount of sulphur in a room, and that that sulphur was a product which did not damage the fabrics.

Re-examined by Mr. MICHAEL: Those experiments were conducted over a period of three months. A person standing in a low room would suffer more from the defilement of that room by gas products; but this defilement is not attributable to the sulphur compounds, but the carbonic compounds.

Mr. MICHAEL: Therefore, as far as sulphur is concerned, it being nothing, if you multiply nothing by any amount it remains nothing still, but when you take the other defilement from merely burning the gas—the carbon compounds and the other matters producing defilement of the atmosphere—of course, the less the amount of that dilution the greater the injury produced?

Witness: Yes. As regards the general result of my own observations I should say that of the very small proportion of sulphurous products which are produced, about one-tenth part of that small proportion is converted into a state of sulphuric acid, and that is in a large measure neutralized by the ammonia existing in the air, and would become sulphate of ammonia, and this being a neutral salt, no injury would occur from that small quantity being present. If anything like the amount of sulphur that was in the gas was converted, by burning, into sulphuric acid—if more than a mere trace was so converted—it would not be a question like the present before the committee, because it would be found that the furniture would be destroyed. It would practically result in this—that no gas could be burnt in a room which was not thoroughly ventilated, whereas we know that gas is burnt in rooms in which there is a total absence of ventilation.

By the COMMITTEE: I have not tabulated the results as to carbonic acid, but I can state them generally. Near the ceiling we got 40 parts in 10,000, and at the breathing height 20 parts in 10,000.

The COMMITTEE: Would these particles of carbonic acid, however formed, not produce any smell or disagreeable influence upon the nostrils or lips?

Witness: Actually carbonic acid itself does not, but these other products of imperfectly burnt gas, and these other carbonaceous products, do.

Dr. William James Russell, examined by Mr. PAULI.

I am a Fellow of the Royal Society, and Professor of Chemistry at St. Bartholomew's Hospital. I have been generally engaged with Dr. Odling in making these experiments, to which he has spoken. I have also heard his evidence, and agree with him in all respects. I believe that the unpleasant effect in rooms does arise from those carbon compounds, and that sulphur has nothing to do with it. We did not appreciate the presence of sulphur, although it would be very easily traceable.

Mr. PAULI: You would have found out, by your experiments, whether there had been carbonic acid or not?

Witness: No, we should not, as far as our experiments went; they would apply more to those sulphurous compounds, or sulphuric acid. The means we took to collect it would have collected it whether it was sulphurous acid or sulphuric acid. Any quantity of either of those acids would exercise a very prejudicial effect upon the leather of bookbinding, and so on. I have heard that great damage has been attributed to the sulphur compounds in gas, in libraries and other places, but I do not believe it is owing to those compounds.

Mr. PAULI: Do you believe it would be any practical benefit to the public at all that the sulphur compounds in gas should be reduced, we will say to 20 grains in 100 cubic feet?

Witness: I do not think they would be able to tell the difference in the least.

Mr. PAULI: Do you agree with Dr. Odling in the infinitesimal amount of these sulphur compounds which you would have to breathe?

Witness: Yes. I think our experiments really show that one would have breathed the tenth of a grain of sulphurous acid into the system, assuming that the whole of the sulphurous acid that went into the system remained there, which would not be the case. With reference to those experiments, our principal object was to get a room which should be as similar as possible to an ordinary room in London. I confirm the evidence of Dr. Odling with regard to the general results of those experiments.

Cross-examined by Mr. CRIPPS: I do not know that there is any reason why proper ventilation should never be ensured in the dwellings of the lower classes; there is no practical difficulty about it. The same thing might be said with regard to the dwellings of the higher orders.

Re-examined by Mr. MICHAEL: Sulphuric acid in a concentrated form is a very corrosive substance, and if it were brought out in that corrosive form in the ordinary process of burning gas, we should find in every room traces of its presence. All the goods would be spotted over with it, and holes formed in them. The carbon compounds ought certainly to be got rid of by ventilation, but that is beside the mark when we are discussing the presence of sulphur as an injury.

Mr. MICHAEL: By the ordinary process is adopted of purification with oxide of iron, would there be left such a quantity of sulphur in the gas as would lead to injurious results when that gas was burnt?

Witness: I think not.

Mr. MICHAEL: Therefore it is useless to resort to the process of purification by lime?

The CHAIRMAN: I think Dr. Russell says he agrees entirely with the last witness.

Mr. CRIPPS: They would not think of burning gas in any quantity in the wards of St. Bartholomew's Hospital, would they?

Witness: I should think so.

Mr. CRIPPS: Are they not very particular to have one burner in a ward and the window open?

Witness: I really do not know what the arrangements of the hospital are, but I hope they adopt what you suggest—good ventilation.

Mr. MICHAEL: Supposing they do, has that any reference to the quantity of sulphur in the gas?

Witness: I should say not. The object of ventilation is to get rid of the products of combustion in the heated air.

The COMMITTEE: Can you give any idea what is really the difference between sulphuric and sulphurous acids, in regard to their deleterious effects, if any?

Witness: Sulphuric acid is the stronger of the two, and would turn out sulphurous acid, while sulphurous acid would not turn out sulphuric acid.

Dr. Thomas Stevenson, examined by Mr. MICHAEL.

I am an official gas examiner, and also a Professor of Chemistry at Guy's Hospital. I have heard the evidence of Dr. Odling and Dr. Russell, and concur in that evidence. I believe I first introduced the use of bisulphide of carbon as a disinfectant, and I have used it exclusively for the disinfecting of rooms in the portion of the Metropolis in which I have been Medical Officer of Health for the last six years. I have used, not pounds, but half a ton in that time. Bisulphide of carbon is a compound of carbon and sulphur, made by passing sulphur over heated charcoal. It exists in the form of a transparent liquid, which is highly volatile and inflammable. When using it as a disinfectant, it is simply placed in an open dish in quantities varying, according to the size of the room, from about one-fourth of a pound to half a pound at a time; a match is then applied, and the vapours and the liquid are allowed to burn. A small quantity comparatively of carbonic acid is produced, and a very large amount of sulphurous acid, so that in a few moments no one can stay in the room so as to breathe. The room is then shut up, and left in that way for several hours, and then the doors and windows are thrown open, and the room can then be occupied; this is done after infectious disease. That sulphurous acid is in contact with the oxygen of the atmosphere.

Mr. MICHAEL: Is it under precisely the same circumstances as the sulphurous acid which may be formed from the combustion of the gas with the sulphur compounds in it?

Witness: Yes; the only difference is that it is in a larger quantity in the room when you burn bisulphide of carbon. I have made experiments with the sulphur in gas, and I find that on burning the gas only about 5 per cent. of the sulphur in the gas, as determined by the Referees apparatus, is directly converted during combustion into sulphuric acid, and that most of that sulphuric acid is neutralized by the ammonia present in the gas and in the atmosphere. During the six or seven years I have employed bisulphide of carbon, we have had only one claim for compensation for destruction of any article in the room, and that was bleaching an artificial flower and a bonnet, the sulphurous acid being a bleacher. I have had no claim for compensation of any kind for the corrosion of articles.

Mr. MICHAEL: This unfortunate artificial flower, if sulphuric acid had been formed, I take it, would have been destroyed by the corrosive action of the fluid upon it?

Witness: I think it would, and I also think we must have had a large amount of destruction prevailing everywhere, in furniture and so on, if any appreciable amount of sulphurous acid had been converted into sulphuric acid.

Mr. MICHAEL: Of course there was a very much larger quantity of sulphurous acid formed than there possibly could be created by burning gas with any amount of sulphur?

Witness: Yes. I should like to add that there is one condition which would determine the conversion of sulphurous acid into sulphuric acid, which is absent in rooms, and that is the presence of an excess of ammonia in liquid, which is an essential condition for the rapid conversion of sulphurous acid into sulphuric acid. That is not present under ordinary circumstances in burning gas. There is an inappreciable amount present of ammonia.

Mr. MICHAEL: Have you ever seen any bad results from the combustion of gas containing sulphur which could be traced to sulphur compounds?

Witness: None which could not be traced to other conditions developed during the burning of the gas, those conditions being increased temperature, increased dryness of the atmosphere, and increased products of combustion, carbonic acid, and so on. I have a table here, which will confirm Dr. Odling:—

DR. THOS. STEVENSON'S EXPERIMENTS ON HYGROMETRY, &c., IN ROOMS IN WHICH GAS IS BURNED.

1. *Drawing-Room.*—11 feet 3 inches high. Capacity 3000 cubic feet. Occupied by two adults. Fire. Three bat's-wing burners, each consuming 4 cubic feet of gas per hour. Gas burnt for 4½ hours before testings were made.

	18 In. above Floor.	4 Ft. above Floor.	1 Ft. below Ceiling.
Temperatures	61°	65½°	79½°
Relative saturation of air with moisture; total saturation = 100	69	55	46
Volumes of carbonic acid in 10,000 volumes of air	—	7.70	44.2
Grains of water required to saturate 1 cubic foot of air with moisture	1.53	3.10	5.87

2. *Dining-Room.*—11 feet 3 inches high. Capacity 3500 cubic feet. Occupied by two adults. Fire. Three bat's-wing burners, each consuming 5 cubic feet of gas per hour. Gas burnt for 4½ hours before the testings were made.

	3 Ft. above Floor.	7 Ft. 9 In. above Floor.	1½ Ft. below Ceiling.
Temperatures	61°	68°	77°
Relative saturation	60.5	58	44
		8½ Ft. above Floor.	
Volumes of carbonic acid in 10,000 vols. of air	18.6	..	35.0
Grains of water required to saturate 1 cubic foot of air with moisture	2.36	3.15	5.59

3. The last (dining) room, lighted with three good oil lamps on table. No gas.

	5 Ft. above Floor.	7 Ft. 9 In. above Floor.	1½ Ft. below Ceiling.
Temperatures	66¾°	64°	65°
Relative saturation	61	54.5	45
Grains of water required to saturate 1 cubic foot of air with moisture	2.87	3.59	4.57

PROPORTION OF SULPHURIC ACID TO TOTAL SULPHUR OBTAINED BY BURNING COAL GAS FROM A BUNSEN BURNER.

1. *The Gaslight and Coke Company's Gas.*

Total Sulphur in 100 Cub. Ft. of Gas.	Sulphur as Sul- phuric Acid from 100 Cub. Ft. of Gas.
14.66	0.97
19.07	1.09
19.45	0.74
16.32	0.91
16.07	0.84

Averages 17.11 .. 0.91 or 5.32 per cent. of total sulphur.

2. *Surrey Consumers Company's Gas.*

Total Sulphur in 100 Cub. Ft. of Gas.	Sulphur as Sul- phuric Acid from 100 Cub. Ft. of Gas.
23.00	3.81
38.35	1.44
38.86	1.82
39.24	0.27
55.38	1.44

Averages 38.97 .. 1.90 or 4.87 per cent. of total sulphur.

QUANTITIES OF COMBINED AND FREE SULPHURIC ACID CONDENSED ON GLASS PLATES AND ON CALICO AFTER 24 HOURS EXPOSURE IN GAS-LIGHTED ROOMS.

1. *Plates Clean and Dry.*

Sulphur in Gas used in Grains per 100 Cub. Ft. of Gas.	Size of Room in Cub. Ft.	Quantity of Gas Burnt per Hour.	Total Sulphuric Acid, Free and Combined, Deposited on 1 Square Foot of Surface in 24 Hours.
19.07	2016	10	.020
35.75	3840	15	.003
36.02	3840	15	.006
33.70	3840	15	.006
39.60	3840	15	.016

.010 average.

2. *Plates Moistened with an Alkali (Carbonate of Sodium).*

19.07	2016	10	.068
36.02	3840	15	.055
39.60	3840	15	.042
23.65	3840	15	.039
36.83	3840	15	.252
—	3840	15	.214
—	3840	15	.201

.124 average.

3. *Clean Calico (Six Days Exposure).*

34.00	3840	15	.380
34.00	3840	15	.290

.330 average.

It thus appears that only 8 per cent. of the sulphur in the air is deposited on plates not covered with an alkali—i.e., in their natural condition.

The quantity of free or corrosive sulphuric acid deposited was too small to admit of accurate determination.

I find the same conditions are not present when I light the room with lamps as with gas, because so much absolute amount of light is not required when lamps are used. When you use gas you burn it in a chandelier in the centre of the room, but when you use lamps or candles you place them near where they are wanted on the table. There is also another thing—viz., that gaslights are usually clustered together, and form a strong ascending current of highly heated and light air, which ascends to the top of the room, and there remains practically fixed at the level of about the doorway, or a little above, so that the whole atmosphere about six inches above the down outlets is practically a heated, dry, and foul atmosphere, cut off from ventilation from the upper part of the room, and very destructive, no doubt, to all articles—books, and so on—which are exposed on the upper shelves of a library. Such an amount of carbon compounds in the atmosphere as I have mentioned would be injurious to health, and would show that ventilation was required, not on account of the sulphur products, but on account of that carbon matter. I have determined also the amount of condensation of those different products, and I find it was very small indeed.

By the COMMITTEE: I have exposed glass plates, and also clean washed calico in various parts of the room where gas has been constantly burnt—one of the rooms being the same as that used by Dr. Odling—and I find that the amount of sulphur deposited on those objects is exceedingly small. The total amount of sulphuric acid deposited was, on an average, per square foot of glass, after 24 hours exposure, only 100th of a grain, and that was nearly entirely in the non-corrosive form of sulphates. As Medical Officer of Health, I complained of the nuisance created in the King's Cross district by the use of lime. I called upon the company to abate the nuisance, and I went thoroughly into it, being at that time advising Mr. Patterson as to his patents.

Mr. MICHAEL: Did you not institute some experiments as to the ventilation of the lime purifiers in order to get rid of the nuisance?

Witness: I called upon the secretary of the then Imperial Gas Company.

Mr. CRIPPS: That is the general company.

Witness: The company carried out some experiments in the ventilation of the purifiers. I did not see them carried out, but I saw the result of passing air through them, and they were most disastrous. They made a far worse nuisance, and damaged the purifiers.

Cross-examined by Mr. CRIPPS: Those experiments were carried out at the Bromley works, but they did a great deal of mischief, and had to be modified; there was an injunction against them. I am not personally acquainted with the Beckton works. There has been a general tendency to remove gas-works from among the populations to places where it was supposed the nuisance would not do much harm, but there are still some remaining in the central parts of London.

Mr. CRIPPS: You have stated that where gas has been burnt there is

something deleterious, which you think can be accounted for by its being dry, hot air?

Witness: Dry, hot, foul air, but not foul from sulphur.

Mr. CRIPPS: There must be some compound arising from gas manufacture besides the mere heat and dryness, in order to produce the effects which you state.

Witness: Not from gas manufacture, but from gas combustion. I think the sulphurous acid is so small that it is quite inappreciable—something like one part to 1000 parts of the carbon products. That sulphurous acid is capable of becoming, by the intermixture of oxygen, sulphuric acid, but that is a very slow process, unless you have an alkali present.

Mr. CRIPPS: However slow it may be, it does become sulphuric acid?

Witness: If it is not removed; but it does not remain for a sufficient length of time in the upper part of the room to become an appreciable amount of sulphuric acid. If it did remain there, and there was no further ventilation, it would become sulphuric acid after a very long exposure—perhaps weeks.

Mr. CRIPPS: After the gas had gone on burning for weeks and months together?

Witness: Yes; but then you have at the top of the room an atmosphere which practically, after four or five hours, becomes uniform, and then we may take it that as much new products of the combustion of the gas are thrown in as old ones removed. Practically the amount of foulness is not going on accumulating, but represents an uncertain quantity.

Re-examined by Mr. MICHAEL: Gas is ordinarily burnt for a certain number of hours, and then for a much greater number of hours it is not burnt. I find from experiments that, in the course of a few hours—say five or six, or even less—if the room is well ventilated, it resumes its ordinary condition in which it was before the gas was burnt. I have found that in a small ill-ventilated room, on turning out the gas and leaving the door ajar, and going in the morning and testing the atmosphere again, it was practically the same as the day before, previous to the gas being lighted.

The COMMITTEE: Are we to understand that when the air at the top of the room is charged with a certain amount of this sulphurous compound, whatever it is, that it does not become any more charged, no matter how long the gas may be burning? Does the air give it off, or does it sink down to the floor; or what happens?

Witness: No doubt a small portion escapes by the ordinary channels of ventilation, if there are any in the upper stratum, and part of it passes into the lower stratum of the atmosphere; and just as much of the foul products in the upper stratum of air as passes down into the lower stratum will pass upwards from the products of combustion.

The COMMITTEE: Do you mean to say that the air is not capable of carrying or of containing at that rate more than a certain charge of these compounds?

Witness: No, I do not exactly mean that; but as the particles of combustion pass to the upper stratum of the atmosphere, they must turn out some of the old stuff that was there; and that just as much as is turned out or displaced in the upper stratum is raised from the lower stratum. It is just like a cistern tap with water running in—as much water must run over the top of the cistern as runs in from the tap. At the works near King's Cross, being in a populous part, they are allowed 5 grains more sulphur per 100 cubic feet than they are allowed at Bromley, and I believe the object of that is to keep down the nuisance.

Mr. James Layton, examined by Mr. PAULI.

I am a bookbinder, residing in Brewer Street, Golden Square. I have devoted a great deal of attention to finding out the best mode of preserving the binding of books. In 1843 there was an inquiry at the Athenæum Club with respect to the bad state in which the bindings of their books had got, and I was called upon to investigate the circumstances. The result was that I found there was absolutely no difference in the condition of the books in a room in which gas was burnt, and the condition of similar books in rooms in which no gas was burnt at all. After paying a great deal of attention to the matter, I came to the conclusion that the state of the books was attributable to the extreme temperature at the top of the room. In the north library there was no gas burnt, and the state of the bindings in that room were even worse than in some of the others in which gas was burnt. The temperature of that room was very high, owing to the flues of the kitchen, and the obvious conclusion was that those books went bad entirely from the excessive heat. I am also binder to the Royal Institution. Gas is there burnt continually in the reading-room, but there are very few books there. In the library they have gas occasionally—the secretary tells me about 19 nights in the year, not more—but the books there are in a very bad condition, the upper part particularly. They are quite as bad as in libraries where gas is burnt continuously. [Witness handed in a specimen of the state of the binding of many of the books from the library of the Royal Institution; another one from the library at the Travellers Club, where there is no gas burnt at any time.] I was acquainted with the Duke of Norfolk's library in 1863. There were two rooms—one the library below, and a room in which books were kept next the roof. There was a very great difference in the temperature of those two rooms. In the summer time, with the sun shining on the roof, the top room was very hot. The books in the lower library were in a very good condition generally, and suffered very little, but those in the top room were very dry and perished, and on removing them the binding would often break off. There was no gas in either of the libraries.

Mr. PAULI: Then I suppose the general conclusion you came to was that the burning of gas in a room has no practical bearing upon the condition of the books, but that the condition of the books was due entirely to the temperature?

Witness: No further than this, that gas, I think, is a great source of heat; I find it hotter where gas is burnt.

Mr. PAULI: But the decay in the books you attribute to the immense temperature? You have shown pretty conclusively that the presence or absence of gas has nothing to do with it?

Witness: It is the dry atmosphere, I think.

By the COMMITTEE: The temperature at the Travellers Club is generally very high, they being gentlemen who have been a great deal in the East, and they like the warmth.

Mr. CRIPPS said he should not cross-examine the witness on the present case.

Mr. MICHAEL said he should not trouble the committee with any further evidence.

Mr. CRIPPS said he should have very few remarks to make on the present case. It would be obvious to the committee that the question of the Crystal Palace Gas Company was no more to the Metropolitan Board of Works than the question of any other particular district within their jurisdiction. It so happened that a small portion of the Crystal Palace district was within the jurisdiction of the Board, and it also happened that the Bill next to be brought before them affected nearly the whole portion of the district under their jurisdiction. The question, so far as they were concerned, was to protect generally the interests of the gas consumers throughout the Metropolis, and it was quite obvious that the proper course for the Metropolitan Board to take was as follows:—There were parties applying for a privilege which the Metropolitan Board and the consumers believed would be detrimental to them, and, on behalf of

the Board, it was desirable to hear all the evidence given in favour of that charge. It was a very heavy onus which the companies were taking upon themselves. It might be that they would be able to prove the case they had undertaken; but as there would be a large body of evidence, scientific and otherwise, to be given in opposition, he (Mr. Cripps) asked, on behalf of the Metropolitan Board, that the decision on the present case might be reserved until all the evidence on the general case had been given. It was true that the counsel would not be the same in both cases, but there were representatives, and they would be perfectly able to represent the whole case when it came before the committee. The question of the gas supply of the Metropolis had been a matter of agitation between the gas companies and the consumers for a considerable number of years. Unfortunately, they had not felt their interests always to be identical, although they really were so, and would ultimately turn out to be so. There was no one a gas director looked upon with more suspicion than a gas consumer, except it was the Metropolitan Board of Works, who, as representing the consumers, were looked upon as worse than the consumers themselves. The consequence had been that, for some years past, a considerable contest had been going on, commencing from 1860 to the present time. A number of Acts of Parliament had been passed, conferring powers on one side or the other, all of which had been more or less compromises of the views of the two parties. In 1860, which was the inception of the matter, and the first Act in which the limitation of 20 grains of sulphur in 100 feet appeared, the gas companies rather than the Metropolitan Board originated the agitation which led to that Act. The companies obtained a very great advantage in that year, which should not be underrated on their part, which was that the Metropolis was divided into different districts, and a supply was given to a particular company, and appropriated entirely to that company, so long as they were able to supply the district, and so long as an inquiry before the Home Office, or something of that kind, did not alter it. Of course there were certain restrictions placed upon the companies, amongst which was the restriction that their gas should be free from sulphur compounds to a greater quantity than 20 grains in 100 feet. The Crystal Palace District Gas Company were not at that time sufficiently within the Metropolis to make that Act applicable, and they were exempted from its operations. In the meantime, the district, like all other districts round London, became more and more metropolitan. Ultimately, in 1873, the Crystal Palace District Gas Company applied for power to raise £150,000 at 7 per cent., which capital, under the Gas-Works Clauses Act, was to be offered in the first instance to the holders of the old shares. In return for that great benefit, the company had to submit to the likening of their district to what was common in other parts of the Metropolis with respect to the sulphur impurities, and they were limited to the 20 grains per 100 feet. That was the contract entered into with the consumers, and it was upon that the consumers rested their case. They said, "We allowed you to have certain benefits upon your incurring certain restrictions for our benefit. We made a great point of our desire to have the gas purer than it was before. You submitted to that, and you have gone on now for a certain number of years supplying gas of that purity, subject to penalties if you do not supply it, and you take a very heavy onus upon yourselves in coming to alter the bargain which you entered into with us at the time."

Mr. COURTNEY: You do not present it in that way. Your petition says it was a mutual bargain which had been paid for.

Mr. CRIPPS said one did not want to put everything in a petition. He was entitled to rely upon the whole case.

Mr. COURTNEY: You are here only to raise it upon the question of health—upon a sanitary question.

Mr. CRIPPS said that was a point he was coming to, but he was then viewing it generally, and therefore was entitled to take any objection. The undertaking the company gave had been carried out from that time till the present, but now they asked to be relieved from that responsibility, on the ground that it was impracticable to do it. They did not say, "We cannot give the gas pure," but all they said was, "It is an expense, and is inconvenient to us," and made them very unhappy; but were those real reasons? If it was any real injury to the company it could be proved, but they continued to divide their maximum dividends. They alleged it was an injury to the consumers, because if they could make their gas cheaper they could supply it cheaper, and every extra penny they paid for the extra purity fell on the consumers. Be it so. The consumers did not ask to be relieved from it. They preferred pure gas, and paid for it, and did not desire any alteration. Then they said, "Oh, but it compels us to make a nuisance at our works," but that was very indefinitely proved. It was very true that at the present time where the Crystal Palace works were was much more surrounded with houses than places where gas was generally manufactured in the Metropolis, but what did that amount to? Of course, if a nuisance was created at those works the company could be indicted for that nuisance the same as anybody else could be. But what was the evidence of that nuisance? There was a small memorial, signed by about a dozen persons, which was presented about two years ago with reference to what was being done at those works, and all that the memorial suggested was that the company should adopt some other way of taking away the impurities in a closed conveyance rather than in the way they were doing. What did the chairman say? He said, "We took it away in carts for some time, but now there is a great improvement. The trucks of the company come to the gas manufactory and take away the products direct; but we do not attempt to cover over the trucks." Surely, if the matter were so urgent, they could, at no very great expense, have some trucks made specially for that purpose. Of course, they ought to be so constructed as to be covered, and so prevent any nuisance; but even as it was, since they had adopted that plan there did not appear to have been any complaints at all—certainly none had been proved. The committee had simply the statement that it would be less expensive to the company if they had not to use that method. Under those circumstances, was there anything proved as a reason why the bargain of 1873 should be reversed? They had heard a great deal of evidence that it did no harm to have the 20 grains of sulphur, but surely the consumers were judges of that; it was purely a consumers question. It was not for the gas company to say, if the consumers desired to have that impurity, "You are mistaken, and are taking an unreasonable view." They might try to persuade a person that there was no harm in the gas he was breathing from time to time; but if he felt that there was, and if he did not desire to have any impurity introduced from which he was free, surely that was for the consumer. Mr. Livesey had told them it could be done, and also that during the very last quarter the amount had only been 17 grains in 100 feet. There was no difficulty in the matter; it could be done, and had been done, and the inhabitants of the Metropolis had had the benefit of it; and now, because of some doubtful evidence (for what could be more doubtful than those laboratory experiments about sulphuric acid?) was the whole Metropolis to be told they were to have gas more impure for the future, because they were asked to remove that restriction of 20 grains, whether the proposition in the present Bill was to be 30, or 40, or anything else?

The CHAIRMAN: Altogether removed?

Mr. CRIPPS said it was a simple repeal, so that whatever quantity of sulphur might be contained in the gas they were to submit to in future. In

all probability the quantity of sulphur would depend upon the coal that was used; and if it should turn out to be 60 or 70 grains, the answer of the company would be, "We have gone to Parliament, and they have expressly repealed, upon evidence, your protection; therefore, however great the impurity may be now, you are not entitled to make any difficulty about it. Your time was to have gone to Parliament, and you had the opportunity of asking the committee not to pass the Bill. They have passed it, and you must now submit to that impurity, whatever it is." He (Mr. Cripps) would not at that time deal with the scientific evidence, because it would be obviously foolish to detain the committee twice over upon a question of that kind; but as the matter stood, had the company shown that it was a perfectly safe thing to repeal the restriction imposed upon them? If not, it unquestionably ought not to be removed. The whole proof was upon them to accept the restriction in return for benefits conferred upon them by the consumers. Was there anything sufficiently certain and definite shown that the gas consumers would not be prejudiced if a considerably larger quantity of sulphur was introduced into the gas? Sulphuric acid, no doubt, was generated by combustion. The amount of that, and the degree in which it was injurious to health, was very doubtful; and the witnesses said that in their opinion—and it was only a matter of opinion—it would not produce any inconvenience. On all those matters, science, even at its very best, was most uncertain; because, after all, it was not the quantity, however infinitesimally small any matter might be, which was detected by the experiment in a particular form, which was necessarily not injurious. Unquestionably, from the evidence as it stood, it appeared that in the gas supplied there was something very injurious, particularly at the top of the rooms, or at a certain height. Some persons thought it was carbonic acid; some thought it was something dry and hot at the same time. It might be that particular matter which they desired to have excluded; and when the height of rooms was spoken of, surely those who represented the consumers must be taken as representing all classes. In some cases, perhaps, persons were so careful of ventilation by modern appliances that the difficulty might be prevented, but that did not apply to the mass of consumers, who lived in small houses, and in rooms which were necessarily very imperfectly ventilated. Without detaining the committee longer, he (Mr. Cripps) could not help thinking that no case had been made out why the Bill should be allowed to pass, or why that which had been the law of the Metropolis for 17 years, and had prevailed against this company since 1873, was to be repealed in spite of the wishes, and against the remonstrances of the consumers of gas, who were the real parties to be looked to in any legislation on that matter. It was really a consumers question, and on behalf of those consumers, who were represented by the Metropolitan Board of Works, he decidedly asked the committee not to pass the Bill.

The CHAIRMAN (addressing Mr. O'Hara) said that Mr. Cripps seemed to ask the committee to decide at once that the preamble had not been proved, but they did not think they could do so, and therefore it would be necessary to go into the case somewhat more fully than Mr. Cripps had done. From the way in which the Bills had been brought on, the committee felt themselves bound to hear the present case upon its merits, and to decide it without waiting for the evidence and the arguments in the next case; but if the parties could make any arrangement by which the evidence taken in the present case could be made use of in the next, it would be a great convenience, and would save time and expense.

Mr. O'HARA expressed a wish to consult with his clients (the Metropolitan Board), and after a short conversation the committee adjourned.

WEDNESDAY, MAY 2.

Mr. Charles Heisch, examined by Mr. O'HARA.

I am a Fellow of the Chemical Society, and the superintending Gas Examiner to the Corporation of London. For 24 years I was Professor of Chemistry in the Medical College of St. Thomas's and Middlesex Hospitals. During that time I have been much engaged in the examination of coal gas and its impurities. Under the Metropolis Gas Act, 1860, the limit of sulphur impurity was fixed at 20 grains in 100 cubic feet. By the City of London Gas Act, 1868, which was originally intended to apply only to the City, but was afterwards extended to some other companies, the duty of determining with what degree of purity gas should be supplied is in the hands of the Gas Referees, who are directed to fix such a maximum as the companies can comply with without creating a nuisance in the neighbourhood of their works. At the present time—i.e., from April to September—they have prescribed 20 grains for works situated near habitations, and 15 grains for those which are more removed. The Crystal Palace District Gas Company are, by their Act, required to supply gas with not more than 20 grains of sulphur, and I think if that restriction were removed entirely, it would be a considerable injury to the consumers. Before 1868 the condition of the gas delivered in London was very variable indeed. Before 1860 I do not think any records were kept of the amount of sulphur impurity present in the gas. The Act of 1868 came into operation in January, 1869, but the Referees were more than two years before they fixed the maximum. I think it was fixed somewhere about April, 1872. For the winter half of 1872-3 it was fixed at 20 grains for suburban works, but no quantity was named for urban works until June, 1873. That was owing to the fact of the Referees being engaged in making experiments, and to give time to the gas companies to make certain alterations which they considered necessary. During that period, the sulphur impurity delivered by different companies varied very considerably. The Great Central, whose works were situated on Bow Common, delivered gas which may be roughly said to have contained an average of something like 12 grains of sulphur in 100 cubic feet. The City Company were higher, going up frequently above 20 grains. They seldom got up above 23 or 24. Sometimes there was a run up to 30, but very seldom. The Gaslight and Coke Company's gas, as tested at Leadenhall Street, generally had an average of from about 32 to 38 grains; and when the Beckton Works were opened, the averages were, during the month of January, 1872, 44.8, and during the month of February, 44.9, and during the month of March, 37.9. Then there was a sudden fall—the average for the next month being 22.9. Then it went up again somewhat to 37 and 38, and just about the time when the maximum was fixed it went down again; in June, 1872 it went down to 12.6, and the next month it was 12, and so on. That was after the fixing of the maximum by the Referees; but when the works at Beckton were first opened, they for the first three or four months averaged from 35 to 45 grains.

Mr. O'HARA: Is the presence of sulphur injurious to property?

Witness: I believe it to be very much so.

Mr. O'HARA: Will you explain your views upon that subject to the committee?

Witness: I believe it to be injurious to property in this way: Although the quantity of sulphur is exceedingly small, yet burnt in the way that it is in gas it is not oxidized in the same manner exactly as it is when it is burnt in a dry state. Very large volumes of water, or of the vapour of water, are formed at the same moment as the sulphur is oxidized from the combustion of the hydrogen in the gas. Now, it is well known that if you burn sulphur, even in a damp atmosphere, a certain portion is converted into sulphuric acid instead of sulphurous anhydride. Now with the very large quantity of water which is specially formed during the

oxidation of the sulphur a very much larger proportion of the sulphur gets converted into sulphuric acid than it does when the sulphur is burnt even in a damp atmosphere, and of course much more than when it is burnt dry. All this matter ascends, and is trapped, as it were, in that heated zone of air at the top of the room, which Dr. Odling so very well described yesterday, and we have up there an aqueous vapour so far removed from its point of condensation as to be what would practically be termed dry, and we have the vapour of this mixture of sulphurous and sulphuric acid. When the fire in a room goes out, and it cools down, this aqueous vapour condenses, and carries with it certain proportions of sulphuric acid varying with the quantity of sulphur which there is in the gas, and upon all the articles in the room where the moisture condenses (and the condensation naturally begins on metal work, which is colder) you have a quantity of very dilute sulphuric acid deposited. When the room is heated up again the water evaporates from that, and it becomes more concentrated, and you get a second dose the next day your gas is lighted, in the same way, and it gradually increases until, upon substances capable of containing moisture or of absorbing it—which is the case with leather and textile fabrics—you get a considerable amount of sulphuric acid concentrated in the material, and thereby increase the injury. We find, practically, that if you wash the surface of metal work which has been in an atmosphere where gas is burnt, you invariably get off a sulphate of the metal which you are using, whatever that metal may be. Moreover, if you wash out from textile fabrics the substance which they contain, you find a very considerable quantity of sulphuric acid in it.

Mr. O'HARA: Have you, since the maximum of sulphur was fixed, detected any benefit or any disadvantage to your own chemical instruments?

Witness: Certainly. I have no hesitation in saying that our delicate metallic instruments do not suffer in the City, now, as they did previously, or anything like those that I have at home do, where I get gas with about 25 grains of sulphur in it. I have been furnished with a valise by Jenner and Knewstubb, of St. James's Street, which has been on a shelf for about two years. I believe that there has not been a fire in the room, but there has been plenty of air. It was a well ventilated room, where they burn a good deal of gas in the winter time. Here is the leather which is outside, and which you will see has gone a good deal—it has been absolutely eaten away. Now in the interior, which of course has been subject to the same temperature as the outside, though not to the same influences, there is the leather as sound as possible. The outside and inside straps I have taken off for the purpose of experimenting with them, and they are not here; but the outside straps were corroded even more than the leather is; the inside straps were perfect. The outside straps, when boiled in water, yielded 2.4 grains of sulphuric acid, and each inside strap which was in a perfect state yielded 0.6.

Mr. O'HARA: To what do you attribute that 0.6?

Witness: I think it may have been that some air got inside from the room, or it may have been that a certain portion of sulphur might have been used in the dressing of the leather.

By the COMMITTEE: The 2.4 and 0.6 grains are the absolute quantity I got from each strap. The straps are the same length exactly, and they had every appearance of being cut off the same piece of leather. This valise has not been exposed in any way, in travelling or otherwise, from the time I got it. It is a piece of spoiled new goods, and has never been out of the shop. It only came to me the day before yesterday.

Mr. PHILBRICK: This is something that you bought recently?

Witness: I did not buy it, they furnished me with it; it has been on the shelf at Jenner and Knewstubb's shop, and I can bring the foreman here if you wish to see him. There is another point to which I should like to call the attention of the committee; which is, that the quantity of sulphuric acid which you are capable of condensing along with the moisture increases very rapidly with the increase of sulphur. When vapours are very much diluted they are much more difficult of condensation than when they are a little stronger, and I found, experimentally, that from the gas with which I am supplied at home—perhaps I had better describe exactly what I did. My gas is supplied by the West Kent Gas Company. They are under the 20 grain restriction; but it is not looked after, and practically I find that they give us from 21 to 25 grains of sulphur—that I have tried. Now, what I did was this—I lighted a 4-foot burner in a small room, a room containing about 290 feet of cubical contents. I burnt this 4-foot burner for two hours; consequently, of course, I used 8 feet of gas; and I then put into the room a flask filled with ice, for the purpose of condensing the moisture which the gas had formed in the room. I left that in for three or four hours more, so that from the time the experiment was started to the time it closed 20 feet of gas had been burnt, which would contain nearly 4 grains of sulphur. The room has a window which fits very badly, unfortunately. It is a room with a boarded side, and there is a considerable crack in the boards, so that there is by no means an absence of ventilation in it. I repeated this over three or four times, and by collecting the water which was condensed on the outside of the flask, I found that on a half-gallon flask I could collect in that water from a quarter to half a grain of sulphuric acid. I have repeated the same experiment in a similar small room, which I happen to have in the City, with gas which, at that time, contained about 8 grains of sulphur in 100 cubic feet; or, at all events, under 10 grains, and from that, proceeding precisely in the same way, I could collect as a maximum only 9-100ths of a grain of sulphuric acid; that I believe to be due to the much greater dilution preventing its condensation. But, out of those two experiments, the one was 9-100ths, and the other of the two was only 5-100ths of a grain, whereas in the first we got from a quarter to half a grain, where the quantity of sulphur was doubled.

Mr. O'HARA: What deductions do you draw from those experiments?

Witness: Certainly, that the sulphur ought to be kept down to as low a point as possible.

Examination continued: There are still some companies under the Act of 1860. One of them is the Phoenix, at Greenwich. As a rule they comply with the 20-grain condition. I have tested for it; and in complying with the condition they do not create a nuisance. I lived for upwards of 40 years very near them, and I never heard of one, nor have the authorities of Greenwich ever heard of one either. I scarcely know, of my own knowledge, any other companies in the country that have gas-works and keep a low average of sulphur without creating a nuisance. I know, of my own knowledge, that they do keep under 20 grains at Bath, and I am informed by the local authorities there that they have never heard of any nuisance, but beyond that I cannot go.

The CHAIRMAN: Do you happen to know whether in all those cases they use the lime process?

Witness: Yes; they do.

Mr. O'HARA: Is it your experience, or is it your view, that this lime process may be conducted without creating a nuisance?

Witness: I believe that it may, but not being a practical gas-maker I cannot go so far as I otherwise might; but I believe it may, because I believe that it is done. During the time that I lived in the Phoenix Gas Company's district, or part of the time, the sulphur was not kept very low, but lately it has been kept down very well indeed, until within the last week or two. They are now altering their plant, and have been obliged to

pull down some of their purifiers; and at the present moment it is, or was a few days ago, rather higher, but that is accidental. A part of the district supplied by the Phoenix Gas Company is within my supervision as gas examiner. Therefore, I am tolerably well acquainted with the capacity of the works, and the results of their operations.

Mr. O'HARA: Are you of opinion that the repealing of the penalty which is imposed upon a gas company—on this Crystal Palace Gas Company say—is a matter that you approve or disapprove?

Witness: I should certainly be very sorry to see it repealed altogether, taking the consumers view of the question.

Cross-examined by Mr. PHILBRICK: Prior to the Metropolis Gas Act, 1860, the Gas-Works Clauses Act of 1847 was the general law throughout the country, and there were then no restrictions as to sulphur compounds. The first restriction in the Metropolis was in 1860. My functions in the City only began under the Act of 1868. Before that, as a matter partly of scientific research, I had had experience in the subject.

Mr. PHILBRICK: Between 1860 and 1868—that is the time when London was under the Act of 1860—was there, to your knowledge, ever any proceeding or complaint of any one of the gas companies with regard to the sulphur compounds on the part of any of the authorities?

Witness: There was an attempt made by the City, which, I believe, at that time were the only authority who had an examiner, but it failed, owing to the lack of jurisdiction. It never was gone into on its merits at all. There were actual proceedings in two cases; one was the Chartered, and the other was the Great Central. I think it was only the Great Central for sulphur compounds.

Cross-examination continued: I think something was known of these sulphur compounds before 1856. We were acquainted with the fact of their existence long before that time, because when I was assistant to Dr. Leeson, as long ago as 1845, we were making experiments to ascertain their quality. That there was sulphur in coal gas in other forms than sulphuretted hydrogen was a matter of ordinary chemical knowledge that dates long before chemistry reached its advanced state as a science. Sulphuretted hydrogen at that time was taken out of the gas by means of lime, and until the discovery of hydrated peroxide of iron that was the only means of removing it. I am not aware, of my own knowledge, that there were ever any legal proceedings taken by private consumers in the City, under the Act of 1860, in reference to the sulphur compounds. There were, I believe, numerous complaints sent in to the Corporation as to damage done to goods, with requests that they would take action. The testings by the Referees are now made on an average of three days; they used to be taken for each day.

Mr. PHILBRICK: Is it not a matter of fact that two testings hardly ever agree, even by your own examiners and with the same gas?

Witness: Within very narrow limits.

Mr. PHILBRICK: But as a matter of fact, the same examiner, with the same test apparatus, dealing with the same gas, does not ever get to identically the same results?

Witness: I would not say never, but not always.

Do you remember a case where it has ever resulted that a gas examiner has got identically the same results—I will go so far as that?—I think I can remember a great many when we have had two apparatus working simultaneously side by side.

That is two instruments side by side; but I mean when the examiner has repeated the process with the same gas?—I do not exactly know how you could do that.

I do not mean where he is conducting two operations simultaneously; but where he has completed his tests, one after the other, with the same gas, supplied by the same company, is it not the fact that the tests do differ?—We cannot do that; we cannot get the same gas two days running from the same company.

I am talking of two hours running?—The sulphur test is a test extending over 24 hours, one test; so that we can never have the same gas two days running.

You know the test, as I understand; I mean in the testing process as directed in the Act of Parliament, and kept by the companies, and by which, by the provisions of the Act, the companies have agreed?—Yes.

Is it not a notorious fact that the tests made by the officers of the companies, in this matter of sulphur compounds, never correspond to the tests of the gas examiner, that there always is a discrepancy?—I am not prepared to admit that at all. They are frequently in accord, and very frequently not; but then it must be remembered that the gas companies test at the works, and we test a mile away from the works—1000 yards it is called, but it is practically nearly a mile.

The nearer the works so the greater ought to be the proportion of sulphur, ought it not—there would be a certain condensation through the pipes, possibly?—There might; or if the pipes were foul they might take up some.

But the tendency would be, would it not, if there was a difference between the two, to show the presence of a greater quantity near the works than at a distant place away from the works?—That might be so or not; it would depend upon the state in which the mains were.

As a matter of fact, the tests of the gas examiners are in excess, as a rule, of those of the company for sulphur, are they not?—I have heard it stated occasionally that they are; but I have also been told that they agree very fairly, taking it altogether, because the tests made by the companies testers I know nothing about officially at all—it is mere gossip with me what their testings are.

Cross-examination continued: The shop in which the portmanteau produced was kept for two years is supplied with gas by the Chartered Gas Company, who, as far as I know, have kept well within the sulphur maximum prescribed by the Referees. The straps which I removed were boiled in water in a glass vessel. A very large proportion of the sulphuric acid obtained by that process was in the form of free sulphuric acid, but I did not make any distinction between that which existed as one or the other. I only took the relative quantities in that which had been exposed and that which had not been exposed, and a highly acid solution came out.

Mr. PHILBRICK: Now, is not there always in leather the presence of some acid?

Witness: Of some acid; yes.

So that, therefore, you began your experiments with something that had got in it that which you were professing to want to find? You took a body that had got a constituent in it that you wanted to find—when you began to experiment with leather that was corroded you began to experiment with a thing which anybody, *a priori*, with a little chemical knowledge, could tell you had got the presence of acid in it?—Yes.

Then if you have the presence of acid and sulphur, or if you have sulphur in any form, you can always safely say that there is sulphuric acid in it, can you not?—Oh, no.

How can you tell what quantity there is? How can you tell that there is any free sulphuric acid?—The acidity is so much more marked than it would be from other acids that I think there is no question about it.

Then because the acid tasted a little sharper in the straps of the portmanteau, you therefore concluded that it was free sulphuric acid, and you put it down to the gas. Is that the chemical result which, as a gentleman

of science, you are prepared to vouch here?—I do not feel any doubt about it at all.

Into questions of doubts in your mind, if you will pardon me, I will not enter before the committee; I want the question of chemical science, and fortunately I have the assistance of a gentleman who is able to keep me right?—In this particular instance I did not estimate the free sulphuric acid, but I have so often found free sulphuric acid under similar circumstances, about which I have not the slightest doubt, that I did not go into it in this particular instance. I merely took the comparative quantities of the two straps.

In giving the instance before the committee, I presume you were examined upon it, on the part of the Metropolitan Board, to bring about certain results. I will not go into any other cases than the one before us. Let me ask you, as a scientific man, how, as a chemical result, you can undertake to affirm that there was present in these straps free sulphuric acid?—I confess that I have made a slip upon that point on this particular occasion.

Mr. PHILBRICK: You shall pack up that slip in your portmanteau, and take it away.

Cross-examination continued: The experiment which I made in a little room at my house which contained 290 cubic feet of air, and in which I burnt the gas with a 4-foot burner, and condensed the vapour upon an ice vessel, was repeated by me in the City with the gas supplied by The Gaslight and Coke Company, who at the present time keep well within the restrictions of the Referees as to sulphur compounds. That room was rather less than the other. It was not without ventilation; it had no chimney, but was by no means hermetically sealed. The quantity of sulphuric acid I then obtained was very minute in any form.

Mr. PHILBRICK: Now it seems to me (I may be ignorant upon the matter) that if the West Kent Company were working down to about 20 or 25—your phrase is—and even to 30 grains of sulphur per 100 cubic feet, and the general result was half a grain, you ought to get from one-eighth to one-quarter if The Gaslight and Coke Company were working with half that quantity?

Witness: Not at all; but that is just the point that I want to bring out—that the sulphuric acid, however it may be in the vapour, is much more easily condensed when it exists in a larger quantity. Although the gas may really contain twice the sulphur, the condensed water will contain a great deal more of the acid produced by its combustion than twice the quantity, simply because, where the vapour is very diluted, it is much more difficult to condense; we have a number of instances of that.

I thought that condensation was dependent upon the temperature, and not upon the volume. What is the boiling-point of sulphuric acid?—I really forget—something between 300° and 400°.

Nearer 600°, is it not?—I suppose it is, but I really forget at this moment.

It is not between 300° and 400°, but nearer 600°. You say that it is more difficult to condense vapour that is in a more liquid form?—That is mixed with a very large quantity of other vapours, such as a very large quantity of the vapour of water, and a very large quantity of atmospheric air, and so on.

You mean to say it is difficult to condense the contents of a product, or difficult to condense the constituents of that product and separate it?—I mean that the same temperature would not produce the same amount of condensation relative to the contents.

If you say that there is a great difficulty in the condensation, is not that condensation the mode of test which the companies have for these sulphur compounds, and which they have to comply with under penalties?—That is by condensation in rather a different sense of the word; it is by condensation in condensing with alkali, and not attempting to condense it as it exists.

Have you, for the purposes of the experiments that you have been detailing to the committee, adopted a different mode of test to that which the Referees prescribe?—I was not simply testing the sulphur in the gas, but estimating the amount of sulphuric acid condensed on a cold article in a room in which gas had been burning.

And therefore arriving at the conclusion that whatever you condensed in the room on a cold surface, or a vessel filled with ice, must necessarily be due to the gas?—Not absolutely.

Cross-examination continued: I believe the Phoenix Company used lime exclusively for a very long time before oxide of iron was introduced. I left Greenwich in 1869. I do not know whether that was before the necessity for using lime again commenced. Gas is generally burnt in work-shops, but I cannot answer the question whether it is rarely burnt in the dwellings of artisans in London. I regard the sulphur compounds as a nuisance which ought to be eliminated as far as possible. Where gas-works exist in crowded places there is a difficulty in the removal of these compounds by means of lime; I do not say it is an insuperable difficulty. I said that, as a matter of observation, there is sulphuric acid found upon metal surfaces, varying in proportion to the sulphur compounds in the gas. What I mean is this, that, if you take metal-work which has been exposed to gas containing a great deal of sulphur, and that which has been exposed to gas containing very little sulphur, the same quantity being burnt in a room, you will find a great deal more of that metal converted into a sulphate in the one case than in the other. I believe this has been detected where 35 grains of sulphur compounds per 100 cubic feet have been present as against 15 grains. I think I could point to several cases in my own house. I have frequently washed off the sulphates of the metal from the surface of the metal-work. It must be sulphuric acid to make a sulphate of the metal. I refer principally to fine polished brasswork, and things of that sort; the brasswork of one's instruments, which do not have to be cleaned with preparations containing acid.

Mr. PHILBRICK: Seriously, are you meaning to represent to the committee that you can differentiate between what you wash off when you have been burning 30 grains of sulphur compound in 100 cubic feet of gas, and another quantity—a less quantity?

Witness: No, I do not mean to put it in that form; but I do say distinctly that I can, with the gas with which we were supplied in the City, freely expose delicate instruments in a way that I cannot do if I burn gas at home.

Re-examined by Mr. CRIPPS: I understood Mr. Philbrick to ask whether the quantity of acid bore any proportion to the quantity of sulphur existing in the gas, and I say that I find practically that it increases more rapidly than the increase of the quantity of sulphur. As an abstract proposition, I assent that it would be desirable to eliminate the sulphur compounds, if it is possible without creating a nuisance. Assuming it to be a nuisance, however, it is a nuisance limited in its operation to a certain number of persons resident in the neighbourhood of the works, whereas the benefit to be derived from taking it out of the gas is a benefit to the whole of the consumers.

Mr. CRIPPS referred to the examination of some of the witnesses before the Select Committee on the City and Metropolis Gas Bills in 1866-7 to show that complaints had been made, subsequent to the Act of 1860, of the impurity of the gas supplied in parts of the Metropolis. On his proposing to read a part of Dr. Letheby's examination,

Mr. PHILBRICK objected, and said: Dr. Letheby, we know, altered his mind before he died.

Mr. CRIPPS claimed his right to quote it, as the evidence on these Bills had been referred to this committee.

Re-examination continued: I have no doubt that sulphuric acid has helped very considerably to effect the corrosion of the leather of the valve I have shown here. I do not say there would have been no corrosion without it. I am not able to say that some other compound may not possibly have had to do in effecting it, but I know that sulphuric acid has been present, and has had its share in doing the mischief.

The CHAIRMAN: Besides the injury which you suppose is done to the brass and to the leather by this sulphuric acid in the gas, do you think it does any harm to human health or life?

Witness: I could not speak very positively—my own impression is that it does irritate the breathing organs and the eyes; but I could not say positively on that point.

In any appreciable degree, do you think?—I think so, but I would only give that as an individual opinion.

You do not know any instance in which you have traced, to your satisfaction, to that cause, irritation of the eyes?—I think I may say to the use of gas; but I would not say positively to the sulphur in the gas. I could not go to that length.

Mr. PHILBRICK: I may mention that Dr. Letheby, in the evidence that my learned friend has read, expressly said that it did not affect human health. He said that he could not say it affected human health.

Mr. CRIPPS: It is only fair that I should read this; he is asked whether these compounds are not pernicious, and then the question is put: "Because it forms sulphuric acid, or oil of vitriol, which destroys fabrics?—A. That is so; it quickly becomes sulphuric, it first forms sulphurous acid, and this, by taking more oxygen from the air, becomes sulphuric acid, or the acid sulphate of ammonia, which is very corrosive, and rapidly destroys fabrics; we have seen so much of that, that there can be no question about it, whatever theory may be formed of the nature of the compound, that is a destructive agent." Chairman: Destructive of what?—A. Of all kinds of textile fabrics, especially to paper, linen, leather, and also to brass-work. I know that unlacquered brass-work will not stand as it did formerly; it cannot be exposed for any time to air without undergoing corrosion. Q. And human health?—A. I do not think it affects human health much. That is the exact answer?

Witness: That is all. He does not say that it does not affect human health, but he says he does not think it affects it much.

The CHAIRMAN: Do you know what was the nature of the complaint on which the legal proceedings were taken by the City, which you mentioned against the gas company? What was it that they complained of exactly?

Witness: Their complaint was an excess of sulphur over the 20 grains allowed by the 1860 Act.

Mr. Thomas William Keates, examined by Mr. CRIPPS.

I am consulting chemist and superintending gas examiner for the Metropolitan Board of Works, and consulting chemist to the River Lea Conservancy Board, and have had very large experience. For some years past I have been very much engaged in investigations as to gas matters in the Metropolis, and was for two years also chemist to the City of London Gas Company.

Mr. CRIPPS: Let me direct your attention to the main point I want to ask you about. Of course, we assume that the only reason why this impurity should not be removed is the probable nuisances being created by the lime purification?

Witness: Yes.

Has your attention been specially directed to that question with a view of seeing whether that nuisance could be removed or mitigated—that is, the nuisance created at the works by the purification?—Yes, I have had opportunities of examining that question, and I have considered it very much, and I am of opinion that the nuisance has been greatly exaggerated and that the removal of sulphur could be effected to a moderate extent without creating any nuisance. It would, of course, mainly depend upon whether the lime, which has been used at the works for purification, could be removed without a nuisance.

First of all, what have you thought with reference to the possibility of disinfecting or mitigating the unpleasantness of the compound in the purifiers, which is made of the lime, for the purification of the gas?—I think that can undoubtedly be done. When the inquiry was going on before the Commissioners for the Board of Trade some years ago, I produced lime that had been disinfected in the purifiers, and that lime was completely inodorous; there was scarcely more smell in it than in a piece of chalk. And last year I had occasion to visit the works at Bromley. I was there with the late Dr. Letheby, when one of the large purifiers was opened. I then took a quantity of lime from the different shelves of the purifiers, and examined that lime, and found that it was quite disinfected. The noxious material in the foul lime has been already stated to be sulphide of calcium, which is an active principle used in taking out these sulphur compounds. That sulphide of calcium is a very foul, stinking material, and on this occasion I found that it was almost entirely removed from the lime.

Mr. PHILBRICK: I do not like to object to my learned friend's line of examination of Mr. Keates; but I must remind the committee that the allegations which are made on the part of the Metropolitan Board are not that any nuisance that is now existing, or might exist, from the impurity of these articles, can be removed or mitigated; but that the allowing of the presence of these sulphur compounds in gas would be very prejudicial to the sanitary condition of the district.

Mr. CRIPPS: Then that raises the whole question. The answer to that is that it cannot be done because it creates a nuisance, and the rejoinder to that is that it can be done without creating a nuisance.

Mr. PHILBRICK: I will not press my objection.

Mr. CRIPPS (to witness): Will you go on with what you were saying?

Witness: I was stating that the lime removed from the purifiers was completely disinfected, and I understood that that process was in current use. It had been first rendered foul, so as to make it capable of taking out the sulphur compounds. I think there are three different methods by which it can be done—one is by passing air through the foul purifier; another by continuing to pass crude gas through until the lime is converted into carbonate of lime; and it can be done by passing the products of gases from a furnace through the purifier—that was an invention which I think was used by Mr. Mann at the City of London works, and was patented by him—i.e., passing the heated gases from a burning furnace through the purifier so as to use the carbonic acid which was produced by the combustion for decomposing the sulphide of calcium and producing carbonate of lime. As far back as 1859, I think, during an inquiry in connexion with a Bill promoted by the City of London Company for a new charter, strong evidence was given by many scientific witnesses upon the point that lime can be converted into carbonate without difficulty, and can then be removed without being at all a noxious thing.

Assuming that it were possible in either of those ways to do it, that probably might involve increased expense?—I do not know, but I think the companies are mostly prepared to do that at the present time. I know that it has been put forward as a plea that in some cases the companies

were making alterations in their purifying plant, and when those alterations were completed, they would be able to carry on those processes.

But setting aside any question of expense, of course you will probably say that, if it can be done, the consumers are entitled to insist upon it?—I speak of the thing as a chemical fact more than as a question of anything else.

Now, if that were done, would the lime when it came out of the purifiers be free from that noxious smell which it has at the present time?—Comparatively free. No materials in a gas-works can ever be turned out quite free from smell; they all carry with them their characteristic odour of gas, and so far as I am aware nothing will remove it entirely. That applies to everything. Oxide of iron, which I believe is supposed to be a perfectly innocuous thing when it gets out of the purifiers, has that peculiar gas smell which cannot be got rid of so far as I know.

Probably it could only be mitigated, at least in the gas-works, being in a part where the population is not very thick, and removed as far as it can be?—I suppose that is the only entire remedy for it.

That is a matter that has been going on from year to year for some time past?—Yes, now some of the larger gas-works are removed from London. The largest gas-works, the Beckett Gas-Works, are some miles down the river; the Bromley works have also been removed from the neighbourhood of houses.

What you suggest would remove the special difficulty supposed to be created by lime purification?—Yes, the lime purification *quoad* this particular question.

Would it at all prevent the lime being used, as it is used now, for taking out the sulphur compounds ultimately?—The sulphur compounds are taken out by lime, the sulphuretted hydrogen is taken out by oxide of iron, and to that extent it would remain as it is; the oxide of iron would still be used partially.

Cross-examined by Mr. PHILBRICK: It is necessary to use the lime in the second set of purifiers, if you adopt Mr. Patterson's mode, in an exceedingly foul state, so as to absorb these other sulphur compounds. I know that passing air through the purifiers has been tried at Bromley, and that the actual effect of doing it was to produce an explosion; but will you allow me to explain? I am told that that has happened, and I can easily believe it is so, but it does not follow at all that that system might not be improved so as to avoid this difficulty. I may say that when I was at Bromley, on the occasion that I mentioned before, they were passing air through one of the large purifiers then; they had been passing crude gas through the purifiers for a considerable time, until they had converted all the lower layers into carbonate of lime from the carbonic acid in the crude gas. Then they had reversed the process and had passed air downwards, and by that means they had converted the upper layers of lime chiefly into sulphate of lime, and there the process was going on, and I did not understand that there had been any difficulty about it.

Mr. PHILBRICK: Did you hear of the fact that the trays had been set on fire?

Witness: I admit that may be the case; when rapid oxidation goes on, you are subject to that sort of thing, but I do not admit that it cannot be remedied.

At the present moment Bromley is the only place where that system of driving the air through the trays of the purifiers has been attempted?—There was some system of the kind, I cannot tell what exactly, in operation at Fulham some time ago. I know that Fulham has always been bitterly complained of; but it does not follow that the cause of the complaints might not be remedied. I had occasion to go to Fulham some two or three years ago in consequence of a nuisance. I was instructed by the Board to go and see the works, and I went and I found that that complaint did exist, but I was told in the works that it would be very soon remedied. I made a report upon it at the time. The second mode I mentioned was passing crude gas through. That is the method by which this foul gas is made in doing that to extract the sulphur compounds. I do not know that it is practised to the extent of going so far as I am saying. It can be done without difficulty, and it was done in the case that I spoke of in one of the purifiers at the Imperial works, and there the change was most effectual, and I found 90 per cent. of carbonate of lime. The effect of that is to carry the sulphur on in the gas necessarily, but then you see, according to this system of purifying gas from the sulphur compounds, it is a necessity, and the passing on of this sulphur becomes a useful thing, and not a detrimental thing, because it can be employed in converting fresh portions of lime into foul sulphide, which will afterwards act upon the sulphur compounds. In a sense the effect of it is to postpone, in one stage of the process, the purification.

Now the third one, in which you drove heated air from the furnace through the purifiers, is a process which has never been carried into effect at all?—I do not think it has, but it was advocated by one of the most practical engineers of the day—Mr. Mann, of the City of London works. He never carried it into execution himself, and nobody else has adopted it.

Did you test for these other sulphur compounds on the part of the gas company as against Dr. Letheby when he was testing on the part of the City?—I did.

As a matter of fact, let me ask you, in testing for them with this operation of nicety, did your tests practically agree? Was not there considerable discrepancy?—I do not think there was. There were occasional discrepancies, and very large discrepancies; then the thing was brought to a test on a particular occasion. There were continued disputes, I may say, between the company and the corporation at that time. On one occasion I went to the London Hospital, and Dr. Letheby went to the works; Mr. Warrington, of the Apothecaries Hall, went to my laboratory in Blackfriars, which was at that time the last place on the gas-mains. I may say it was in reference to the Great Central Gas Company that these disputes were arising, and then, by-the-by, I was testing for them, and not for the City of London Company; but on this occasion, some five or six of us made a similar experiment at seven o'clock in the evening, and we got exceedingly coincident results.

You got coincident results; but prior to that time when you had been testing, or assuming to test, the same gas, were there coincident results?—I tested the gas of the City of London Company for several years, and there were occasionally very great discrepancies between myself and Dr. Letheby.

Do those discrepancies arise from errors on the part of the observer, or from that which is inherent in the mode of testing?—You ask me a question that I cannot possibly answer. With regard to the errors on the part of the observer, I cannot tell you about that; I can only tell you that I think I was right. It is not a delicate operation to test for these other sulphur compounds. It is an operation that is carried on in some places in London every night. I am willing to admit that you never get exact concurrence, but you get it so close that you may take the result as being practically true.

Now just as to this matter—as to the presence of these sulphur compounds in the gas—supposing there to be, I will assume, 20 grains, which is the limit—in order to get 20 grains you have to work to a minimum—you have not much less than that in practical gas-making?—I suppose you have to have a margin of safety.

Practically you require 20 grains, in order that the gas-maker may be

safe, he has to work down to 15?—He would have necessarily to work to something less.

Now take the gas which would be supplied under a restriction of 20, and which would be 15 or 16, or whatever it might be; and take a gas which had 30 or 35 grains of those other sulphur compounds in it per 100 cubic feet. Do you say, as a gentleman of experience, that practically to a consumer burning that gas there would be any real difficulty or difference?—I am myself rather in favour of relaxing the limit. I think that a little above 20 grains may be allowed, but I think that it would be the greatest possible mistake to remove the restrictions altogether.

How much would you give, then?—I think even 25 or 30 grains might be allowed, but I think that there ought to be a strict limit put upon it.

With regard to the limit, that is a matter of policy and discretion, but with regard to the 30 grains, you would say, as I understood you, this—that if the process of purification by lime can be conducted, if proper appliances be used, without creating a nuisance, you still say it is not weighing one nuisance against the other, but you say you would not object to even 30 grains of sulphur in 100 cubic feet of gas, in the interests of the consumer?—I think it would be straining the thing in favour of the company; but when you consider the expediency between a nuisance created and an advantage to be gained, I think that 30 grains may be allowed.

You say that would practically bring it down to 25?—That is the way you put it; but I do not think it is so really.

In order to get at the limit of 20, you will have to use quite as much lime as if your limit were 30, would you not?—I think certainly not.

You would have to put not quite so much lime, but you would have to have as large a surface of lime at a time employed?—Even supposing that was so, that would make a great deal of difference in practical gas-making in the works.

Cross-examination continued: I have said, in a letter which has been published, "It will be seen that the talk which is made about the sulphur in the gas is, after all, practically a thing of very little, if of any consequence from a sanitary or economical point of view." My opinion is not in the least changed as far as all that goes. Bisulphide of carbon has been actually burnt in a lamp specially contrived by me, and used for disinfecting and antiseptic purposes. The bisulphide of carbon is a compound of sulphur which in burning gives off an enormous quantity of sulphurous acid. Some time last year a paper of mine was published in the *Lancet*, recommending the use of bisulphide of carbon to be used for disinfecting purposes; but if you put a lamp here, containing bisulphide of carbon, which is a liquid like spirits of wine, it would be impossible for you to stop here after a minute or two. It is the same thing that you get when you burn sulphur. If you burn a quantity of sulphur, you very soon bring the atmosphere into a state in which you cannot breathe, and that is just what happens when you burn bisulphide of carbon.

Re-examined by Mr. CRIPPS: Bisulphide of carbon may be very useful as a disinfecting agent, but extremely disagreeable. There is no comparison between the things—not the slightest; if you light a brimstone match, and hold it to your nose, you will, in fact, be getting sulphurous acid. The testing under the Act of Parliament for sulphur compounds is not one testing only, but since last year the average testing of a day. In the case of a penalty the average of three days must be taken.

Mr. CRIPPS: That is with regard to the Chartered Bill, is it not?

Witness: Yes; I was thinking of the law in the Metropolis. I do not know how that is in the Crystal Palace Act.

Mr. PHILBRICK: It is a simple testing in our Act.

Mr. CRIPPS: If it is so, I am wrong.

Mr. PHILBRICK: In our case it is a single test on a single day, one test on one day, and we have had to pay the penalty.

Witness: It does not say anything about the average of any number of testings. It cannot be otherwise, because the testing for sulphur occupies the day; therefore there cannot be any average of testing, the test is going on during the whole day—it is continuous. It is continued for about 20 hours—the gas must burn that time.

Mr. CRIPPS: You say very properly that for the purpose of avoiding a penalty, the care to be taken at the works would always go somewhat beyond the exact amount of the penalty?

Witness: It must do so just exactly in the same way gas companies are obliged to give something above the illuminating power in order to secure the minimum.

Whatever that amount may be does not matter exactly. Now with reference to what I asked you in chief, and what my learned friend has been upon, about those three modes of purifying by lime, which is an important point. He puts it to you that by passing in the air, on some particular occasion, an explosion was produced. I understood you to say that that explosion is not a necessary effect of what you suggest should be done?—The explosion, I take it, happened in this way. The air passing into the purifiers expelled the sulphuretted hydrogen, which is a combustible gas, and when sulphuretted hydrogen is mixed with a certain quantity of atmospheric air it becomes an explosive compound; and what happened, I take it, was this, that, as the lime was passed into the retort, it discharged the sulphuretted hydrogen, and this, being mixed with the air, went into the furnace, and an explosive mixture necessarily was formed, and it exploded. I do not know, but I should think, as an engineering question, that that difficulty might be got over in this way, that these gases might be passed through a sort of supplemental oxide of iron purifier which would take out the sulphuretted hydrogen at once; and, therefore, it would not be necessary to burn it at all. The accidental occurrence of that explosion does not alter my opinion about the feasibility or practicability of the thing.

Mr. PHILBRICK: It was the air going through the oxide in this case, I am told.

Witness: Of course, I do not know; but I do not see what the air going through the oxide could have had to do with the defecation of the lime purifier; it does not relate to these matters at all.

Mr. CRIPPS: You consider that that could be done?

Witness: I think that it could be; it appears to me the only difficulty is an engineering difficulty, which might easily be got over.

Then, again, with reference to putting gas through, it is put to you that that would postpone the process of purification—would that signify at all?—No; I think it is very much a question of space; I suppose that is one of the great difficulties that gas companies, particularly London companies, have been always placed in; the want of space for extending their purifying plant; but that certainly would not apply to companies outside, where they have abundant space.

The CHAIRMAN: Do I understand your evidence to be that you hold that the difference between 20 and 30 grains of these sulphurous compounds does not make any substantial difference to the injury done to leather, metals, and so on?

Witness: Of course, whatever difference it would make, the effect of sulphur is, no doubt, in exact proportion to its quantity; therefore 20 grains produce a certain quantity of sulphurous matter in the atmosphere; 30 grains would produce one-half more; and, therefore, whatever the effect of 20 grains would be, the effect of 30 grains would certainly be greater in that way.

Do you agree that the presence of this sulphurous matter in the gas which we burn has to any extent an injurious effect upon pieces of leather?—I think that question has been very much exaggerated. There is no doubt at all about the fact that you actually find sulphuric acid in things that have been long exposed to the action of gas. I have taken down for the purpose of experiment, within the last few days, a line which has held up a picture for a great many years in a room. I thought it was fairer to examine that than it would be to examine leather, which is sometimes treated with materials containing sulphuric acid in some form. I have examined this line, and I find it does contain sulphuric acid in a small quantity; it contains sulphuric acid in the free state—some portion of it is neutralized, and some portion of it is in a free state, but you can obtain from this piece of material, without the slightest difficulty, indications of sulphuric acid. That piece of line had been up for a long time. I cannot remember in the least when it was put up, but I should think it must have been up 20 years; it has been hanging in a room in my house, and I thought that that was a good material to experiment upon.

Might I ask you, with regard to the sulphurous compound or sulphuric acid, do you believe that the presence of the sulphurous ingredients in the gas is injurious to human health or life?—No, I do not, in the small quantity in which they exist.

Do you believe that the other one—the nuisance of the sulphide of calcium produced by the lime process—is injurious to health or life?—No; I do not think it is. It is a foul thing, and it is a very offensive thing; but I never have known cases of damage to health that could at all be attributed to the effect of gas-works. I think rather the reverse is the case. In inquiries that have taken place, I think it has always been shown that gas-works are ordinarily healthy places.

Mr. PHILBRICK (through the committee): Will you tell us whether in that room where the line was, there was gas burning, or only a coal fire?

Witness: There were both; it was a little library, which is lighted every night with gas in my house at Dulwich.

Dr. Edward Frankland, examined by Mr. O'HARA.

I am a Professor of Chemistry in the Government School of Mines, and also a Doctor of Philosophy, a Doctor of Common Law, and a Fellow of the Royal Society. During the greater part of a quarter of a century I have frequently been called upon to make investigations connected with the manufacture of coal gas, and I have had many opportunities of inspecting gas-works, and have seen the processes carried on there. Besides sulphuretted hydrogen, crude coal gas contains bisulphide of carbon, or bisulphuretted carbon, as it is frequently termed. The other compounds contain both sulphur, carbon, and hydrogen, and all those compounds when burnt alone yield practically the same products of combustion—that is, chiefly sulphuric acid and partly sulphurous acid. Until about the year 1856 the purification of gas was effected by means of lime. I think that was about the time that the change took place. The purification by lime removes not only the whole of the sulphuretted hydrogen present, but also a large portion of the other sulphur compounds—the bisulphide of carbon and the sulphur organic compounds as they are called; whilst peroxide of iron removes only sulphuretted hydrogen. My experience would lead me to say that, under the lime process, the number of grains of sulphur in 100 cubic feet of gas would, on the average, rarely exceed 15. I mean to say that the quantity of bisulphide of carbon and other sulphur compounds, other than sulphuretted hydrogen, will not contain more than 15 grains of sulphur to the 100 cubic feet of gas after purification by lime. The peroxide of iron system leaves a quantity varying from about 28 or 30 grains to 40 grains of sulphur per 100 cubic feet. Perhaps I ought, in completion of the answer to your former question, to add that the proportion of those sulphur compounds in gas depends very much upon the way in which the gas is manufactured. If the gas is manufactured at a very high temperature, by which a large quantity of gas is produced of a lower illuminating power, there is always much more of those sulphur compounds than are present when the gas is subjected to a lower temperature, so that it will necessarily vary in different gas-works. During the combustion of coal gas a considerable portion of the sulphur is converted into sulphuric acid and the remainder into sulphurous acid, but this sulphurous acid, diffusing itself through the atmosphere of the room, passes very quickly into sulphuric acid, and I should say that for all practical purposes it may be held that in a room in which gas is burnt freely in the open air of the room, all the sulphur passes into the state of combination known by chemists as sulphuric acid, or oil of vitriol; and 100 cubic feet of gas containing 40 grains of sulphur would produce, when burnt, rather better than 122 grains of oil of vitriol.

Mr. O'HARA: Now, what becomes of the oil of vitriol?

Witness: As oil of vitriol cannot exist as a gas at the ordinary temperature of a room, it condenses to minute drops—to the very minute kind of drop that you have in a fog—and floats about in the room until it is either removed by ventilation or attaches itself to some object in the room. Those minute drops are too small to be seen by the naked eye, except under favourable circumstances. You can see them if you pass a ray of sunlight through the room, or a ray of electric light; you can see that the air is filled with minute drops of something; but then, as there are so many minute drops of other kinds of liquid, I do not mean to say that you can see the sulphuric acid drops amongst the others. These drops attach themselves to walls, furniture, decorations, and so on. They destroy books, and corrode gilding and paperhangings, and so on. They perform all those reactions which are well known to follow the application of sulphuric acid. I may mention, as a matter of my own experience, within my own house, during the last few years, that I have found the bell cranks to be very powerfully corroded in the butler's pantry, where those bell cranks are placed near the ceiling, and therefore get rather a large dose of the sulphuric acid so produced by the gas. Those bell cranks, being corroded, stick fast from time to time, and on examination I find that they are covered with the crystals of sulphate of copper. Of course, sulphate of copper, I need not say, is the product of the action of sulphuric acid and air upon copper.

In the total estimate of the damage to goods, can you give us any ratio of the proportion of damage by gas?—No, I cannot.

Mr. PHILBRICK: A compensation case?

Witness: The damage caused is not merely proportional to the quantity of sulphur in the gas, but I should say it would be likely to increase at a more rapid rate than the increase in the proportion of sulphur in the gas; but that is a matter of opinion.

Mr. O'HARA: Have you anything to say about the comparative results of burning gas in Liverpool, Manchester, Edinburgh, Glasgow, and London with reference to this sulphur?

Witness: I think that the illuminating power of the gas that is burnt is a very important factor in the case, because, if for the production of a given quantity of light you require to have a large volume of gas, you will get more sulphuric acid produced in your room than if you are burning gas of a higher illuminating power; and, as the gas with which we are supplied in London possesses very low illuminating power as compared to what is supplied to many other towns in the kingdom, I think that is a very important element in the matter, and that it is desirable that the

sulphur should be kept down in the London gas to the lowest practicable amount.

In your opinion, as to the use of lime for the purification of gas, if it is attended with proper precautions, should it cause a nuisance in the neighbourhood?—It certainly would not with proper precautions. I have known the process carried out in Manchester, where I lived for six years, and had an opportunity of seeing this process of purification by lime carried out. There was practically no nuisance to be complained of at the gas-works, but there was a nuisance by carting this lime through the streets. It was originally carted away in open carts, and, of course, the lime smelt abominably as it passed through the streets. That was really an unnecessary thing, as it could have been taken in closed carts, and then, of course, there would have been no nuisance of that kind. It was not in consequence of the process at all, it was the careless way of doing it.

Supposing for a moment that it was necessary to devise another process, can you state to the committee how, while still using peroxide of iron, the sulphur might be removed from the gas in a different, and, perhaps, in a more satisfactory manner?—There are several processes which have been proposed from time to time, and one of them, at least, has come into practical use, I believe; but I am not able to speak, from my own observation, as to its success. One of those methods, and the oldest of them, is that known as Bowditch's process, which consists in passing the gas over heated lime, lime heated to about 500° Fahr., and maintained at that temperature. The sulphur compounds which I have been speaking of are, by contact with this hot lime, transformed into sulphuretted hydrogen, which can be then removed by passing over peroxide of iron, and getting rid of sulphuretted hydrogen, that is clear. I mention this method as a process that could be used if it were again found desirable to substitute the peroxide of iron for the lime purification, because then the peroxide of iron would remove the sulphuretted hydrogen caused by the heated lime. The heated lime goes on performing this function for a very long time, it is very long before it gets exhausted, so that there is practically no expense in the lime; the only cost consists in the provision of the plant, and in the maintenance of the lime and gas at the temperature of 500° whilst the action is going on. The quantity of lime is infinitesimal here.

Then, with reference to the plant, you said it was simple plant?—I think so; but I am not an engineer, and I have not seen it erected on a large scale, so that I would rather not say anything about it. That is one of the processes. I said there were three of them. The second process is the invention of Mr. Vernon Harcourt, who substitutes porous materials of various kinds for the lime, and finds that they will, to a certain extent, at least, perform the functions of lime. I have no experience of that process, and have only heard that it can be used in that way.

The substitution of porous substances, such as brickbats, and so on, for lime?—Yes. Then there is a third process, which, I believe, has been extensively used in the Manchester Gas-Works, and that is Mr. Leigh's process of removing sulphur compounds. It consists in washing the gas with sulphuret of ammonium—with the gas liquor, in fact. By bringing the gas in contact with the gas liquor that is collected in the condenser, those sulphur compounds are extracted from it to a considerable extent, and the sulphur is brought down to 10 or 15 grains, or something like that. There is another process, I believe, by General Scott, which is a modification of the lime process. It is by heating the lime in a different way. It was tried, I may mention, at the South Kensington Museum a year or two ago on a tolerable scale, and was found to answer pretty well.

Dr. Odling was called here yesterday, and he gave the committee some very interesting evidence, and admitted, if I take his evidence correctly, that there was damage from sulphur, but he said it was due to desiccation of air, and not to the sulphur from the gas. Did you hear him say so?—No, I was not here yesterday at all, and I have not had an opportunity of reading the evidence.

Dr. Stevenson put in evidence two tables showing results in two rooms, in one of which gas was burnt and the other oil, and I find that practically the desiccation was the same in both cases. The desiccation, therefore, being common to both, we must ascribe the damage which took place in the one and not in the other to the sulphur which was in the gas?—Dr. Stevenson's results show that which I certainly should anticipate would be the case, because in burning oil in oil lamps you produce a much smaller quantity of water for a given amount of light than you do in burning gas; consequently, I should think that the desiccation would be, perhaps, a little greater in the case of oil lamps than in the case of gas. It certainly would be very much greater if you require to develop the same quality of light. But then an oil lamp produces less heat per 100 units of light than a gas lamp; therefore I should anticipate the desiccation would be something nearly the same with oil as with gas, and that is what Dr. Stevenson appears to have got as the result of his experiments. My own experience goes to show that you may burn oil lamps in rooms without any damage of the kind complained of, whereas you cannot burn gas. Bisulphide of carbon, when burnt alone, becomes chiefly sulphurous acid—almost entirely sulphurous acid—and that simply in a room gets converted into sulphuric acid. But the conversion into sulphuric acid is very much facilitated by a moist atmosphere; but a good deal of the matter in the atmosphere, which is supplied by the gas, the water, and the sulphide of carbon, is burnt in the gas. When burnt in the gas it becomes almost entirely sulphuric acid before it leaves the room, unless the ventilation is very good indeed. I think that is a very objectionable thing.

Mr. PHILBRICK (in cross-examination): You have given us three lime processes, or three processes of purification; I will ask you a question or two about those. First, as to Mr. Bowditch. Do you know that the Bowditch process was put into operation at Wakefield?

Witness: I am not aware that it was put into operation on a large scale. I know that Mr. Bowditch made experiments on what would be the largest scale experimentally there, but I am not aware that it was ever applied to the whole of the Wakefield gas.

Do you know from your own knowledge, not from hearing or from what others have told you, that the Bowditch process has ever been practically used?—I do not know from my own knowledge that it has been practically used on a large scale. I have used it myself for months on a small scale.

Do you know that it was tried at Wakefield, and that it was found impracticable to subject the gas to the heated lime a sufficiently long time to satisfy the exigency of gas-making in a practical way—that that was the objection?—I do not know it, because, as I say, I do not know anything about Wakefield.

Cross-examination continued: I believe that Mr. Vernon Harcourt's process of heating the gas has been put into operation to about the same extent as Mr. Bowditch's; but I may say, with regard to that process, that I know nothing of my own experience; I have not even tried it myself. I know that he invented it, and I have heard him say (and he is a great authority in gas matters) that he has no doubt it could be practically applied. Mr. Leigh is the Medical Officer of Health and Chemist to the Manchester Corporation. The corporation are the owners of the gas-works in that city. I believe they have adopted Mr. Leigh's process; I have not seen it, but I have been told that they have applied the process for several years past; it is not a newly-invented process. I do not know

that they abandoned it in 1875, and have not used it since. I remember hearing of its being tried in the South Metropolitan district. I do not know that it proved an utter failure. General Scott's process is lime heated at a higher temperature, and some other modification also. It has not been adopted, except experimentally, at the South Kensington Museum. My opinion is that all the sulphur compounds which are burnt in gas ultimately resolve themselves into sulphuric acid. I presume we may say that the whole quantity at the point of combustion is, for the moment, in the condition of sulphurous acid. I have made experiments—not in a room, but in a glass vessel—to determine the relative proportions of sulphurous acid and sulphuric acid in the combustion of ordinary gas. There are no known methods by which the relative quantity of sulphurous acid and sulphuric acid can be determined at the very moment in a room with accuracy, but in their passage to the room you can determine. I do not think I have ever determined the presence of sulphuric acid in a room.

Mr. PHILBRICK: Not having determined it to be present, why do you say it ultimately assumes the form of sulphuric acid?

Witness: I will tell you exactly. I have received the product of combustion from an ordinary gas-flame in a glass cylinder of a particular size, and I have determined the quantity of sulphuric acid and the quantity of sulphurous acid produced under those circumstances, and I have found a certain quantity of sulphurous acid there and a certain quantity of sulphuric acid. Then I have increased the size of the cylinder and repeated the experiment again with the increased size of the cylinder, and there was always a large quantity of sulphuric acid and a smaller quantity of sulphurous acid formed, and as the result of these experiments I concluded that when those products of the combustion of gas are passed into a room instead of into a small glass cylinder, then all the sulphurous acid is converted into sulphuric acid.

First let me ask you, was it a closed cylinder?—No, there was a draught to it, by which the products of combustion passed through the cylinder. There was first a trumpet-shaped tube over the gas-flame, by which the products were conducted into the cylinder, and another tube from the cylinder, by which the unconsumed products escaped into the room.

Was that what is known as the Letheby apparatus?—It was substantially the same as the Letheby apparatus.

Did you find there the sulphuric acid combined or in a free state?—In the free state almost, in the largest cylinder; all the sulphur compounds I found in the water condensing there were in the condition of sulphuric acid; there was not a trace of sulphurous acid.

But the large cylinders were abandoned, were they not, because they were found not to absorb one fifth of the entire quantity?—Certainly not; they absorbed a great deal more than that.

Were they abandoned?—The Letheby process of determining the sulphur and gas was abandoned in favour of the more accurate process invented by the Gas Referees.

Under Dr. Letheby's own advice and opinion, in carrying out his own experiments, was not the large cylinder abandoned in favour of the smaller one, because the smaller one was more accurate?—No; certainly not. In my experience the larger the cylinder the greater the amount of sulphur that is to be obtained in the shape of sulphuric acid from burning gas.

I am quite aware that you have said that the larger the cylinder the more often these products shape themselves into sulphuric acid. You have used that as an argument to show that in a room there would be a still greater proportion of sulphuric acid?—Yes.

Do not you know that Dr. Letheby himself, in conducting his own experiments in his own way, he being the discoverer of these sulphur compounds, actually prohibited the use of these large cylinders because they led to results that could not be trusted?—If he did abandon them it would be because they gave too much sulphur.

You do not mean to say that a man like Dr. Letheby, who has passed away from us—a gentleman of his scientific attainments—would discard an apparatus because it led to a certain result, if he believed that result to be a true one?—First of all, I do not know that he did abandon the large cylinders; and, in the second place, I know that if he did it is quite contrary to my experience that they ought to be abandoned because they give too little sulphur, because I always found the larger the cylinder the more sulphur you obtained in the shape of sulphuric acid. Just allow me to explain that part of my answer to which you seem to take objection. Dr. Letheby, in proposing this method of testing gas, had in view the use of a particular sized cylinder, and he said, "That is my apparatus, which has such and such dimensions. The gas ought not to contain more than 20 grains of sulphur in 100 cubic feet." Then it was found afterwards, I think by other persons, not by Dr. Letheby, that the larger cylinder produced more sulphuric acid; but Dr. Letheby, I think, altered his evidence before the committee, and said, "It is not fair to use the larger cylinder; the Act of Parliament contemplated the cylinder of the size in which I first invented it;" and that was the reason, I believe, that he abandoned it.

If you have exactly represented the effect of Dr. Letheby's evidence in the reverse sense to that in which he gave it, what would you say about your conclusion?—I cannot alter my conclusion from my own experience.

Then it strikes me that your conclusion is entirely independent of the premises from which you draw it?—No; it is based entirely upon my own experiments, and I cannot give up my own experiments.

Is the free sulphuric acid, which you say you found in these tubes, produced always under the same conditions as they would be by the burning of ordinary gas in an ordinary apartment?—It is as near as possible, in the experiments to which I have referred. The difference is simply that the products are passed into a smaller chamber instead of a large chamber. There was no ammonia put in the chamber. These were experiments with a view of ascertaining how much free acid there was, and there was a considerable quantity—a large proportion.

Cross-examination continued: There is no sulphur test in Manchester. The gas there is of a higher illuminating power than in London. I am not aware that in Manchester the injurious effects attributed to the sulphur compounds are visible all over the city. The quantity of sulphur given off there is reduced to about one-half, by the gas being of double the illuminating power, with the ordinary burners employed. At Manchester I believe they do not use lime, but peroxide of iron in the purification. It is canal gas supplied there which cannot profitably be burnt in an Argand burner. It is better to employ a fishtail burner. Canal coal does not contain a greater proportion of sulphur, as a rule, than ordinary coal; at all events, what is really of importance here is this, that the gas manufactured from canal coal contains less of these objectionable sulphur compounds than gas from ordinary coal, because it comes off at a lower temperature. I do not know, since the tests have been taken in London, that at the stations where canal gas is made the proportion of sulphur compounds has been invariably greater. I have not seen any room in Manchester where injury has arisen from the sulphuric acid produced by the combustion of gas. I have not lived in Manchester since 1857, and at that time they were purifying with lime. I have seen its corrosive action in my own rooms in London, first at Haverstock Hill, between 1857 and 1860, and then at Lancaster Gate up to the present time. In both cases the gas was supplied by the Imperial Company. I have not

noticed the effects in the formation of a zone round the top of the room, but I certainly noticed that these effects were very much stronger nearer the ceiling. The metal articles about the room, or 3 or 4 feet from the floor, were comparatively unacted upon, while any metallic substances near the ceiling were rapidly corroded. I never made any experiments as to where the action began. They were really not experiments, only the result of experience. I found that the brass cranks at Lancaster Gate, from 6 to 12 inches from the ceiling, were very powerfully corroded, and covered with crystals of copper. I cannot tell what wash they had been dipped in by the manufacturer; but whatever it was it had all gone, while the other cranks retained their wash. This was in the pantry—a small room where the ventilation was deficient. I never burn gas in the ordinary rooms of the house; I have given it up now on account of the sulphur compounds and the low illuminating power. It is only burnt in the basement and in the passages now. There are no damp walls in my pantry, and a damp wall would not produce sulphate of copper. I use paraffin duplex lamps in my dwelling-rooms. There is scarcely a trace of sulphur in paraffin.

Re-examined by Mr. CRIPPS: The quantity of cannel used in making gas in London is only a small percentage; but in Manchester the gas is made entirely of Wigan cannel. If you have a gas of high illuminating power, you do not want so much of it in quantity; and I know from my gas bills that I used much less in Manchester to illuminate my rooms than I did when I used gas in London. I should, therefore, not expect to find so much sulphur compound present.

Mr. CRIPPS: I want to ask you about the inverted tubes that you have spoken of. You say where the tube is contracted the sulphurous acid is generally found, but when you get the larger tube you find sulphuric acid?

Witness: Yes, I found sulphuric acid myself in the very smallest tube, but more in proportion to the size of the chamber—it is not exactly a tube.

If, instead of being a chamber, it was a room, there would be a considerable portion of sulphuric acid there, would there not?—I think that is a fair inference.

Will you tell the committee why that is—you, of course, have a reason to assign why, as the tube widens, the sulphuric acid increases?—The transformation of sulphurous acid into sulphuric acid is a question of time, and the length of time you could allow these products to remain in a close chamber, even of the largest size that can be blown, is, of course, very small, compared to the length of time it would remain in a room; hence the process of transformation will be much more perfect in the room itself than it possibly could be in the largest glass tube that could be used for the experiment.

By the COMMITTEE: It would take a longer time to deposit, and to combine with oxygen it must combine with atmospheric oxygen; that is a process that requires time—say ten minutes or a quarter of an hour—and you must keep up a rapid current of air over the glass to get perfect combustion, and all this air must be carried up in a glass chamber in order to deposit the acid. I should not say that a greater quantity of sulphuric acid would be produced in a small room than in a large one, and with the same amount of gas, I should say, if there is a difference between a large room and a small room, the larger quantity would be produced in the larger room, because there would be still more air. Still, in a room of ordinary dimensions, it would probably not be large enough to transform the greater part of the sulphurous acid into sulphuric acid. The size of the room is almost infinitely greater than the size of the glass chamber under which these experiments were taken.

Mr. CRIPPS: Then, whatever may have been the immediate object of Dr. Lethely's experiments, your experiment in having first the contracted and then the larger tube showed you that sulphur was converted into sulphuric acid, if you gave it time?

Witness: Yes.

You have been asked whether Mr. Bowditch's process has ever been applied or not upon a large scale. Did I not understand you to say that you had tried it yourself?—Yes, I have tried it on a small scale repeatedly, and for a considerable length of time. On one occasion I remember passing the London gas, for a fortnight continuously, through a tube filled with lime, heated to a temperature of 500°, and during the whole of that time the sulphur, in what is called an irremovable form, was continuously and uniformly transformed into sulphuretted hydrogen, all except 4 grains per 100 cubic feet.

Then would that experiment lead you to believe that there is nothing to prevent it being adopted on some larger scale, and with success?—I cannot believe that engineers could not produce a result of that kind. It is so very simple, and the expense of getting the lime at 500° is so small, that it seems to me, therefore, to be no insurmountable difficulty. The only problem would be the applying it on a larger scale. It is a purely engineering question.

The CHAIRMAN: Do you believe that these sulphur compounds have any injurious effect upon the health of human beings?

Witness: I should have considerable doubt as to there being any appreciable effect produced upon persons in ordinary robust health, but for invalids and persons with weak respiratory organs, I think a good deal of suffering, at all events, would be produced. Whether there would be ultimate injury or not I should not like to say, not being a medical man.

Do you think that the difference between 15 grains and 35 grains, which is represented by employing this lime process, would have any appreciable effect upon the health of even an invalid?—I think so. I think the difference between two rooms, one lighted with gas containing only 15 grains, and another lighted with gas containing 35 grains, would be very considerable—in fact, I know it is from having experienced the atmosphere of the two rooms.

Then, perhaps, you are in a delicate state of health yourself, as regards the respiratory organs?—Certainly not; but I feel the effects of the sulphuric acid in the throat. There is a peculiar sensation similar to that which one perceives in a London fog. It is very much the same sort of thing, and it is very much stronger in a room lighted with gas containing the maximum amount of sulphur, as compared with a room in which there is the minimum amount of sulphur.

Then you have no hesitation in referring that to the different amount of sulphur compounds?—It is entirely due to the sulphur compounds.

Is there anything injurious to human health in the process of lime purification besides the disagreeable smell?—I should say decidedly not because of the offensive smell arising from sulphuretted hydrogen or sulphate of ammonia—and these are two reagents that are daily in use in chemical laboratories, and the students working in these laboratories are exposed to them very much more than persons would be to the lime from gas-works, and yet no injury to health results.

There is sulphur to some extent produced in any room where a full fire is being burnt, is there not?—There is sulphur produced in a fire, but it all escapes up the chimney. Unless the chimney smokes, no trace of it comes into the room.

Mr. Arthur Herbert Church, examined by Mr. CRIPPS.
I am a Fellow of the Chemical Society, and Professor of Chemistry at the Agricultural College, Cirencester. I have paid a good deal of attention

to the compounds produced by the combustion of sulphur in gas. I have found generally that the whole of the sulphur in the gas may be converted into sulphuric acid when the quantity of sulphur is small; but when the quantity of sulphur is large, say over 30 to 35 grains in 100 cubic feet, a small portion of it, when the combustion is as perfect as you can get it, is still in the state of sulphurous acid; it does not go further; it does not get completely oxidized. But under the ordinary conditions of combustion, especially when a small quantity of gas is burned, and where there is an ample supply of air, the sulphuric acid is the only product of the combustion. I have had, from time to time, a number of specimens sent to me of leather binding from the upper shelves of libraries, chiefly private, but on some occasions public, and I have been asked to determine the cause why they were reduced, as one of my correspondents said, to the condition of Scotch snuff. I attributed it to the presence of sulphates in larger quantities than in natural dressed leather; that is, in leather that had been submitted to the process of dyeing, or something of the same sort. I also found that the watery extract showed a distinct acid reaction, due to the presence of free sulphuric acid. I attribute the presence of large quantities of sulphate in that disintegrated binding of books from upper shelves to combined sulphuric acid as well as free; to the action of the free produced by the burning of the gas on lime, and which prevented the whole of it being in a free state. The sulphuric acid, by its action upon the leather, combined with the lime, and formed sulphate of lime. I found a very large quantity of combined sulphuric acid, and a small quantity of sulphurous acid in the injured bindings. In completing this account, I ought to say, with reference to metals, that I have found crystals of sulphate of copper and sulphate of zinc, both due to the action of sulphuric acid on the copper and the zinc. They could only have been formed by the action of the free sulphuric acid produced in the burning of the gas upon the metals.

Mr. CRIPPS: You mentioned the effect upon leather. Are there any other articles upon which this effect could be observed, such things as fibre, and textures of different kinds—dresses, muslins, or the canvas of pictures; would it have any effect upon those?

Witness: My experiments have almost entirely related to the canvas of pictures, which have been found to become rotten when hung at a great height, and I have found more sulphates, and in a few cases free sulphate, from the watery extract of disintegrated canvas, which has been hung high up, while pictures that have been hung lower than 12 or 14 feet have been comparatively free from sulphate when removed from the same room.

Would it have any effect upon the oil and varnish of pictures themselves?—I found that some varnish resists the action of sulphate almost completely, but lac and shellac and mastic are rendered brittle, or the process of becoming brittle is accelerated—they do generally become brittle, but more quickly brittle when they are hung high up in a region which is hot, and laden with a larger quantity of sulphuric acid than the air of the room below.

Are there other materials on which it would have that effect—such as white lead?—I find white lead partially converted, in the upper walls of a room, into sulphate of lead, the walls injured, and the texture disintegrated, while the lead paint in the lower part was not in any way affected by the gas, or only to a very slight extent.

Its effects upon some other matters are well known to all of us, probably upon copper and brass metals; have you observed its effects upon those?—I have a copper vessel in my laboratory which has been heated with a paraffin lamp, and another similar one which has been heated for a like time at intervals for a similar purpose with gas-burners, and drops of strong solution of sulphate of copper are formed every morning on the one which has been heated by the gas-burner, while the other shows no appreciable corrosion except a small darkening of the surface, which is due to the action of the copper. This was at Cirencester, and out of the province of the metropolitan gas companies; consequently, we have a very impure gas. I am not prepared to say what its general average of purity is.

Would it have any effect upon statuary and marble even in a museum?—I found it slightly rotted the surface of finely-polished statuary marble which had come from the hand of the sculptor; it was found to be slightly corroded, and I found that you could wash off sulphate of lime or gypsum, the same as often occurs in London upon the marble from sulphur that is burnt in coal. It is well known that you can extract from the stone of some parts of Westminster Abbey portions of sulphate of lime. I know as a fact that some of the best sculptors in England have what is called skin disease, and are undoubtedly affected by something. This may be partly due to the effect of sulphuric acid, and partly to other influences.

Under these circumstances, do you think that it would be desirable that means should be employed to take out these sulphur compounds from the gas which is to be in use generally in London?—I think so, upon the score of the preservation of the materials and objects, both useful and decorative, in our houses.

Cross-examined by Mr. PHILBRICK: I am not prepared to say that I would have all gas absolutely free from sulphur. What the restriction should be is a question I feel myself unable to answer. I would restrict it as far as it could possibly be done. I have not had my attention called to the limits prescribed in London by the Referees. I do not know that in the case of the Commercial Company it is 30 grains at the present moment. I am not prepared to speak authoritatively on the point as to how much sulphur there would be in the gas, supposing it was purified by the oxide of iron process. I have made one or two determinations from time to time of the sulphur contained in the gas at Cirencester, to see how much sulphide of carbon there was in it, solely for the purpose of attempting to purify the gas for my own use. I found a proportion which corresponds to about 35 to 40 grains of sulphur in 100 cubic feet, and in one case in which they did not take out the sulphuretted hydrogen, I found about 70 or 75 grains. Estimating the quantity at 35 grains, that would produce about 90 or 100 grains of sulphuric acid, or three times its weight. I have not made a calculation as to volume.

Mr. PHILBRICK: You have referred to some leather books, and so forth—some binding that had perished. Those bindings, I suppose, had been treated with size. You know there is acid in size, do you not?

Witness: There is, sometimes; but I made all my experiments of comparison with the leather which had been taken from a lower shelf of the same library.

Then it is just possible, unless you had the same identical binding in each, and leather treated in the same way and bound by the same man, that you might have size in the one case and not in the other?—Yes; still it would be very singular if all the leather on the top shelves contained the sulphuric acid. I do not know where those books were bound which came from the top shelf and which from the bottom. I have taken some myself from where gas was burning in the library at Cirencester.

In the library at Cirencester, where gas was burning, was the condition of the injured books which you have described the same generally in all the upper shelves?—It was the case with those books which were not frequently moved in the upper shelves—the two upper shelves. They suffered most, and those down near the floor but very little.

Have you ever read the late Professor Faraday's evidence on this subject

in the inquiry as to the Athenæum, and Professor Brand's?—In past time I have, but I have very little recollection of it now.

Cross-examination continued: I have not read Mr. Vernon Harcourt's researches upon this matter. I am aware that the atmosphere of all large towns contains more than a trace of sulphuric acid; but I am not aware that the top shelves of a library have a peculiar attraction for this impurity. I should not attribute any portion of the sulphuric acid in the atmosphere out of doors to the presence of sulphur in gas. I cannot say generally that the bindings of books suffer more from decay on the upper than on the lower shelves of a library, except where I have found gas to be burnt. Decay has never been brought to my attention in other cases. I cannot be quite sure whether I have had any experience except where gas has been burnt, because I have not had my attention drawn to it lately. I have had experience upon that fact sufficient to enable me to answer on oath, and give the committee a reliable opinion. Whatever investigations I have made have been made with reference to the presence of sulphuric acid in bindings. I hope I am chemist enough to know that in the pigments used by painters there is an acid present. In some there is chromic acid, in some carbonic, and in some acetic acid. I am aware that the mastic and other varnishes used by some painters for glazing and for the transparent tones of pictures do, apart from the use of gas lighting altogether, decay of themselves. I am not prepared to admit that they have therefore been abandoned, and that the reason why the tints of Sir Joshua Reynolds and other great masters fly, is because of the bad medium they used. I know it is the greatest reproach to an artist if he uses any amalgam or medium of that sort, as they do not stand. The megylf which used to be met with, which is half copal and half mastic varnish, is now, to a great extent, discarded by everybody who understands it. The ultramarine, which is used for the skies of pictures contains sulphur, and it has been found that where used the canvas has perished behind it.

Re-examined by Mr. CRIPPS: There are many materials used in painting and matters of that kind in which you can trace the effects of sulphuric acid. That is one of the strongest decompounds we have, and would leave its effect upon anything that could be decomposed in that way. I have, for the purpose of experiment as to the effects of sulphuric acid, compared the bindings of books on the higher shelves of libraries with those on the lower shelves in rooms where gas has been burnt, all other circumstances being, as far as I know, the same, and in those on the upper shelves I have found sulphuric acid.

By the COMMITTEE: I have been making these observations for about ten or fourteen years. I have a work upon the subject in preparation, and have been obliged to make experiments upon artistic materials for that purpose.

In those volumes which were sent to you, were they sent at your request with a view to your work?—A good many of those to which I have referred—and they all gave me the same result—were sent to me as a professional chemist to advise as to what was the cause of the destruction of the binding, and how far I could suggest a remedy, and I have always suggested complete ventilation.

I think you said that the more air the greater quantity of sulphuric acid would be formed?—Only that the more complete would be the product of sulphuric acid in the burning of the gas at first. It would all ultimately turn into sulphuric acid, therefore its effects would be the same, only that at the moment of preparation, before the burning is complete, you do not get it so completely formed.

Then the injury to the upper shelves of the bookcase would be caused, not by the sulphuric acid which was created at the moment of combustion, but from the sulphurous compound which afterwards turned into sulphuric acid?—Partly by the one and partly by the other.

Therefore you say the better ventilated the room is the greater the proportion of what would ultimately become sulphuric acid, and that would be produced at the moment of combustion?—Yes; and it would be carried away in a well ventilated room before it had time to do injury to the books. May I be permitted to say it was only portions of bindings from volumes that were sent to me, as a rule—only pieces of leather.

But the binding of the volumes—were you informed, when they were sent to you, whether they came from the upper shelves or the lower shelves of the library? Was your attention called to that fact?—In some cases it was; in some it was left for me to find out.

How did you ascertain that you were right in your supposition?—They were labelled. Those which I reported upon as containing sulphuric acid I was afterwards told were taken from the upper shelves. In some instances I never heard the result; I was merely asked my opinion without reference to where the book came from, or anything about it.

(To be continued.)

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

FRIDAY, MAY 12.

(Before Vice-Chancellor MALINS.)

GLOSSOP v. HESTON AND ISLEWORTH LOCAL BOARD.

The plaintiff in this case is a gentleman residing at Silver Hall, Isleworth, and the action was brought against the District Local Board to restrain them from permitting sewage, or water polluted with sewage or other offensive matter, to pass through the drains or channels under their control into the river Crane, in such a manner as to render the water of the river, at or near the plaintiff's residence at Silver Hall, unfit for use by the plaintiff, and injurious to the health and comfort of the persons resident in such premises. An application was made some time ago for an injunction in the terms of the claim, but the application was ordered to stand over to give the defendants time to adopt any means they could of remedying the alleged nuisance. The plaintiff now stated that no steps had been taken by the board, and asked that the injunction be granted. It appeared that the river Crane came down from a district where there had lately been a large addition to the number of houses, and where the population had greatly increased. It then passed for about 200 yards through the pleasure-grounds belonging to Silver Hall, and afterwards emptied itself in the Thames above the grounds of Sion Park. It was shown that before reaching the Isleworth brewery the water in this stream was pure and clear, and the plaintiff alleged that the water used formerly to be perfectly clear when it reached his premises, but latterly it had become offensive to the smell, and injurious to the health of those who resided in the neighbourhood. The impurity had been gradually increasing for the last ten years, owing, as the plaintiff asserted, to the sewage of the new houses in the district being allowed to drain into the river instead of being carried away by some efficient means. A considerable amount of evidence was produced on both sides, and some of the witnesses were cross-examined. The plaintiffs evidence went to show that the water was now in a most impure state, and that he and his family had suffered severely in health in consequence thereof. The defendant's evidence, on the contrary, was to the effect that there was not the amount of nuisance which had

been described; that the water was not impure, but was perfectly wholesome, even for drinking purposes; and the illness suffered by the plaintiff's family in 1874 was attributed to the effect of a cesspool belonging to the plaintiff's house, which had not been emptied for many years.

Mr. GLASSE, Q.C., and Mr. STURGES addressed the Court for the plaintiff; Mr. HIGGINS, Q.C., and Mr. METHOLD appeared for the defendants.

The VICE-CHANCELLOR, before hearing the counsel for the defendants, said if they would consent to the cause standing over for some months he would dispose of it now without hearing further argument.

Mr. HIGGINS, said the defendants would consent to this course.

The VICE-CHANCELLOR said the nature of this case was very plain. The river Crane was formerly—that was to say, about 20 or 30 years ago—a very pure stream, in which, according to the evidence, one could see the pebbles at the bottom. This stream ran through the grounds of the house occupied by the plaintiff, in which he had lived for about six years, and which his father had occupied for about 30 years before him. During the last 10 years there had been a considerable increase in the population of the district, and the river Crane had gradually become less pure by reason of the drainage from the numerous houses that had been of late years erected in the neighbourhood. The plaintiff alleged that the water had become so impure that it could not be used for drinking purposes, and that the smell was so offensive that it prevented him from opening his windows on that side of his house, and produced disease among the members of his family. On the other hand, there had been evidence given contradicting this statement, and stating that the water was not by any means impure, and certainly not sufficient to cause illness to persons who resided in the neighbourhood; and one person, who was a miller lower down the stream, said there was nothing to complain of, and nothing which the defendants could be called upon to remove. Upon hearing the evidence on both sides, although he had not been addressed by the defendants counsel, he could not help coming to the conclusion that there was some ground of complaint, though it might not be so great as the plaintiff and his witnesses asserted. Then it appeared that the board of this district had had a notice served upon them by the Thames Conservancy, requiring them to remedy the nuisance now complained of, and if they did not comply with that order before Monday next they would be liable to a fine of £50 for every day that the nuisance remained. Considering the effect of that notice from the Thames Conservancy, and also looking to the desire which the board had expressed of doing all in their power to prevent further complaints, he did not think there was any necessity for granting an immediate injunction. It was evident that the board had great difficulty in deciding what was the best course to take, and the same difficulty existed in many parts of the country at the present day. After much deliberation, they had determined to adopt the "A. B. C." process of deodorizing the impurity by the use of alum, blood, and charcoal; but that plan had been stopped by the difficulty of obtaining a piece of ground for the purpose of their works. His lordship thought, in the circumstances, that it would not be right to embarrass the defendants further by granting an injunction. He gave the board full credit for their intention to remedy the nuisance, and he thought that the best order he could make would be to let the cause stand over for about nine months, and the pressure exercised upon them in the meantime by the Thames Conservancy would be sufficient to prevent any further delay in carrying out such works as should be finally decided upon. He should, therefore, direct the cause to come on again on the second cause day in Hilary Term, 1878.

CLERKENWELL POLICE COURT.—MONDAY, MAY 21.

(Before Mr. BARSTOW.)

BREAKING STREET-LAMPS.

Harry Philp, Alfred Connolly, and Hubert Jefferys, three youths, described as "gentlemen," were charged with wilfully breaking street-lamps at half-past three on the previous morning in Dartmouth Park Hill, Highgate.

A lamplighter said he saw the defendants throwing stones, there being no other persons in the street. A watchman in the street said he saw the defendants break three lamps in succession.

Mr. BARSTOW ordered the defendants to be imprisoned and kept to hard labour for fourteen days.

On the following day Mr. HUMPHREYS, a solicitor, applied on behalf of the prisoners, that the magistrate would reconsider his decision.

Mr. BARSTOW declined to reconsider the matter, remarking that there had lately been several acts of wanton damage, and the prisoners, from their position, ought to have known better than to indulge in such mischievous freaks. He did not regret the decision he had come to in the case, and the matter being now out of his hands, the only course before Mr. Humphreys was to memorialize the Home Secretary.

A correspondent, writing to *The Times*, says: "I am glad to see that Mr. Barstow has set a good example by sentencing three young men, who were well dressed, and described themselves as 'gentlemen,' to fourteen days hard labour without the option of a fine, for breaking some street-lamps in Islington. I reside near Primrose Hill, which is provided with a number of handsome lamps, and it is really deplorable to see the number which are wilfully broken. A short time since I counted close upon 200 panes, and taking 12 consecutive lamps I found that 32 panes of glass out of 48 were broken—smashed to pieces. If the authorities would exercise a little more diligence, and the magistrates would follow the example set by Mr. Barstow, a stop would soon be put to so shameful a scandal."

MARKET DEEPIING GAS COMPANY, LIMITED.—At the annual meeting on the 14th inst. a dividend of 6 per cent. was declared. During the past year the price of gas has been reduced to 5s. 10d.

HULL GAS SUPPLY.—Mr. Baynes reports that the gas supplied to the district of Sculcoates and Myton by the British Gas Company during April gave the following results, free ammonia and sulphuretted hydrogen being at no time present to the ordinary tests:—

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16'03	14'18	15'35
Grains of sulphur per 100 feet	30'50	28'40	29'38
Mean barometer 29'65; temp., 57°. In the east district, Mr. J. Baynes, jun., reports that the gas supplied to the above district by the Sutton, Southcoates, and Drypool Gas Company during the past month gave the following results:—			

	Max.	Min.	Mean.
Illuminating power standard sperm candles	15'66	15'10	15'37
Grains of sulphur per 100 cubic feet	—	—	6'6
Grains of ammonia per 100 cubic feet	—	—	22'6
Mean barometer and temperature in photometer-room: Bar., 29'62; temp., 56'3°.			

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 5, 1877.

Circular to Gas Companies.

THE topic of the greatest interest to all Gas Companies, that presents itself to our mind is one which we can only lightly touch upon. It is the great "sulphur" question, as presented to Parliament by The Gaslight and Coke Company. This is not merely a metropolitan question. It concerns, directly or remotely, every Gas Company in the kingdom. Those who now possess statutory powers will have to apply for further, and year by year non-statutory companies will be in Parliament for special Acts. The case now before a Select Committee of the House of Commons will necessarily have a very important bearing in relation to these measures. If the Chartered Company be relieved from all obligations to purify gas from "sulphur," no other Company need trouble themselves about the matter. If, on the other hand, the Legislature insist that "sulphur" shall, as far as possible, be removed from gas, then we may be certain that more stringent restrictions will follow than any yet imposed. This case has drawn attention to a matter which was almost forgotten. There has been next to no agitation on the "sulphur" question for more than ten years, and its revival to-day is greatly to be regretted. The peculiar circumstances of the Chartered Company, however, rendered the revival unavoidable, and they and all must put up with the consequences.

The deliberations of the Committee will be resumed this morning, and there is a general impression that they will soon be concluded. It is, however, rumoured, as we said last week, that the opponents of the Company will seek to bring forward a good deal more evidence on a point on which the Committee appear to have made up their mind—viz., the damage done by

sulphur in gas. Now, the Committee seem to consider that there is a balance of evils. On the one hand, purification by lime occasions a nuisance in the neighbourhood of gas-works, and, on the other hand, they seem to admit that sulphur may be the cause of some injury to goods. Which is the greater evil—the nuisance or the damage? A decided answer to this question involves the success or rejection of the measure promoted by the Chartered Company. We are, of course, precluded from expressing any opinion on the matter at the present moment.

There is, however, one point to which we have already made a brief reference, and that is an expression of opinion on the part of the Chairman, that if relief be granted to the Company it should be accompanied by some reduction of the initial price of gas by way of compensation to the public. A decision of this kind, we may take it, would be satisfactory to neither party. It is not a question of price with the two opposing authorities, who are perfectly satisfied with the arrangements made last year, which are working with undoubted advantage to the public. Nor could the Company for a moment accept the relief they seek, accompanied by a reduction of price. On this point, however, enough was said last week, and we need only refer to a matter which has cropped up since. Most, if not all, of our readers will, no doubt, have seen in the public prints a report of the proceedings at the Miners Conference, held last week, and will have noticed how narrow an escape we have had from an artificial coal famine. It was seriously proposed, and nearly decided, to enter into a general combination to diminish the output of coal, with the object of advancing prices. Of course, the first effect of such a combination would have been felt by coalowners and contractors; but it would presently have produced serious consequences to Gas Companies. As it is, it may be expected that coalowners, finding themselves exposed to such a contingency as that which has lately been avoided, will be rendered more cautious in making contracts, and will be induced to demand higher prices.

There is just now another matter to which we may here call attention. The war has sent up freights to a considerable extent, and this will have the effect of making an addition to the cost of coal, which, in the case of the Chartered Company, may amount to no inconsiderable sum. Giving, then, due weight to these several considerations, and estimating dispassionately the effects of such contingencies and realities as we have mentioned, we repeat that it would be the height of injustice for the Committee to insist on a reduction of price which will satisfy no one. This is, however, a question of clauses not involved in the Bill as presented to the Committee, and we must leave it to the serious consideration of the party most concerned. We entertain a strong opinion that the proceedings will be brought to a close to-day, or at the latest to-morrow. The Committee are evidently tired of the business, and will probably refuse to listen to evidence beyond that they themselves have requested. In any case we are certain to be able to report the final result in our next.

The rumour again obtains that Earl Redesdale is about to retire from the post of Chairman of Committees of the House of Lords. In spite of the fact that we have always regarded his lordship's influence as inimical to the interests of Gas Companies, we shall greatly regret his retirement. Earl Redesdale is a man of fixed ideas, and always knows his own mind, and if you went before him you knew what to expect. He has set a mark on the Gas Legislation of the last ten years, which will remain until the conditions of things are altogether different from what they are to-day. We look about the Upper House in vain for a successor who will combine his knowledge of, and aptitude for, business with such perfect impartiality.

THE JOURNAL OF GAS LIGHTING, &c., as all our readers know, has no politics, and, if we now refer to Mr. Gladstone's visit to Birmingham, it will have no reference to the ultimate objects of that demonstration, whatever they may be. We would simply remark on the speech made at the Mayor's banquet, on which occasion Mr. Gladstone sang a paean in praise of the doings of the Municipality of Birmingham. He praised the condition of the streets, and the police and watching arrangements; he noticed the means provided for public recreation, which he very correctly observed were largely contributed to by private liberality; but, so far as we can learn, he said no word on the greatest enterprise of the Town Council, and the crowning achievement of this host, Mr. Chamberlain, M.P.—namely, the acquisition of the gas and water undertakings supplying the borough. It can hardly be supposed that Mr. Chamberlain had left the great statesman in ignorance of a transaction that cost the Municipality more money than they had ever before expended, and laid a heavy weight of debt on their shoulders. What inference, then, may we draw from Mr. Gladstone's silence on this, the greatest enterprise the Corporation of Birmingham have ever entered upon? Are we to suppose that

he, as a political economist, does not regard with favour the possession of commercial undertakings by Municipal Authorities? We hesitate to draw such an inference, but it might almost be justified. Sound political economy we believe to be entirely opposed to the acquisition of commercial undertakings by Municipalities. There may be something to be said in favour of the supply of water, which is a necessary of life, by a public body, but not more than, if so much as, might be alleged in favour of a public supply of bread and meat, which are equally necessities of life. The manufacture and distribution of gas, which is rather a luxury than a necessity, is a different matter, and is a purely commercial business, which is always better left in the hands of commercial men. Possibly, Mr. Gladstone knows this, and hence his silence on the greatest achievement of the Corporation of Birmingham. As some of our friends in Birmingham are very sensitive, we may assure them that there is nothing in the foregoing remarks which at all reflects on the conduct of the Corporation in acquiring the undertakings, or in their subsequent management. On commercial and economic grounds, we are strongly opposed to the possession of commercial undertakings by Local Authorities. They have, in no single instance, done better for a community, and, in some notable instances, have done nothing like so well for consumers, as the legitimate purveyors of gas would have done. We say nothing about advantages to ratepayers, which would involve the indirect taxation of gas consumers; we simply refer to the undertakings as commercial enterprises, and we may express a strong opinion that their general absorption by Local Authorities would be fraught with disaster. There are not even now sufficient sound investments to employ the savings of the country at a really remunerative rate, and we may safely say that the purchase of every gas undertaking involves the loss of a large amount of productive capital to this country.

The "electric candle" continues to attract some attention in Paris, where it has caused a fall in the value of shares in the Gas Company. Generally, however, in the French gas world, it is not regarded as a formidable rival to gas illumination. A new contemporary, the *Journal des Usines à Gaz*, discusses the matter in a very temperate spirit, pointing out the limited applications the light can receive, its dazzling whiteness, which soon fatigues the eye and renders it impossible to work long by its aid, and its non-diffusibility. In the experiments at the Magasin du Louvre, we believe the candles are shaded by opaque glass globes, which, no doubt, render the light tolerable by cutting off seventy or eighty per cent. of that furnished by the candle. We have no information as to the cost of the light, but our contemporary somewhat sarcastically remarks that at present its use is certainly more economical than gas, for it is supplied gratis.

The City of Brussels have some gas-works of their own, a report on the working of which, during the past year, has recently been presented to a Special Gas Committee of the Communal Council, which seems to show that the undertaking is not a brilliant success. The profit made last year was only about three and a half per cent., and the gas unaccounted for was about 31 per cent. of the make. Public lamps intended to consume from 140 to 200 litres of gas per hour actually burned 250 litres. The grave defects which allow of this enormous loss of gas are being remedied, and a hope is expressed that the leakage will soon be reduced to ten per cent. of the production. The mains appear to have been originally laid in the most careless manner, so that the pressure at various points has been extremely irregular, and in consequence some districts got scarcely any gas at all when, as we gather, the initial pressure was four inches. The report says little for the municipal management of a gas undertaking in Brussels.

The Town Council of Exeter are, apparently much against their will, compelled to prosecute the Gas Company for a nuisance. The Company, while denying that the stench complained of emanate from their works, are, nevertheless, by diligently making alterations, and setting up improved apparatus, doing their utmost to remove the possibility of complaint. Under these circumstances, a prosecution must necessarily fail, and the money spent on it will be thrown away. A very unsatisfactory state of affairs in relation to gas matters has prevailed in Exeter for some time past, which we shall be glad if this prosecution clears away. We have no doubt the Company will establish a good case for themselves, and then the agitation must cease.

At a special meeting of the shareholders in the Blackburn Gas Company, held last week, a resolution was unanimously passed approving the terms of purchase and sale arranged between the Corporation of Blackburn and the Directors of the Company.

In answer to a correspondent, whose letter relating to our remarks on Aitken and Young's process we published in our last, we may say that the remarks we made were based rather

on the specification of the patent than on the experiments at Hamilton. This document proposes a wider and somewhat different application of the process than that suggested for Scottish works, where, as we understand, water gas is not made.

Water and Sanitary Notes.

THERE are still, it seems, innocent people in Lambeth, who imagine that they can get rid of their indebtedness by the simple process of refusing to pay their debts, and therefore, we may imagine that the Lambeth Police Magistrates will presently be occupied with some hundreds of summonses. A test case will, of course, be selected, the decision on which will govern all the others. The eyes of the silly people will then be opened to their folly. They will pay the cost of the summons in addition to the water-rate, and will leave the Court wiser, if not richer men. It is lamentable to see men, who ought to know better, advising resistance and repudiation, but we suppose something must be done to earn and keep a seat in the Metropolitan Board of Works.

The inquiry before Mr. Thornhill Harrison, C.E., one of the Local Board Inspectors, relative to the scheme promoted by the Corporation of Birmingham for the formation of a united district for the sewerage of their borough and the neighbourhood was brought to a prompt conclusion by the vigorous action taken by the Town Council. The lawyers evidently wanted to make a long job of it, and the inquiry promised to be interminable. Opposition sprang up from Local Boards which was not anticipated, and, indeed, in cases in which it was understood that a common agreement had been arrived at. Under these circumstances, the Town Council of Birmingham cut the matter short by authorizing their Sewage Committee to withdraw the scheme if they thought fit. That brought the opposing Boards, or rather lawyers, to their senses. They immediately accepted the scheme, subject to an appeal on some minor points to the Local Government Board. It should be mentioned that West Bromwich is left out of the scheme.

Now, the Town Council have to deal with Sir Charles Adderley, who insists that provision shall be made for the separation of storm water from sewage. It is, of course, competent for the Local Government Board to make an order that this shall be done, but, as the doing of it will cost the Corporation of Birmingham alone something like a quarter of a million of money, they would withdraw the scheme rather than assent to it. The proposal is, in the highest degree, absurd; for if the plan were carried out, the river Tame would soon be choked with the *débris* of Birmingham roads, which is now stopped at Saltley.

We have nothing further at present to report on the Lower Thames Valley drainage scheme, over which, we presume, there will shortly be a great fight. There is nothing, we fear, to be done in this case, but for the Local Government Board to make a peremptory order constituting the united district.

GAS EXPLOSION ON BOARD SHIP.—A Board of Trade inquiry has just been concluded at Liverpool, before Mr. T. S. Raffles, stipendiary magistrate, and Captains Grant, R.N., and Wilson, nautical assessors, as to the cause of an explosion on board the steamship *Levant*, on the 28th of April, in the Bay of Biscay. The *Levant* was on a voyage from Cardiff to Gibraltar, with a cargo consisting of 830 tons of South Wales steam coal, and on the 28th of April a fireman lighted a match in the fore-castle, this act being immediately followed by an explosion of gas that had generated among the coal. Five men were injured, one of them fatally. The Court gave judgment on Wednesday. They considered that the explosion was clearly caused by the want of proper ventilation, which caused an accumulation of gas in the fore-castle, and that this was exploded on a match being incautiously ignited. It would appear that the South Wales steam coal was of a peculiarly gaseous nature, and a similar catastrophe, owing to this cause, occurred only last year at Cardiff, in the case of a sailing vessel called the *Atalanta*, resulting in a greater loss of life than in the present case. It was suggested in the report of the inquiry held with regard to the *Atalanta*, that all vessels carrying coal should be provided with proper deck ventilation, and the Court, in the present case, entirely concurred in that expression of opinion. In this case the master, who had had considerable experience in carrying South Wales coal, did not anticipate any danger in going to sea on the morning of the 26th of April. Unfortunately, the state of the weather did not allow him to open the hatches until the morning of the 28th, and there was not sufficient time for the accumulated gas to escape before the match was struck which ignited it. This second catastrophe, following so soon after that of the *Atalanta*, satisfied the Court that it was absolutely incumbent to provide that all vessels carrying a similar cargo should be fitted with efficient deck ventilators, and the Court recommended this question to the serious consideration of the Board of Trade. The Court acquitted the master of any default, considering that the explosion which took place was owing to an accident which he could not foresee. It was elicited in the course of the inquiry that neither the managing owner nor the master of the *Levant* was aware of the case of the *Atalanta*. During the inquiry one of the witnesses casually intimated that the master of the *Levant* was under the influence of drink on the day when the vessel left Cardiff, and at the time she left. This was contradicted by all the other witnesses, and the Court did not give credence to the accusation; and it should be added that the man who made it had been "logged" for absence from his ship without leave. The captain's certificate was then handed to him, and the inquiry closed.

A TREATISE ON THE SCIENCE
AND PRACTICE OF THE MANUFACTURE AND
DISTRIBUTION OF COAL GAS.

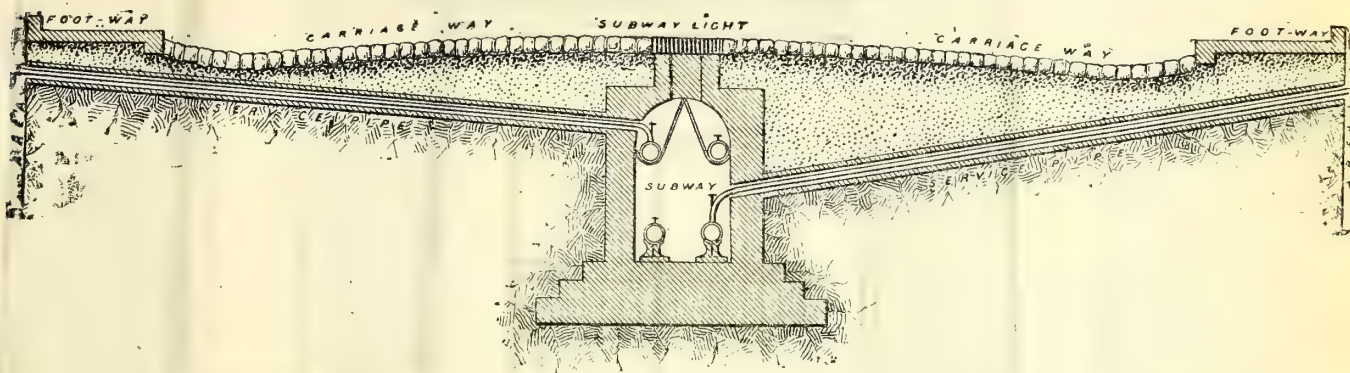
CXXXVII.

SUBWAYS (continued).

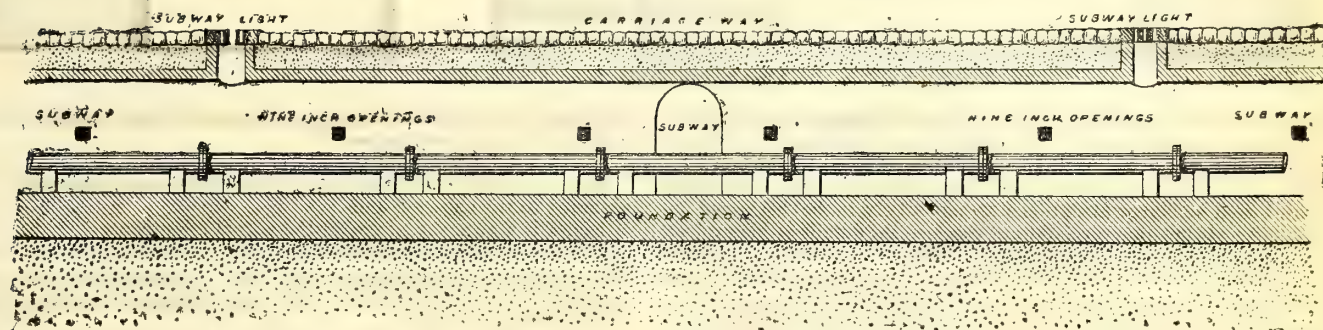
The first suggestion for constructing subways underneath the streets of London was made by Mr. John Williams, a stationer, in Cornhill, in a letter dated Aug. 27, 1817, addressed to Mr. Michael Angelo Taylor, at that time Member of Parliament for Durham. In the year mentioned, a Bill was introduced by Mr. Taylor, and passed, for removing obstacles and nuisances from the streets of the Metropolis, and regulating the paving and public lighting.

This Act, which proved highly useful in clearing the pavement of wheelbarrows, and impediments generally from the public way, and

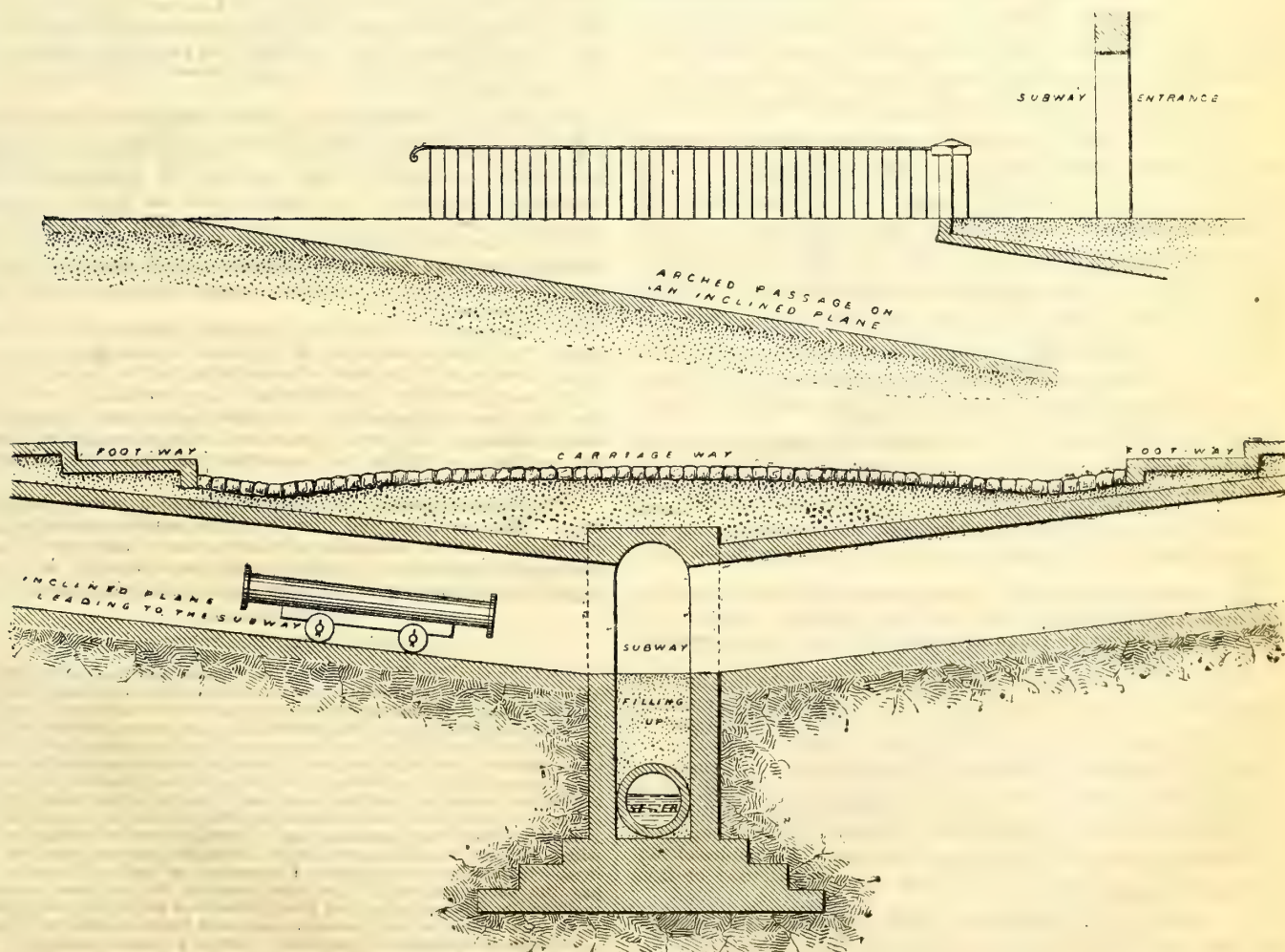
also prevented projections from shop windows and doors, which had become an intolerable nuisance, led Williams to address a letter to the author of the Act, to the effect that as the labours of the committee of the House of Commons on the Act for improving the paving of the Metropolis, of which Mr. Taylor was the chairman, were likely to produce considerable benefit to the public, he took the liberty, with much deference, to offer to his notice, in furtherance of that object, an idea which he believed was capable of rendering the views of the House, in addition to the Act of Parliament recently enacted upon that subject, thoroughly complete. "It was," he stated, "perfectly attainable, to prevent the pavement, when once laid, from ever being disturbed for any purpose whatever; and as the simplicity of the plan, when explained, might create a question of its originality, although it had never been adopted, or indeed thought of, he proposed to submit the idea to Mr. Taylor as the



TRANSVERSE SECTION.—FIG. 1.



LONGITUDINAL SECTION.—FIG. 2.



SECTIONS SHOWING THE ENTRANCE TO SUBWAY.—FIG. 3.



GATEWAY AT ENTRANCE.—FIG. 4.

promoter of the new Act, in order to prevent disappointment, either in the loss to the public of an object so important, or of any remuneration which he (Williams) might be entitled to receive."

Mr. Taylor replied, desiring particulars, but Williams, who began to think that sufficient attention was not likely to be bestowed on the subject at that juncture, did not disclose the details of his project, and so the matter rested till the year 1822. At this time the old London Bridge Water-Works Company were dissolved by Act of Parliament, and the whole of the works destroyed, the supply being assigned to the New River Company, who immediately began to open the streets for the purpose of laying down larger mains. Williams, deploring the evils arising from the streets being torn open, which he said "appeared as though the entire City was preparing for a siege," and considering that the time had arrived for bringing his project before the public, took out a patent, in October of that year, "For a method to prevent the frequent removal of the Pavement and Carriage Paths, for laying down and taking up Pipes, and for other purposes, in Streets, Roads, and Public Ways."

To effect this object, he proposed to construct subways and passages of various descriptions as to capacity, form, situation, and materials, by opening the ground to the required depth—say, of 10 feet—lay a course of bricks, stones, or iron, nearly level, or, rather, curved, on the ground, 5 feet wide, with drains to go into the sewers; raise a wall on each side 5 feet high, and arch it over so as to leave the height in the centre $7\frac{1}{2}$ feet clear; to leave openings of 9 inches in each upright wall, at the distance of every 20 feet, 3 feet from the base; from these openings to carry tunnels to the sides of the streets, and at the end of the tunnels fix gratings or doors to be opened from the inside; to leave similar openings in the top of the arch, at the distance of every 100 feet, for the admission of light and air; and doorways 5 feet high and 3 feet wide, in each side-wall where these openings were made.

The proposed subways might be entered at the sides by doors and passages, wherever required, from the houses and buildings in the streets and roads, in the same manner as into cellars that are under the streets, and the main-pipes for every purpose were to be placed therein, on iron cradles, or otherwise; and the service-pipes for the supply of the public through the tunnels or openings in the side-walls.

The subways might also be formed double, or another parallel to the first—one for water and the other for gas pipes—and in any number that might be required, with or without doors, communicating into each.

From these subways and passages access was to be had into the sewers and drains, or springs and wells of water; and for almost every purpose for which the pavement and carriage paths in streets, roads, and public ways had previously been opened.

With the assistance of Mr. Henry Willey Reveley, a civil engineer, Mr. Williams prepared drawings of the proposed subways, and a committee having been appointed at a public meeting, held at the London Tavern, the "London Subway Company," with a capital of £100,000, in shares of £100 each, was projected. Five miles of subways were first proposed to be laid, at an estimated cost of from £16,000 to £20,000 per mile.

The accompanying engravings exhibit the system of subways as proposed by Williams, being copied from his drawings.

Fig. 1 is a transverse section, showing the roadway and footpath

overhead, the method of arranging the gas and water mains, and the channel for the service-pipes.

Fig. 2 is a longitudinal section.

Fig. 3 shows the means by which access was proposed to be obtained to the subway, and

Fig. 4 is a gateway at one of the points of entrance.

The project was a remarkable one, and the drawings illustrating it are not less so, embodying, as they do, to a large extent, the main principles of the more recent and matured designs that have been carried out in practice.

Williams pursued the subject for two years, at his own cost and charge, with all the pertinacity and enthusiasm of an inventor; labouring unceasingly, to the injury of his own regular business, to get his scheme put into actual operation, but without success, till, on the 10th of February, 1825, he offered the patent for sale at Garraway's Coffee House. It does not appear, however, that any purchaser was forthcoming.

Williams, in a volume on the subject, compiled by him, and published in 1828, reiterated his unflinching confidence in the project. "A remarkable period," he says, "in British history commenced some time after subways came forward. In consequence of the abundance of capital in the kingdom, and the want of adequate employment for it, projects were presented daily, if not hourly, in the City, for both of these purposes. Some of them were highly laudable, and gave activity to thousands, while many, on the contrary, were suggested in fraud, for foreign purposes, and produced great distress and ruin.

"At the period of the sales, numerous endeavours were made, among the brokers and others at the Stock Exchange, to bring forward subways with the view of speculating in the shares; but the object having nothing speculative in it, they could not succeed—not one share ever appeared in the market; none were allowed to be issued, although they were printed and stamped ready for circulation, so that no bubble ever connected itself with this important work,

"The immense quantity of these projects soon overwhelmed subways. They were lost and literally buried under a mass of evanescent matter, which, when cleared away at some future period, after the fever of speculative intoxication shall have subsided, will again appear like a mine of gold, for sober and enlightened construction."

(To be continued.)

CLEVEDON GAS COMPANY.—The annual meeting was held on the 29th ult. —Mr. J. Maynard in the chair. On the motion of the chairman, seconded by Dr. Heard, the following report of the directors was adopted:—"Your directors have much pleasure in presenting a statement of accounts for the year ending March 31, 1877, and recommending the payment of a dividend of £7 per cent., free of income-tax. There has been a considerable increase in the quantity of gas consumed, but, owing to the reduction in price, the returns are somewhat less than last year. On the other hand, the cost of coal for the past year amounts to £987 0s. 8d., as compared with £1100 16s. 10d. for the preceding year. Your directors trust that, as there will be but few extensions or renewals during the coming year, they will be able to meet the present state of depression of trade in Clevedon, and pay the usual dividend." The total receipts for the year amounted to £2878 15s. 3½d., including last year's balance of £26 7s. 6½d., the expenditure being £2011 1s. 5d., leaving a balance of profit of £867 13s. 10½d., of which £840 is dividend at 7 per cent. There is a balance carried to next year's account of £7 3s. 10½d.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

GARDENS IN GAS-WORKS.

SIR,—We ask your indulgence for liberty to make a few remarks on a portion of the extract from the *Hendon Times*, referring to the Child's Hill Gas-Works, which appeared in your last issue. We refer to the editorial comments on the excellence of the fruit, flowers, and vegetables, which have been grown on the premises and in the adjacent gardens. The questions here involved are of great interest to gas companies and managers, since in many localities the existence or non-existence of deleterious fumes, or, as it is generally termed, a "nuisance," proceeding from gas-works, is a matter of contention and expensive litigation between the gas companies and the local authorities. In such cases a powerful argument against the wild accusations frequently levelled by obstructive neighbours against the works, would be the perfection to which vegetables could be raised therein, if the spare ground which is generally to be found in small or medium-sized works were cultivated in an efficient manner. That this is possible we are able to prove, by producing certificates awarded at various horticultural exhibitions for exhibits from our own spare ground; and it would be a good plan for the directors of gas companies, having any facilities of the kind, to encourage their managers to so vindicate the harmless nature of their manufacturing processes, by growing such vegetable productions that their works might become a pride to the neighbourhood, instead of, as in many instances, a blight. It is unnecessary to dwell upon the personal influence which would react in the gardener himself, and probably redound to the advantage of the gas-works through him; but it appears to us that a voluntary arrangement on the part of the directors to recognize the efforts of their employees in this direction, by adding a premium to any prizes obtained at any local horticultural exhibition, for articles grown on their own property, would be of very great advantage to all parties concerned.

H. SKOINES AND CO.

Argyle Street, King's Cross, London, May 30, 1877.

Legal Intelligence.

NOTTINGHAM POLICE COURT.—FRIDAY, MAY 25.

(Before Mr. GIBSON and Alderman LAMBERT.)

CONVICTION OF THE CORPORATION FOR REFUSING TO SUPPLY GAS.

The TOWN-CLERK appeared on behalf of the corporation to answer a summons taken out by Messrs. Mitchell and Rodwell, trading as the Nottingham Brewery Company, for refusing to supply gas to a public-house; Mr. M'CRAITH appeared for the complainants.

The TOWN-CLERK did not deny the act of the corporation in cutting off the gas, for which he said they had several grounds of defence, which it was not proposed to enter into. The summons was for cutting off the gas attached to the "Three Horseshoes" public-house on the Derby Road, and the persons demanding the supply, Messrs. Mitchell and Rodwell, of Nottingham, common brewers, had taken possession under a bill of sale. He would now shortly state the point in respect to which the decision of the magistrates would be asked for. The custom had prevailed in that town for 30 years, in the case of public-houses, for the incoming tenant to make himself responsible for the gas-rates and taxes left over by the outgoing tenant. Such an arrangement was manifestly convenient for the public, as under other circumstances the corporation would have been compelled, as a protection for themselves, to get security for gas, which, be it understood, they were not compelled to supply without security. It was now attempted, for the first time for 30 years, to break down the custom. This case was brought under section 39 of the Gas-Works Clauses Act, 1871, which provided that "in case any consumer of gas supplied by the undertakers (who were, of course, in this case the corporation) leaves the premises where such gas has been supplied to him without paying the gas-rent or meter-rent due from him, the undertakers shall not be entitled to require from the next tenant the payment of the arrears left unpaid by the former tenant, unless such incoming tenant"—in this case Messrs. Mitchell and Rodwell—"has undertaken with the former tenant to pay or exonerate him for the payment of such arrears." In the present case the question was whether Messrs. Mitchell and Rodwell did make such an agreement with Mr. Stevenson, the outgoing tenant. Upon this point there would be a conflict of testimony.

The TOWN-CLERK then proceeded to call the following witnesses to prove the agreement Messrs. Rodwell and Co. made with the outgoing tenant, including the payment by them of the liabilities on the house:—

Mr. Leonard Stevenson said he formerly kept the "Three Horseshoes," on the Derby Road. On the 15th of May he was bought out by the Nottingham Brewery Company for £100. The arrangement witness came to with Mr. Marriott, clerk to Messrs. Maples and M'Craith, the solicitors engaged for the company, was for £100 and the outstanding gas and other rates, and all claims that the company had against him.

Cross-examined: At Messrs. Maples and M'Craith's office witness agreed to go out of the house for £100, all liabilities against the house to be paid by the company. Witness made the proviso because he wanted to go out of the house "straight," that is, without owing anything.

Re-examined: It was usual for the incoming tenant to make himself responsible for the gas bill and rates incurred by the outgoing tenant. Personally, witness had now no interest in the matter, having filed a petition. If witness had had to pay the outstanding liabilities, very little might have been left of the £100.

Mr. Henry Barker, furniture dealer, Bridlesmith Gate, said he was present at the interview between Stevenson and Marriott. The latter distinctly stated that he would see the gas and rates paid. He also observed that the amount for gas was a very large one.

Cross-examined: Witness had traded with Stephenson for several years, who, although "a long-winded 'un," always paid up honourably.

Mr. John Newton, warper, of Norfolk Street, gave corroborative evidence as to Mr. Marriott's having said that he would see about the payment of the gas.

Mr. M'CRAITH said that though the complainants were nominally suing for a penalty, they wished in reality to protect themselves from the claim of the corporation as gas suppliers, which they maintained was unjustifiable. As the Act was only passed in 1871, the question of custom was out of the question altogether. The facts of the case were, that the complainants were very large creditors to Mr. Stephenson, who owed them something like £500, and a few days previous to the date of the interviews deposed to, they took possession under a bill of sale. The goods alone were not very valuable, but, with the licences, would have been worth possibly £300 or £400. The endeavour was made to

induce Stephenson to go out on certain terms, and he finally agreed to do so in consideration of the payment of £100, and a receipt for his liabilities to the company. It would be proved that this was the only offer made. Pressure was afterwards put upon Marriott by Stevenson for him to allow some part of the latter's things, forfeited under the bill of sale, to be left out of the bargain, and it was arranged that he should have his bed-room. As it was the complainants were losers to the extent of £200, and it was only worth their while to pay Stephenson what he had asked in order to get him out of the house. It was stated at the interview between Stevenson and Marriott that probably the gas would be cut off, seeing that the bill was outstanding, and Marriott then said, "We shall take care of that." No doubt Barker and Newton did understand from these words that Marriott undertook to pay the gas-rate, but there was no idea of such a thing on his part, and in respect to this matter Stevenson must be deliberately telling an untruth.

Mr. Marriott, Messrs. Maples and M'Craith's managing clerk, said that Stevenson agreed with him to go out of the house, and give up everything, for £100. In the afternoon witness further agreed to let him have some bedding out of the house. It was agreed at the interview in the morning that witness should go up in the afternoon to endorse the licences and settle the matter. Witness then learnt from Barker that £12 was owing for gas, and remarked, "We shall take care of that," or something to that effect.

Cross-examined: Arrangements were completed in the morning. Witness never used such words to Barker as would lead him to suppose that the firm meant to pay for the gas.

Mr. Whitley, clerk to Messrs. Maples and M'Craith, denied that the agreement with Stevenson included the liabilities against the house. It was made a condition that £100 should be the limit, and the firm engaged to see their clients in order to ascertain what they would give.

The MAGISTRATES, after a short deliberation in private, fined the corporation to the extent of 1s.

Miscellaneous News.

AVERAGE METER SYSTEM IN PADDINGTON.

The following report of the Gas and Water Committee of the Vestry of Paddington has been presented:—

Your committee have much pleasure in submitting for the information of the vestry, the annexed tabular statement, showing the results of the working of the average meter system, for the quarter ending Lady-day last, by which it will be seen that the saving effected in gas for the above-mentioned period has been 1,940,644 cubic feet, representing in money £341 3s. 8d., the amount gained during the corresponding quarter last year was £244.

(Signed)

JAMES FLOOD, Chairman.

Table showing the Hours of Burning and Consumption of Gas for One Lamp during the Quarter ending Lady-Day, 1877, under the Old and New Systems.

Month, 1877.	OLD SYSTEM.			NEW SYSTEM.					Gain in Gas over all Lamps.
	Hours Burn- ing per Month.	Esti- mated Quan- tity at 5 Cubic Feet per Hour.	Hours Burn- ing per Month.	Esti- mated Quan- tity at 5-0 & 4-6 Cubic Feet per Hour.	Gas Saved.				
					Agreed Quan- tity by Meter Aver- age.	Esti- mated Con- sump- tion per Hour.	By Meter In- dica- tion.	Total by Meter and Mo- dified Hours.	
January.	Hours.	Cu. Ft.	Hours.	Cu. Ft.	Cu. Ft.	Cu. Ft.	Cu. Ft.	Cu. Ft.	Cubic Feet.
February.	478-8	2394	457-75	2240-56	2064-90	4-51	175-66	329-10	571,317-60
March ..	417-2	2086	361-50	1752-25	1630-38	4-51	121-87	455-62	791,411-94
	369-8	1849	390-08	1881-52	1772-08	4-54	109-44	336-92	586,914-64
Totals.	1265-8	6329	1269-33	5874-33	5467-36	..	406-97	1121-64	1,949,644-18

(Signed)

GEORGE WESTON,
Inspector of Public Lighting.

AVERAGE METER SYSTEM IN ST. PANCRAS.

The Chairman of the Lighting Committee of the Vestry of St. Pancras has just prepared the following report:—

In accordance with annual custom I avail myself of the opportunity of laying before you, in a concise form, a brief record of your labours during the past year, and am glad to say that your efforts to combine economy with efficiency in your department have been successful. The continued success of the average meter system puts beyond further debate the prudence and forethought of the vestry in adopting it, and from the action which has been taken in many towns and parishes, there is further proof, if such were required, that the course pursued by our vestry in adopting this system was the proper one, and one that will be deemed worthy of imitation in many other places.

Now that the system is in full working order, it is unnecessary for me to go into detail as to its operation, more especially as it has recently been given in a report of the second year's working. I may, however, remind the committee that during their year of office they have established a Committee of Observation, whose duty it is to view from time to time the state of the lighting of the parish. This has had a good effect in keeping up the standard of lighting and in showing the men the importance of looking after their lamps both as regards cleaning and lighting. One important alteration in the original arrangements has also been made during the year, by mutual agreement between you and the gas company, and that is that the meters are to be tested *in situ* instead of being removed for testing purposes, and only those are now removed which are known to be out of order. This will not only save considerable expense, but the apparatus will last longer through not being disturbed from time to time as was originally contemplated. You will remember that when the average meter system was commenced it applied only to the lamps under the Imperial Company, and that the lamps, in the south-western portion of the parish, which were lighted by the Chartered Gas Company were not brought under this system.

Now that the Imperial has been amalgamated with the Chartered Company you have been enabled to arrange with the amalgamated company that the lamps formerly in the Chartered District, and now in the united district, should also come under the operation of the average meter system.

The present arrangement for supervising and controlling details, both as regards the foremen and lamplighters, is working admirably, and is a very marked improvement on the plan at first adopted.

The great improvement which you have effected in the lighting of the Triangle, Great College Street, by the erection of two brilliantly illuminated tri-

partite lamps, has been much appreciated by the residents in the vicinity, and has, I hope, so added to the appearance of the spot that the representatives of the Marquis Camden cannot but feel that the improvement will tend to the interests of their estate

I am sure that the success of our operations will meet the approval of the vestry and of the ratepayers generally, especially when I point to the fact that for the current half year it has only been necessary for the vestry to lay a rate of 1d. in the pound for lighting, whereas heretofore there has never been a rate lower than 1½d. in the pound in any half year. The following table shows the total saving effected during the past year.

Total Saving by the Meter System.			
In the cost of gas	£2,868	14	1
In cost of lighting and extinguishing and in repairs and maintenance of lamps.	304	1	6
Deduct—			
Annual proportion of cost of meters, meter-boxes, governors, cocks, &c., £3226 13s. 9d.	£320	0	0
Cost of maintenance of meters, salaries of officers, &c.	583	15	9
Total saving for the year.	£2,268	19	10

In conclusion, I beg to convey to the deputy-chairman and to the committee generally my thanks for the valuable support I have received as chairman, without which it would have been impossible for me to have passed through the year's work so successfully and pleasantly as I have done.

(Signed) GEORGE MACKANESS, Chairman.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health, on the composition and quality of the metropolitan waters in May, 1877:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen	Nitro-	Ammonia.		Hardness (Clarke's Scale).	
		required by Organic Matter, &c.	gen. As Ni- trates, &c.	Sa- line.	Or- ganic.	Before Boil- ing.	After Boil- ing.
<i>Thames Water Companies.</i>							
Grand Junction	Grs. 20.50	Grs. 0.049	Grs. 0.135	Grs. 0.001	Grs. 0.007	Degs. 13.2	Degs. 3.3
West Middlesex	20.20	0.059	0.150	0.000	0.007	13.2	4.2
Southwark and Vauxhall	19.60	0.052	0.150	0.001	0.008	13.2	3.3
Chelsea	20.10	0.052	0.135	0.000	0.007	13.2	3.3
Lambeth	21.00	0.053	0.180	0.000	0.008	13.7	3.7
<i>Other Companies.</i>							
Kent	31.00	0.003	0.420	0.000	0.002	19.4	6.5
New River	19.40	0.036	0.138	0.000	0.006	12.6	3.3
East London	18.80	0.028	0.180	0.000	0.007	11.6	3.3

Note.—The amount of oxygen required to oxidize the organic matter, nitrates, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid, namely:—Grand Junction, West Middlesex, and Lambeth. C. MEYMOTT TIDY, M.B.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary Meeting of the Proprietors of this Association was held at the City Terminus Hotel, Cannon Street, London, on Tuesday, May 29th.—JULIAN GOLDSMID, Esq., M.P., in the chair.

The SECRETARY (Mr. Albert F. Jackson) having read the notice convening the meeting, the corporate seal was affixed to the register of proprietors, and the following report was presented:—

The present half-yearly ordinary meeting of the shareholders has been convened, agreeably to the company's Act of Parliament, for the purpose of receiving a report from the president and directors upon the affairs of the association, and for declaring a dividend for the half year ended the 31st of December last.

Gas Made.—The total quantity of gas made at all the stations in the half year ended the 31st of December last was 2614 million cubic feet. The total quantity made in the corresponding half year of 1875 was 2718 million, being a decrease of 104 million, or at the rate of nearly 4 per cent. The diminution arising from the sale of the works at Bordeaux was 154 million, showing, therefore, an increase at the remaining stations of 50 million cubic feet, or 1.84 per cent.

Lights.—The total number of lights at all the stations on the 31st of December last was 1,095,671. The total number of lights on the 31st of December, 1875, was 1,093,371. These figures show an increase of 2300, or at the rate of nearly one-quarter per cent., notwithstanding the loss of 52,560 at Bordeaux.

Mains.—The total length of mains laid up to the 31st of December last was 1077 miles. The total length of mains on the 31st of December, 1875, was 1131 miles, being a decrease of 54 miles. At Bordeaux more than 85 miles were given up.

There is nothing special to report as to the condition of the several stations. They have all been maintained in good repair and working order. Mr. G. W. Drory has, with the assistance of the engineers and agents at the different stations, superintended the conduct of the business, and generally the affairs of the association on the Continent.

The rental for the half year ended the 31st of December last (1876) was less than for the corresponding half year of 1875. The decrease was owing to the association having ceased to light Bordeaux on the 15th of April, 1876.

The profit also was less, though, notwithstanding the loss of Bordeaux, by a small amount only.

The cost of the coal employed during the half year now under review was nearly 2s. per ton less than during the half year ended the 31st of December, 1875.

The value of the secondary products—coke, tar, and ammonia—was 78½ per cent. of the cost of the coal, being an increase of more than 3 per cent. on the corresponding half of 1875.

In the half year now under consideration, large sums were expended at several of the stations—viz., Amsterdam, Brussels, Frankfort-on-the-Maine, Hanover, and Vienna—for the completion of costly purifying apparatus, and for new gasholders.

A considerable outlay was also incurred for mains at nearly all the stations, but more particularly at Berlin, Frankfort-on-the-Maine, Hanover, and Vienna.

Plots of land for the ultimate extension of the works of the association at Hanover, Lille, and Vienna were purchased.

At Brussels, the suit by this association against the town authorities for the balance due from them on payment of the works sold, was still before the court, and remained undecided.

On the 5th of December last a new contract was concluded for lighting one of the suburbs of Brussels—namely, the "Commune" of Forest.

At Hanover, on the 21st of September last, a further contract for lighting the suburb of Linden (containing some modifications of the then existing contract) was signed with the authorities of that suburb.

At Vienna, on the 30th of last November, a contract was concluded for lighting the small suburb of Floridsdorf.

The president and directors desire now, in conclusion, to draw the attention of the shareholders to the accounts for the half year ended the 31st of December last.

These have been duly audited, and from them the directors have, in accordance with the provisions of the Companies Clauses Consolidation Act, prepared a scheme showing the profits of the association for the last half year, and the portion thereof applicable to

the purposes of dividend, which the president and directors recommend now to be declared—namely, a dividend of £2 and a bonus of 15s. per share, payable, free of income-tax, on and after the 15th day of June next.

The directors who go out of office by rotation are Julian Goldsmid, Esq., M.P., N. Montefiore, Esq., and Francis Bassett, Esq. The auditor who goes out of office is Joseph Sebag, Esq. These gentlemen are all eligible for re-election, and offer themselves accordingly.

The CHAIRMAN: Gentlemen, the report which you have just heard gives you the usual information with regard to the affairs of the association during the half year ending on the 31st of December, 1876, and I think you will be of opinion with the board that, under the circumstances, it is a report which is most satisfactory, both to us, as managers of this undertaking, and to you, as shareholders in it; because, notwithstanding that we have sold one of our important stations—Bordeaux—and therefore the accounts for the half year we are now considering have to be compared with the corresponding half year, which included the business done in that town, we have still very nearly the same amount of profit that we had at that period, and we are able to declare again the very highest dividend and bonus ever paid to the shareholders of this association. Now, you will ask, no doubt, what is the reason of this? One reason is, of course, a very obvious and simple one—that is, that our business has been increasing very largely at other stations. We are spending very large sums of money upon some of those stations, and we find it is absolutely necessary that we should do so. Every one who is acquainted with an important capital like Vienna must know that the extensions which take place yearly are very large. If he will compare, for instance, the additions which are yearly made to any of the suburbs of London, he will be able to judge how rapidly a capital increases itself, and as we light several capitals, we have to spend large sums of money constantly in providing for that purpose. Sometimes we spend £120,000 or £130,000 a year to meet the legitimate enlargements of our business, which legitimate enlargements ultimately lead to increase of profits. But there is also the much more important reason, namely, that coals have been unusually cheap. I mentioned last year that on several occasions we had been told that the cost of coal did not affect us. The fallacy of that statement has been abundantly proved by more than one gas company. The fact that we have been able to maintain our profits at the same amount, notwithstanding the loss of a considerable station, is owing to the great extensions of our business generally, and to the decrease which has taken place in the cost of coal. We are paying to-day 2s. per ton less than we were paying for the corresponding period of last year, and I do not see at present any prospect of a serious increase in price for some time to come. I think, therefore, in this respect we may congratulate ourselves as to the prospects of our undertaking. The president of the association, Sir M. Montefiore, has written to me to say that he regrets his absence from the meeting on this occasion, and that he entirely concurs in the views of the board with reference to the present position of our affairs. The next matter to which I would allude is one that has been discussed on more than one occasion, and it is one respecting which all of us—shareholders and directors alike—are anxious; I mean the proposed writing off of the £6 15s. unpaid on the shares of the association. We have already informed you that we have consulted some of the most eminent counsel, and we have gone into the matter thoroughly and conscientiously; but the result of the advice we have taken is that it is entirely out of our power to write off this amount without the authority of an Act of Parliament. We find that if we did so we should be exceeding those limits which the most experienced lawyers say we have no right to exceed, and that we should render ourselves liable to proceedings in Chancery on the part of trustees whose rights would be to some extent affected thereby. We do not, therefore, recommend that any course of that kind should be adopted. Still we see there would be very great advantage if the thing could be done, and we are at the present time in consultation with our solicitor, who is carefully preparing the heads of an Act which we shall endeavour to obtain in the next session. Our solicitor will lay this before us in due course, and we shall then ask for your approval if necessary. But I think the shareholders will agree with the board in the opinion that we should endeavour in this Act to settle several other points which may arise, and may be of importance to us hereafter, and this we propose to do. I think, too, you will be of opinion with the directors that we should endeavour to obtain that Act to leave us to manage our own affairs, for we practically are the only people affected by them. The Legislature is not required in our case to look after the interests of any consumers; the municipalities or other local authorities in every town we light do that; and therefore all the Legislature has to do is to see that we do not exceed those proper limits which ought to control every board of directors in the management of a company such as this is. Now, gentlemen, I have pointed out to you on more than one occasion that as our affairs are growing in importance, personal supervision becomes exceedingly difficult. None of your directors have hesitated, when required, to go to the Continent and look after the interests of the association on the spot, and during the past year it was thought that a personal inspection should take place with regard to three stations in Holland. Under those circumstances, Mr. Wood and Mr. Palmer kindly went over to that country and gave us the benefit of their inspection of our works. But there is one portion of our business which no director could investigate. We used formerly to leave to Mr. Drory the personal supervision of the accounts of the individual stations, but Mr. Drory is now labouring under a disability which affects all of us in turn, and generally at a time when we least like to experience it, and that is old age. Mr. Drory is—well, I need not say how many years past 70, and he finds it is not now so easy a matter to move about in the way he formerly did. Under these circumstances, and, considering the very large business which we are now carrying on in the very important towns of Vienna, Berlin, Antwerp, Frankfort, and so on, we have thought it desirable to have a perfectly independent and extraneous investigation of the accounts of these stations, which are always locally looked after, but have not hitherto been looked over from London, except through the medium of Mr. Drory, as manager on the Continent. We have, therefore, on the strongest recommendations we could have, appointed a gentleman for one year, just to see how the thing will work, whose duty it will be to inspect, on the spot, the accounts of the several stations. That gentleman is Mr. Wingfield, and we have every reason to believe he will prove to be a very valuable servant of the association. Well, now, gentlemen, these, I think, are the points of the greatest importance in your affairs which it is my duty to bring before you. But, before closing, I would make one remark with regard to Bordeaux. You will remember that, on more than one occasion, you have been told, both by Mr. Twells and by myself, what difficulties we had to deal with at Bordeaux. First of all, we had more or less to fight the municipality; then we had to fight the company which ultimately obtained the new concession—a concession which we did not consider at all likely to prove profitable, and were, therefore, unable to take. We are in hope now that nearly all the questions pending between us have been practically settled, and, when that is done with, I think we shall have no more trouble about Bordeaux, as the money for the purchase of the property, as you know, has been paid. But now we do not get the profit of lighting Bordeaux. One thing I am certain of. From all I hear, it is not lighted in the same satisfactory manner as when we were the contractors

for doing it. I believe that in no case, in which we have either sold our property to another company or to the local authority, has the lighting of a town been improved by the change. This proves, of course, satisfactorily that our work was done as well as it was possible to do it; I do not want you, however, to look with equanimity on this state of things. Having lost Marseilles and Toulouse, and sold Cologne and Bordeaux, we are reduced by four important stations, and although the increased business at our other stations nearly covers the loss thus experienced, we cannot go on upon that principle. We have been endeavouring, in the new contracts made in the last few years (and in the last few months we have had examples) to give every reasonable concession to the local authorities, in order that we may carry on business for as many years as possible in the towns we undertake to light. We are anxious to remain a gas company, and not to realize our property. We endeavour to light well the towns we light, while we look after our own interest, and pay a substantial dividend. I think under all the circumstances you will agree with me that the report you have heard to-day is very satisfactory, and that I am justified in moving that it be adopted and entered on the minutes. Mr. JOHN RICHARDSON seconded the motion.

Mr. PRICE, referring to the remarks made by the chairman as to the appointment of Mr. Wingfield, asked whether that gentleman had been accustomed to gas manufacture, or whether he was a novice in the business. On another point mentioned, the writing up of the £6 15s. on the shares of the company, he was not presumptuous enough to question the opinion of a Queen's counsel, but it seemed to him rather contrary to ordinary notions of business that the company were not able to call up their own property in any way they pleased. However, as the board were going for an Act of Parliament to decide the point, he was content to wait, and felt it was quite right to have the matter made perfectly clear. With regard to the profits of the last six months as compared with the half year ending Dec. 31, 1875, he asked for an explanation. The difference in the amount was only about £4000, notwithstanding the loss of the Bordeaux works. In the last half year was the amount set apart as profit the real earnings of the period, or were there other items included of any kind? Of course there were the dividends on the very large investments held by the association in both half years, but there might also be some items in the last statement which did not appear in the former. He regretted to hear that Mr. Drory was beginning to feel the infirmities of age. The association were indebted to that gentleman for very much of the success which had characterized their operations for many years, and they owed him a debt of gratitude for his services. With regard to the reserve-fund the directors had now brought it up to nearly £200,000, and he would like to know what additions would yet be made to it and how far the shareholders were off from getting a larger dividend than they had yet obtained. On the last occasion they were told that the period had not then arrived; another six months had rolled away, and he thought they were past it. He did not care to lay up so much for those who would come after them, and thought they ought to have a little of the money in their own pockets. No doubt the investments of the association were in good stocks, but it was not their business to be a trust company. All they should aim at in this way was to be sure that they had a sufficient sum of money laid by for the purpose of meeting contingencies. He thought they had already more than enough. Again, he took exception to the proposition to pay £2 per share dividend and 15s. bonus. Why not call it all dividend? He thought an improvement had been introduced by the directors in announcing the rate of dividend in advance, and not leaving it to be disclosed at the meeting. It closed the door against the possibility of prior information being made use of, as it had been in this company. He congratulated the directors on this new movement; they had now got upon the incline, and perhaps would soon give the shareholders something more. With reference to the proposed application to Parliament, he hoped the board would endeavour to cover as much ground as possible, and that in their proceedings they would be guided and advised by some parliamentary agent who was in the habit of having gas companies Bills in his hands. There was always some technical information to be had from such agents which was not otherwise attainable. Referring to Vienna, did he understand that the directors had made a fresh contract for the suburbs, as they had done in some other towns?

The CHAIRMAN said they had been making such contracts gradually. The directors, some four or five months ago, discussed the question of announcing the dividend before the meetings of shareholders, as was done in the case of the great railways, and came to the conclusion it was a desirable course to adopt. They were glad that it met with the approval of the proprietors, and they would continue to follow that course in the future. With regard to the appointment of Mr. Wingfield, he did not desire, nor would it be fair to that gentleman, at this meeting to go into the recommendations upon which he was appointed. The board were quite satisfied that in appointing Mr. Wingfield they had appointed an honourable and conscientious gentleman, who, they believed, was eminently qualified for the discharge of the duties he would have to fulfil. As already remarked, the arrangement was for one year only, and was so made that each side might be free to act if it was not satisfactory; and that if at the end of the time it was not mutually agreeable, they could part without bitterness. He hoped, however, that Mr. Wingfield and the association would remain in connexion for many years. As to the proposed application to Parliament, Mr. Price might be assured that the directors would not do anything in too great a hurry, and that what they did would be maturely considered. As they had the good fortune to have two or three members of Parliament on the board who had had experience in gas matters, the shareholders need not be afraid that the best course would not be adopted. The directors would endeavour to make the Act as comprehensive as possible, so as to meet the future requirements of the association. With reference to the inquiry as to Vienna, the shareholders were aware that in many of these large towns the Municipality covered only what might be called the town proper, and that there were important suburbs requiring to be lighted, with which the association were able to make arrangements. This had been the case at Vienna, as was stated in the report just read; and since then several other suburbs had followed suit. The directors, in the contracts thus made, gave to the districts every advantage they possibly could, while at the same time they endeavoured to do the best for their shareholders. Referring to the reserve-fund, Mr. Price would remember that one member of the board—Mr. Bassett—when he sat on the other side of the table, made some excellent speeches in favour of increasing the dividends, but he also spoke strongly in favour of having a good substantial reserve-fund, which could not be touched without the sanction of the shareholders. When asked at one time how far he would go in this direction, Mr. Bassett said he thought it ought to amount to a quarter of a million. That view had been concurred in by the board, looking at the fact that their property was not freehold, but only leasehold, which might terminate at the end of their concession, or which, if continued, could only be renewed by making considerable changes. He believed that if the shareholders looked at the matter from the same point of view, they would fully agree with the directors. The only other inquiry made by Mr. Price was with regard to the profits; and, in reply, he would say that there had been no alterations in the accounts in that respect, and nothing had been included in the last half year which was not included ten years ago.

Mr. PRICE said his inquiry was whether the difference of £4000 was to be accounted for by the loss of Bordeaux.

The CHAIRMAN said if the honourable proprietor had listened to the report he would have heard that the difference in profits by the loss of Bordeaux was much more than £4000, but that the increase at other stations had reduced the larger amount to the sum of about £4000.

The motion for the adoption of the report was then put and carried.

The CHAIRMAN moved, and Mr. TWELLS seconded, the following resolution, which was also adopted:—"That a dividend of £2 per share, and a bonus of 15s. per share, be declared upon the 56,000 shares of the association for the half year ended the 31st of December last, and that the said dividend and bonus be payable, free of income-tax, on and after the 15th of June next."

Mr. TWELLS: Gentlemen, you have heard by the report that several directors go out of office on this occasion, and the first of these is our excellent friend and chairman, Mr. Julian Goldsmid. I think a motion for his re-election would come better from this side of the table, because we, the directors, are not only anxious to have an efficient chairman for the management of the company, but also a gentleman who, by his social influence, courtesy of manner, and general aptitude, is entitled to the cordial co-operation of the other directors. I have, therefore, much pleasure in moving the re-election of Mr. Goldsmid.

Mr. HADEN seconded the motion, which was cordially adopted.

The CHAIRMAN acknowledged the compliment thus paid to him, and moved the re-election of his colleagues, Mr. Montefiore and Mr. Bassett.

Mr. HELME seconded the motion, which was carried unanimously.

On the motion of Mr. PRICE, the retiring auditor, Mr. Sebag, was re-elected, and that gentleman returned thanks.

The CHAIRMAN moved, Mr. PRICE seconded, and it was resolved that a vote of thanks be given to Mr. G. W. Drory, the general superintendent of the affairs of the association on the Continent, and to the agents, engineers, and other officers of the association.

Mr. HADEN moved, and Mr. RICHARDSON seconded—"That the cordial thanks of the meeting be given to the president and directors for their able management of the affairs of the association, and to the chairman for his conduct in the chair this day."

The motion was put and carried unanimously, and

The CHAIRMAN having acknowledged the vote, the proceedings terminated.

CARLISLE CORPORATION GAS-WORKS.

The *Carlisle Patriot* of the 18th ult. furnishes its readers with the following interesting particulars respecting these works:—

Amongst the many improvements now going on in this city to meet the growing demands of the time, few are of more importance than the extension of the gas-works on the present premises, and the initiatory steps now being taken for the establishment of new works on Boustead's Grassing. When the corporation acquired the then gas-works, in 1848, the present site was considered sufficient for any enlargement that would likely be made. Of late years, however, the ever-increasing demand upon the Gas and Water Committee not only rendered it necessary to utilize to the best advantage every inch of the ground at present in their hands, but they were also compelled to look around for a site on which to erect manufacturing apparatus adequate for the inevitable requirements of the future. The following is a summary of some particulars showing the growth of the works from 1855:—

Date.	Loans on Mortgage.	Gross Capital Expended on Works.	Revenue from Gas Sold.	Net Profits.
1855 ..	£18,227 ..	—	£6,805 13 9 ..	£1,242 4 11
1860 ..	17,262 ..	£36,798 13 2 ..	8,993 8 5 ..	2,774 5 5
1865 ..	13,698 ..	42,065 19 6 ..	8,925 11 10 ..	2,316 10 4
1866 ..	12,279 ..	42,742 19 9 ..	9,193 17 9 ..	2,018 19 11
1867 ..	12,279 ..	44,343 11 3 ..	9,424 18 7 ..	2,400 13 5
1868 ..	12,279 ..	44,861 16 0 ..	10,192 4 10 ..	2,015 13 8
1869 ..	12,279 ..	47,333 5 0 ..	10,802 10 1 ..	2,724 2 9
1870 ..	12,107 ..	52,406 6 3 ..	10,599 9 11 ..	2,531 18 3
1871 ..	11,720 ..	53,047 0 5 ..	10,707 16 7 ..	4,181 16 5
1872 ..	11,505 ..	54,234 16 9 ..	12,072 9 0 ..	4,750 10 6
1873 ..	11,505 ..	57,074 13 9 ..	14,200 4 6 ..	3,072 9 10*
1874 ..	11,505 ..	57,404 1 8 ..	15,056 9 1 ..	2,924 15 6*
1875 ..	10,989 ..	58,557 13 3 ..	14,039 18 11 ..	3,305 18 7
1876 ..	10,000 ..	60,786 10 6 ..	15,468 6 4 ..	5,401 4 7

* Great advance in price of coal.

In 1855-6 the price of gas was 4s. 2d. per 1000 cubic feet; in 1865 it was reduced to 3s., and remained at that figure until coal became so dear in 1873, when an additional 6d. per 1000 was charged for that and the following year. In 1875 the price was again reduced to 3s., and it remains at that figure at the present time.

Two years ago Mr. Hepworth, the able and courteous engineer and manager, drew attention to the necessity for the immediate and considerable extension of the works; he pointed out that the growing demand taxed to the utmost several parts of the apparatus employed, and that, in some respects, the ground would not admit of further material extension, though, with certain additions and continued care in the management, provision could be made for procuring the estimated consumption of gas for a few years. He calculates that the consumption of gas in Carlisle is doubled every 13 or 14 years. After much deliberation, the corporation agreed to carry out certain extensions which would lighten the necessary darkness until new works were constructed further up the banks of the river Caldew. Under the active superintendence of Mr. Hepworth, the alterations are now being carried out with vigour. A condenser, capable of condensing 750,000 cubic feet daily, was brought into use in October last. It cost about £700, and stands at the top or north end of the works. Last month, the committee have come into possession of a part of Nelson's yard, about 1000 yards in extent, upon which a new retort-house, sheds for additional coal storage, and other convenient housing will be erected. The foundation of a new retort-house has just been commenced. It will contain six ovens of through retorts capable of manufacturing 300,000 cubic feet of gas per day, and will cost about £500. A new washer is nearly completed; it will cost about £100. A new scrubber was finished in March last and another is being enlarged. The estimated cost of this work is about £850. Messrs. Hill and Beatty, builders, are now busy with the erection of a chimney at the end of the retort-house, the contract for which is £450. The manager hopes to see it completed by the end of June. It will be 120 feet high, and 5 feet 6 inches internal diameter. The existing or old chimney, standing in the centre of the viaduct, has not been used for several weeks, and will soon be removed—from an æsthetical point of view, the sooner the better. The house and offices adjoining the works having been very much darkened by the construction of the viaduct, considerable alterations are now being carried out there. On the ground floor a large store-room and residence for the foreman is being fitted up; the first floor is being converted into a suite of offices, including committee-room, manager's offices, general office, and show-room for fittings. There will be an entrance to the offices from the viaduct, and a flight of steps exists for access from the main thoroughfare to the works. Lately several

new mains have been laid from the works to some of the principal streets in the city, to the viaduct approaches, to the west side of the Caldw, to the new streets near to Fusehill Workhouse, to London Road, as far as Upperby, and to other places in the vicinity, which are becoming thickly populated. With the erection of a gasholder at the site of the new works, it is conjectured that the present manufacturing power will be sufficient for a year or two.

As already stated, the new works are to be erected on Boustead's Grassing, where some ten acres have been set apart by the corporation for this object. Many years, however, may elapse before the general scheme is fully developed. For the present, a large holder, 125 feet in diameter, will be constructed there, and it will be connected with the works by a large trunk main, which is now in progress of construction. Excavations are being made for a trial well preparatory to erecting this holder, and it is questionable if it will be ready for use before the spring of next year. The site lies immediately behind the works of Messrs. Lowthian and Fairlie, over the new bridge. We have seen the plan of the general scheme. Crossing the bridge, there is a portion of what is known as Heysham's field on the left, upon which and a portion of the Grassing it is intended to erect six holders, averaging 125 feet each in diameter. The offices, foreman's residence, and store-rooms will be placed on the ground adjoining the new road at the bridge; behind this group of buildings will be a row of sheds for storage purposes, and in rear of these, and adjoining the Maryport and Carlisle Railway Company's line, there will be a purifying-house, scrubbers, condensers, &c. Further up the Grassing a retort-house, engines, exhausters, boilers, pumps, and other apparatus will be fixed. At the high end of the works large tanks will be constructed. The plan also shows that lines from the Maryport and Carlisle Railway Company's line will connect the works with the main line; they will be used for bringing in coal, pipes, &c. The new street will be carried onward in continuation from the bridge. On the right side of the ground, adjoining the river, the space will be utilized for storage and other purposes. Many years will be required to complete the scheme. Matters of detail, which, in some instances, may yet result in a re-arrangement of sections of the work, will be duly considered as the exigencies of the time demand. The whole of the work now going on is being superintended by Mr. Hepworth, who has also drawn out the various plans, and for a considerable time to come his hands will be pretty well filled.

EXETER GAS SUPPLY.

At the Meeting of the Exeter Town Council, on Wednesday, the 23rd ult.—the MAYOR (Mr. W. Cuthbertson) presiding,

A letter from the gas company was read, in reply to a communication from the council on the 11th of May, and in reference to a resolution passed at a meeting of the council on the 5th ult. The directors refused to admit that the nuisance complained of arose at their works, still, for the information of the council, they stated that a staff of men had been engaged for more than a month past in carrying out alterations and improvements, also that additional apparatus would be fixed as early as practicable, with the greatest care, so as to avoid the possibility of a nuisance arising therefrom.

Mr. WARE asked if the committee of the council were empowered to conclude the purchase of the gas-works.

The TOWN-CLERK replied that the terms of purchase were pretty well agreed on, and the committee had to learn whether the company would accept those terms.

At a subsequent part of the meeting in reference to the instruction given him to inquire as to whether there was evidence procurable to sustain a prosecution against the gas company, the TOWN-CLERK reported that he had collected certain evidence which was of a very direct character, and perhaps the council would now refer the matter to some committee to conduct the prosecution.

Mr. WILCOCKS said he should like to know whether the town-clerk was going to proceed with the prosecution of the company.

The TOWN-CLERK replied that the council could not help themselves.

Mr. WILCOCKS said that although the council could not help themselves, and must prosecute the gas company, still he could not allow the prosecution to proceed without entering his formal protest against it. He might say the "gas nuisance" had never affected him, either directly or indirectly, and he very much doubted whether all the stench that had been recently smelt had arisen from the gas-works. Whilst he did not wish to put himself forward as a champion of the gas company, and though he considered they had unwittingly been much to blame, still he liked fairness, and when he saw them trying to put their works into a state which would comply with the recommendations of the eminent man brought down by the council, he thought it was not right to prosecute them. The council had been charged with not doing their duty in this matter, but he maintained that the council had done everything they possibly could to have the nuisance abated. The council had tried, and were trying now, to purchase the gas-works, and just as they were coming to terms with the gas company they had notice served upon them to prosecute the company for an alleged nuisance. He repeated again that he considered the notice to be mischievous and malicious, and not only that, but the charge against the council, of not doing their best, was a piece of infamous calumny. From what he had been able to see in the papers lately, it appeared to him that there were some people who did not wish the council to buy the gas-works. The only reason he could see for that was that those persons would have nothing further to agitate for if the gas-works were purchased. ("There's the water question.") Their stock-in-trade would have vanished. The words of Dr. Watts's hymn, that

"Satan finds some mischief still
For idle hands to do,"

had occurred to him as appropriate to the authors of that statutory notice. He had asked himself, what was all this agitation against the gas-works for? Was it for a certain individual, or number of individuals, to gain a cheap notoriety? Or was there something to be done to try and divert the attention of the citizens from anything else—as Mr. Hirtzel suggested, from the water company? He protested against the course.

Mr. F. THOMAS did not think that all the persons who signed the statutory notice were actuated by the feelings Mr. Wilcocks imagined. While the gas company were doing all they could do, the council would be prepared to do their duty. He was quite aware they would have the same equally disagreeable duty to do with regard to the water company, and if Mr. Wilcocks hinted that they were likely to overlook that one, he was very much mistaken. He should like to know if the committee who were empowered to treat with the gas company had the slightest power to commit the council.

The TOWN-CLERK: They have no power. It is with this body to conclude the negotiations or not.

Mr. COURTNEY certainly thought the council ought to stay their hands before running into such an expense as that involved in the contemplated prosecution.

Alderman CLIFFORD entirely agreed with Mr. Wilcocks. But the council were in this position—they were compelled to act, and, therefore, the matter had much better go before the Sanitary Committee. He accordingly moved that the question be referred to that committee.

Mr. HIRTZEL seconded.

Mr. NORRINGTON asked if the council were aware of what the gas company were doing. The moment the council saw a serious attempt was being made to remove the evils complained of, the memorialists came upon them to prosecute the company. To prosecute at the present time looked to him as a quite unnecessary act. He only hoped that what the memorialists had done, they had done in ignorance.

Mr. JONES said if Mr. Norrington would put himself in communication with some of those gentlemen who had signed the statutory notice, he would find that their object was to prevent the purchase of the gas-works.

Mr. WILLEY said there was an impression abroad that the council were obliged to purchase the gas-works at a maximum of 10 per cent. That was not so, because there was a large quantity of the property that did not pay 10 per cent., and, therefore, he thought the purchase would rather be at the rate of 7½ per cent. He agreed with Mr. Norrington that this was an unfortunate time for the prosecution. He had lately been at the works, and endeavoured to make himself acquainted with the subject, and he believed that the company were trying to do all they could to bring their works into good order.

The motion referring the matter to the Sanitary Committee was then carried.

BAHIA GAS COMPANY, LIMITED.

The Ordinary Half-Yearly General Meeting of this Company was held at the London Offices on Tuesday, the 29th ult.—EDWARD HORNER, Esq., in the chair.

The SECRETARY (Mr. A. J. Head) read the advertisement convening the meeting, and the following report and statement of accounts were presented:—

The directors herewith present the audited statement of accounts for the half year ending Dec. 31, 1876.

The mains for the first two sections of the new system have arrived at Bahia, and are now being laid. Those required to complete the system will be sent out as soon as the manager is prepared to lay them. Considerable progress has been made in the reconstruction of the works.

The profits for the half year, £3919 7s. 8d., added to the balance brought forward, makes the sum of £4360 19s. 11d.; out of which the directors recommend the sum of £500 to be carried to the reserve-fund, and the payment of the preference dividends of 10 and 7½ per cent. respectively for the half year, and that a dividend of 3 per cent. per annum be paid on the ordinary shares. This will absorb £4125, leaving £235 19s. 11d. to be carried forward.

to be carried forward		Dr.		Balance-Sheet, Dec. 31, 1876.		Cr.	
Capital—				Concession		£7,000 0 0	
5000 ordinary shares . . .		£100,000 0 0		Investment to June 30, 1876 . . .		95,941 13 9	
1000 10 per ct. preference shares . . .		20,000 0 0		Additional during half year . . .		1,410 18 6	
1500 7½ ditto ditto . . .		30,000 0 0		Freehold land . . .		4,705 2 7	
Creditors—				Meters fixed . . .		3,014 6 9	
On open accounts . . .		947 15 9		Office furniture and fixtures at Bahia and in London . . .		400 17 8	
On acceptances . . .		5,014 11 6		Preliminary expenses . . .		16,914 17 3	
Dividends unpaid . . .		36 10 2		Suspense account—			
Insurance-fund . . .		47 4 10		Extension of retort-house, &c. . .		2,114 4 11	
Reserve-fund . . .		2,000 0 0		Mains renewal . . .		488 3 9	
Profit and loss . . .		4,360 19 11		Plant . . .		569 9 11	
				Amounts due for gas, fittings, &c.—			
				Public lamps . . .		1,580 18 4	
				Ditto establishments . . .		4,067 15 11	
				Private rental, fittings, and coke . . .		5,517 18 7	
				Sundry debtors . . .		66 11 4	
				Stock—			
				Coals . . .		3,065 8 9	
				Coke . . .		223 4 0	
				Fittings . . .		3,961 16 3	
				Mains, lamp-columns, and other materials . . .		2,430 4 2	
				Goods in transit . . .		3,834 16 7	
				Bills receivable . . .		3,500 0 0	
				Cash at bankers—			
				General account . . .		431 5 0	
				Dividend account . . .		36 10 2	
				Bahia . . .		763 8 1	
				London office . . .		11 12 6	
				Bahia office . . .		335 18 2	
		£162,407 2 2				£162,407 2 2	

Revenue Account.	
Coals carbonized . . .	£6,550 2 10
Purifying materials and wages . . .	331 16 0
Carbonizing wages . . .	1,327 3 6
Wages, yardmen, &c. . .	269 12 9
Repairs, mains, and services . . .	369 19 0
Lighting and repairing of public lamps . . .	1,412 12 8
Salaries . . .	1,821 16 11
Directors fees . . .	400 0 0
Auditors fees . . .	21 0 0
Rent and taxes . . .	113 1 6
Interest . . .	47 6 2
Stationary . . .	43 4 2
Office expenses . . .	33 11 5
Trade charges . . .	193 12 11
Travelling expenses . . .	54 13 2
Wear and tear . . .	1,144 6 11
Bad debts and allowances . . .	458 1 6
Exchange (loss) . . .	187 9 11
Law charges . . .	42 10 11
Extraordinary disbursements—	
Extension of retort-house, &c.—	
One-sixth of £3951 11s. 5d. (5th instalment) . . .	658 11 11
One-sixth of £1078 19s. 6d. (4th instalment) . . .	179 16 7
One-sixth of £1274 16s. 3d. (3rd instalment) . . .	212 9 5
One-sixth of £687 17s. 9d. (2nd instalment) . . .	114 12 11
Renewal of mains—	
One-sixth of £585 16s. 5d. (1st instalment) . . .	97 12 8
Renewal of plant—	
One-sixth of £707 7s. 11d. (1st instalment) . . .	117 18 0
Balance—profit . . .	3,919 7 8
	£20,122 11 5

Profit and Loss Account.	
Dividend declared Nov. 14, 1876 . . .	£3,625 0 0
Reserve-fund . . .	1,000 0 0
Balance . . .	4,360 19 11
	£8,985 19 11
Balance of account to June 30, 1876 . . .	£5,066 12 3
Revenue account, net profit for the half year ending Dec. 31 . . .	3,919 7 8
	£8,985 19 11
Balance brought down . . .	£4,360 19 11

The CHAIRMAN moved the adoption of the report. In doing so he said on looking over the accounts the shareholders would perceive that the profits made during the last half year, as compared with those of the corresponding period of 1875, were somewhat better, although not quite equal to those of the half year ending June last. Whether that arose from the circumstance of the badness of trade or otherwise, he could not tell; probably the great bulk of the inhabitants of Bahia were now supplied with fittings for gas. There was a falling off in the receipts on that account, and the profits were less by £284, but on the other side of the account there was a decrease in the charges for renewal of plant and mains of £351. The cost of coal was something like £167 less this half year, although the quantity carbonized was the same; but probably the result obtained from the coal had not been quite so good. The leakage continued to be exceedingly unsatisfactory, and such as in an English town would be regarded as very serious. The directors were in hope that they had in some measure discovered a part, at all events, of the cause of it; for in laying down a new main lately it was found that the mains laid down many years ago were in a perfectly decayed state, so that the amount of leakage must have been of very large extent. Indeed, great as the cost of relaying the mains in the town would be, it would have this advantage, that it would lead to a thorough overhauling of the services, and the detection and remedying of faulty connexions. Another cause for the large amount of unaccounted-for gas was the excessive consumption of some of the public lamps. As soon as they were able to do so, the directors intended to adopt governors to these lamps, and thus remove another unsatisfactory element in the present working, for if the leakage could only be reduced to a moderate amount, it would make an enormous difference in the profits of the company, because then much less coal would be required, less purifying material, and, in fact, everything would be reduced in proportion. It was fortunate, therefore, that they had something to look forward to as a means of improving the condition of the undertaking. Still, looking at the accounts as a whole, he thought it was gratifying to observe that there was a considerable improvement upon the previous year. The quantity of gas produced per ton of coal was very fair, and but for the leakage from the services, and excessive consumption of the public lamps, which ought not to exist, they might congratulate themselves generally upon the state of affairs. Some new mains had been laid in the half year, and the directors had sent out mains to the value of £3000, and probably before those mains were laid the cost would be something like £6000. But as, of course, those mains were greatly in excess of the mains before laid, they would only partially become a charge upon the revenue. It was to be hoped that in Bahia, as elsewhere, the laying of larger mains would be found a source of considerable profit to the company. In this matter, therefore, he thought the prospects for the future were not bad. The most difficult question for the directors to deal with was the money question. All the capital was called up, and the board had nothing to fall back upon for the necessary outlay involved in such operations as main-laying. This, to a certain extent, did not embarrass them, for they had plenty of assets, but still they were not in so pleasant a position as if they had more capital to call up to pay for these extensions. However, if they got these pipes properly laid, he had no doubt they would find an immense advantage from them. He did not know that he had much further to state, except to mention that the directors had been able still further to reduce their expenses at Bahia, for which he thought the manager out there deserved considerable credit. The rental had not increased very much, the public lighting in the half year was only £314 more, but then the fines had been largely reduced. Instead of being £1300 or £1400, as they once were, they were now only £221, which in itself showed that, notwithstanding the difficulties under which he laboured from the state of the mains, the engineer was doing his best to improve the condition of affairs. He (the chairman) was very much in hope that when the larger mains were completed the item of £221 would almost entirely disappear. As he had before remarked, the private consumption remained much about the same; there was a little deficiency, about £70, but probably that could be accounted for if the manager was present. The total result of the half year's working was that the revenue had increased by £250, in what was, after all, the best period of the year. With these remarks he moved the adoption of the report.

Mr. H. BROTHERS seconded the motion.

Mr. WILSON asked whether in the next account they might expect to see a better result from economy in the cost of coal.

The CHAIRMAN said that probably it might be so, but somehow or other during the last six months the cost of coal per ton was exactly the same as before. The amount in money was £167 less than for the corresponding period of 1875, but there had been more coal used. He did not think they would obtain coal much cheaper, for freights had been very low. In fact, latterly the company had had to pay a little more.

The motion was put and carried.

The CHAIRMAN moved—"That a dividend for the half year ending Dec. 31, 1876, at the rate of 10 per cent. on the 10 per cent. preference shares, at the rate of 7 per cent. on the 7 per cent. shares, and at the rate of 3 per cent. on the ordinary capital of the company, less income-tax, be and is hereby declared." In making this motion he ought to state that at the present moment the directors were not in funds to pay the dividend, but they were expecting remittances, and in the course of a month they hoped to be able to send out the warrants.

Mr. MAGNUS OEBEN seconded the motion, which was put and carried.

Mr. H. P. STEPHENSON moved a vote of thanks to the directors for the admirable manner in which they had managed the concern, and in doing so expressed his satisfaction at seeing the chairman present in an improved state of health.

Mr. R. KING seconded the motion, which was cordially adopted.

The CHAIRMAN acknowledged the vote, and the proceedings terminated.

STAFFORDSHIRE POTTERIES WATER-WORKS COMPANY.

The Thirty-first Annual Meeting was held at the Company's Office, in Hanley, on the 30th ult.—Mr. J. ALCOCK in the chair.

The following report of the directors was presented:—

In submitting to you the annual statement of accounts, made up to March 25, 1877, duly examined and certified by the auditors, your directors have to report an increased rental for the year ending March 25, 1877, exceeding that of the previous year by the sum of £1066 18s. 11d. The balance for the year ending the 25th of March last, and the previous undivided balance of £2706 4s. 5d., make a total of £6211, out of which your directors recommend that a dividend be declared at the rate of 6 per cent. per annum, clear of income-tax, and payable by dividend warrants, to be forwarded to the shareholders on the 25th day of June next. This will absorb the sum of £3460, leaving (after placing a further sum of £1000 to the reserve-fund account, which will then amount with interest to £3553 4s. 2d.) a surplus of £751 to be carried to next year's account.

The operations in connexion with the Cheddleton Park works have not been resumed during the past year, and a portion of the temporary plant has been removed and used for carrying on the sinking operations at the Meir works. The extension at present being carried on at the Meir comprises pumping water from the existing 24-inch bore-hole, and the sinking of a shaft 10 feet diameter through the base of the marl into the sandstone. The sinking has reached a depth of about 72 yards, and is intended to be continued to about 100 yards, at which depth the principal feeders were met with in the bore-hole.

Your directors have also to report that during the past year they have purchased

Mr. Thomas Wardle's riparian rights in the river Churnet (so far as those are or can be affected by the Tittesworth reservoir) for the sum of £1818 16s. 5d. The service of water to the district has received much attention, and considerable outlay has been involved in re-arranging and improving the distribution.

A vigilant house-to-house inspection is being made, and all service-pipes found wasting water, and too weak to bear the pressure, are being renewed with pipes of proper strength. The result of this careful inspection and prevention of waste has enabled the company to give a longer service of water to a portion of the district, and to dispense with turning off the water on Wednesdays. Your directors hope to still further extend the time of service, and improve the supply, so soon as the consumers fittings can be got into a proper state of repair, and fit to bear the pressure they are required to sustain.

The reservoirs, engines, and other works of the company are in good working order.

A proposal will be submitted to the proprietors at the extraordinary meeting to raise additional capital by the creation of 4200 new shares, as authorized by the "Staffordshire Potteries Water-Works Act, 1868."

The directors, who go out this year by rotation are Joseph Alcock, John Alcock, Charles James Homer, and William Keary, Esqs., but, being eligible for re-election, offer themselves accordingly. Mr. Robert Edwin Narramore, the auditor, who retires by rotation, is eligible for re-election, and the secretary has received notice of his nomination.

The statement of accounts showed a total of receipts under revenue account of £31,049 17s. 1d., which has been disposed of in the shape of £10,794 for dividends, £1857 19s. interest on loans, £2647 19s. 6d. working expenses at pumping-stations, establishment charges—including £2000 for millowner's claims and other heavy items—£8438 3s. 8d., £1000 amount carried to reserve-fund, &c. After all these items have been charged, there remains a balance available for dividend of £6211. The reserve-fund account shows a balance of £3553 4s. 2d.

The CHAIRMAN, in moving the adoption of the report and statement of accounts, said that during the past year they had not had a single complaint as to scarcity of water. He attributed this to the improved mode of distribution which they had adopted, and the stoppage of the waste which had occurred in various parts of the district. With regard to the waste of water, some little dissatisfaction had been expressed, more particularly with reference to the expenses some persons had been put to in renewing their fittings in order to prevent the enormous waste which had been going on for years. He believed there were instances where waste had been going on for months at a considerable flow. Of course, the company did not profess to supply water to have it wasted, and though certain persons might consider it a grievance to be compelled to renew their fittings, it was absolutely necessary that they should do so to prevent waste. The company themselves were about to take up 700 yards of lead piping, in order to substitute iron piping, so that they were not proposing to others what they did not do themselves. It might be asked what they were about to do with the proposed increase of capital. He wished to anticipate questions of that kind. The directors had it in contemplation to make a considerable outlay; in the first place, they proposed to erect a duplicate engine at the Meir, and to renew many of the mains in Longton, several of which were old ones, purchased from the Duke of Sutherland, and wanted renewing. This would involve a considerable outlay. Then there was the reservoir at Birches Head, which leaked considerably. This would have to be put in repair, and possibly covered over.

Rev. W. M. BEEBY seconded the motion.

Mr. S. RHEAD complained that the company had raised the water-rents, based upon the new poor-law valuation for the parish of Stoke, two months before that valuation was put in force by the guardians of the parish.

The CHAIRMAN said the rates levied upon the company's property had been largely increased, and the advanced water-rates would be only about an equivalent.

Mr. BOOTHROYD said the guardians were not bound to act upon the new valuation at once, but the company were bound to adopt the new assessment as soon as it was made.

The motion was then put and carried.

The CHAIRMAN moved that a dividend be declared at the rate of 6 per cent. per annum, for the half year ending March 25, 1877, on £182,000, consolidated stock, clear of income-tax, and that the same be payable by dividend warrants, to be issued to the stockholders on the 25th of June next.

Mr. STEPHEN EDGE seconded the motion, which was carried.

The retiring directors and auditor were severally re-elected.

The CHAIRMAN, in thanking the shareholders for re-electing him, referred to his connexion with the company since the formation, in 1846, and said it was a source of satisfaction to him that they had arrived at such a pitch of prosperity as they had. They had been much abused in the newspapers and by the public about their supply of water, but were now in a position to congratulate themselves upon being able to give satisfaction, not only to the public, but also to the shareholders.

The usual votes of thanks having been passed and acknowledged,

The meeting was made special, for the purpose of creating additional capital.

The CHAIRMAN said it was necessary to keep adding to the capital as their wants increased. They wanted more water to meet the needs of the public, and of course that involved considerable outlay. He therefore moved the following resolution—"That the sum of £21,000, as authorized by the Staffordshire Potteries Water-Works Act, 1868, be raised by the creation of 4200 new shares, or an equivalent amount of stock, of the amount of £5 each, such new shares to be allotted *pro rata* amongst the existing stockholders, pursuant to the Companies Clauses Act, 1845."

Mr. NARRAMORE, in seconding the motion, said he felt confident that the money about to be raised would be judiciously and properly laid out by the directors.

In answer to questions, Mr. BULL said they were getting more water every day, and the CHAIRMAN said there was a scheme for getting more water elsewhere, but it was not sufficiently mature to talk about.

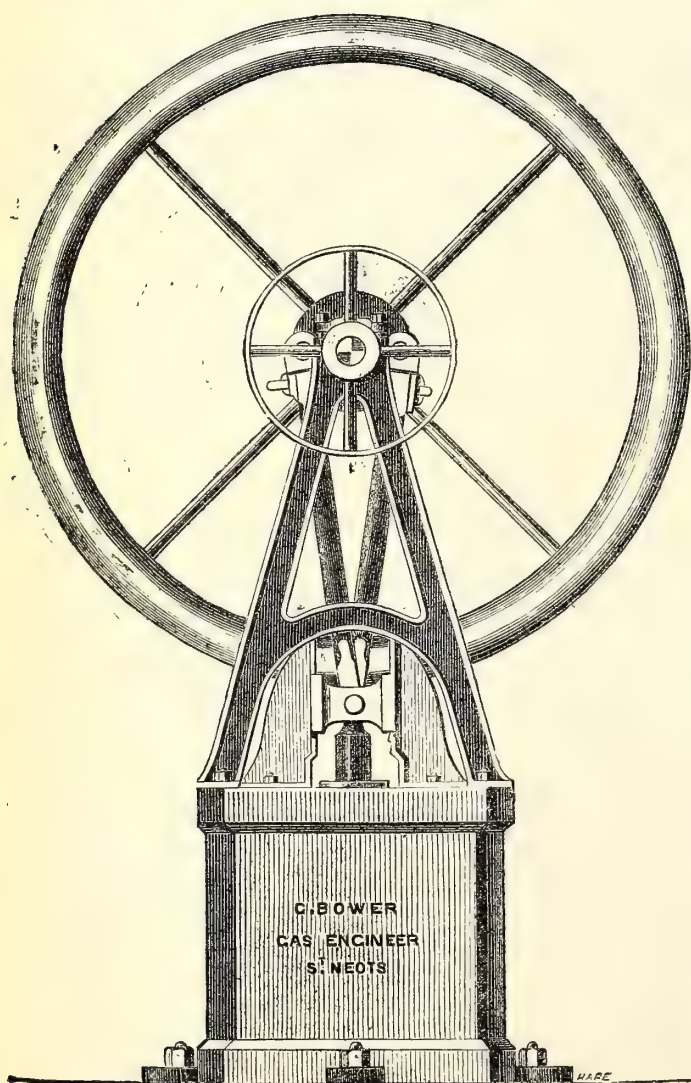
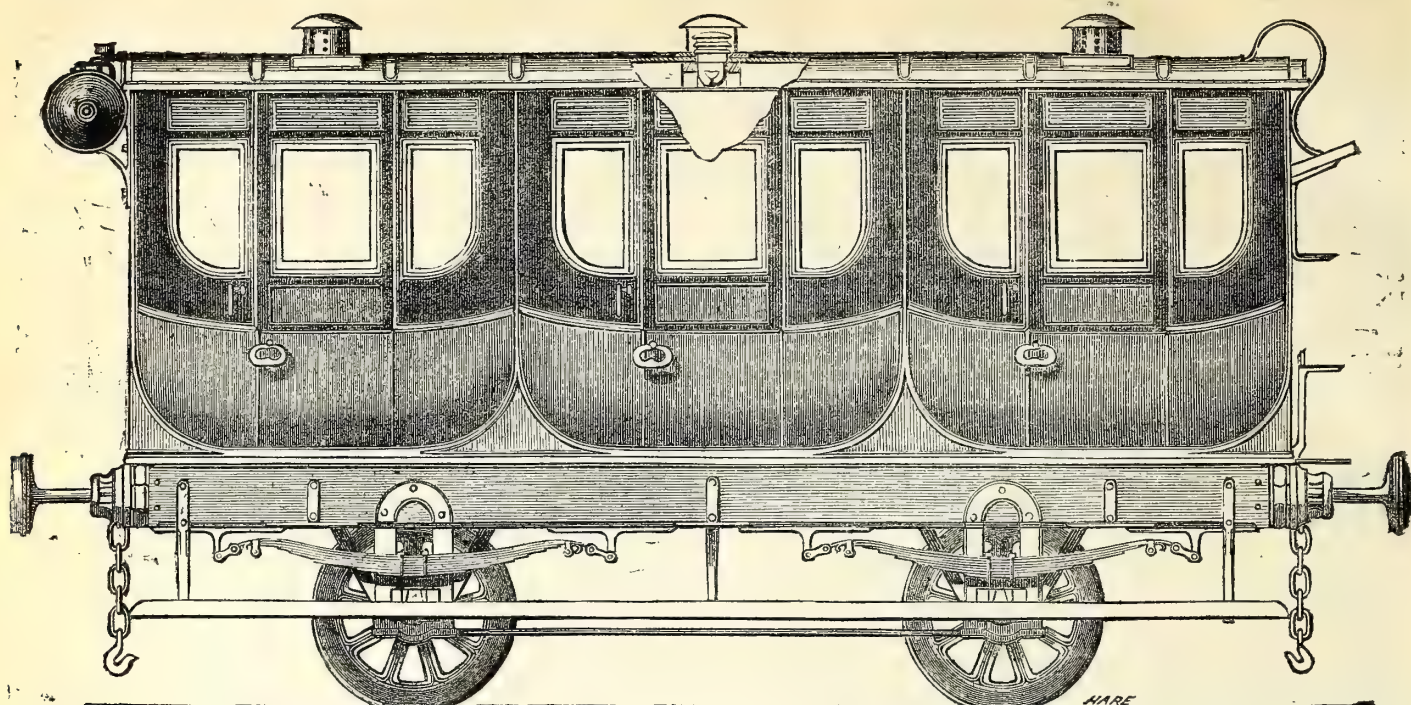
The motion was then carried.

The attention of the shareholders was directed to a museum of effete pipes, by means of which the water of the company had been extensively wasted. It was stated that in the course of examining the pipes in Hanley, one in seven had been found to be defective, the waste of water being enormous.

BOWER'S APPARATUS FOR LIGHTING RAILWAY CARRIAGES WITH GAS, ETC.

Various attempts have been made from time to time to establish a system of lighting railway trains with gas. Some have partially succeeded, but the majority have been failures. Two methods have been usually adopted for this purpose, the arrangements being modified according to the several inventor's peculiar ideas, but substantially the same in principle; the first one consists in using a *dry* or *wet* reciprocating reservoir for the gas, working at the ordinary pressure; the second one is by means of gas at a high pressure, contained in a suitable vessel. In both cases the gas is supplied to the burners by lines of tubing running along the carriages, the connexions between the carriages being made with flexible tubing and union joints.

On the Metropolitan Railway, where the carriages are very long, and where the distance between the termini is very short, the gas is carried



in a box or receptacle on the top of each carriage; but as, in this case, the flexible holders within these boxes can be replenished every few minutes, such a system would not be applicable for trains running long distances. For this purpose, gas at the ordinary pressure would be found too inconvenient and cumbersome; for instance, a train consisting of 12 carriages, running between London and York, say in six hours, each carriage having three lights, and each light consuming $1\frac{1}{2}$ cubic feet per hour,* would require a storage capacity for the gas of 350 cubic feet.

Gas supplied from one reservoir also requires joints to connect the carriages, which are difficult to maintain gas-tight, and which are extremely inconvenient when a change of carriages takes place, the disconnection causing always an inevitable leakage of gas.

What railway companies require, and what it will be necessary for them to have before they can adopt gas illumination for their trains generally, are as follows:—

1. The system must be easy of application.
2. Taking equal amounts of light, and the relative amounts payable for

* If the gas be made from shale oil or petroleum, three-fourths of a cubic foot per hour would be sufficient.

labour, wear and tear, &c., as the bases of comparison, gas must be less costly than oil.

3. Each carriage must carry its own independent supply.

The plan proposed, in order to carry out these conditions, is the following:—At certain stations along the line of railway, where there are pumping engines, and where, of necessity, there must be men to attend to them, let there be gas-works erected for the joint purpose of supplying the stations and the cylinders hereafter named. The gas may be made from Boghead, or other rich cannel, or it may be made from ordinary coal, and afterwards carburetted at the burners; but this would depend upon the locality. If cannel were cheap, the gas should be made from that material; if dear, then from ordinary coal, and enriched by carburation. The retort or retorts should be set by the side of the boiler, if possible, so that the spare heat from the furnace may assist in the generation of steam. At Essendine, on the Great Northern Railway, and other places, where such an arrangement has been adopted, the heat which would otherwise go up the shaft is sufficient to generate the necessary amount of steam, with scarcely any additional fuel, whilst the same man makes the gas and drives the engine and pumps. The gas should be made at such stations in the ordinary way, and condensed into cylinders to a pressure of from 10 to 12 atmospheres or volumes. The cylinders to be placed on brackets at one end of the carriage, and each provided with a valve for regulating the supply to the burners, and also, in the contingency above mentioned, with a carburator.

There should be a supply of cylinders at each station at which the gas was being made for this particular purpose, always ready charged, the pipes and other apparatus attached to the carriage remaining fixtures, whilst the junction between the cylinder and supply-pipe would be made in less time than is now occupied in changing the oil-lamps.

By this plan the tops of the carriages are left free, as at present, for luggage. Each cylinder should be of such a capacity that when filled with gas compressed to a pressure of 10 to 12 atmospheres or volumes, it would be able to supply, say, three lights in each carriage for any given time. For example, supposing the cylinder to be of 14 inches of internal diameter, and 5 feet long, the cubical capacity would be about 5 feet; or when compressed to 10 volumes, capable of containing 50 cubic feet of gas, 45 feet of which would be available for the burners; then if each light consumed $1\frac{1}{2}$ cubic foot, which with rich gas would be about equal to the light of 6 candles (far in excess of what the majority of the lights in railway carriages now give) the supply would last for ten hours. The quantity of gas required for a given length of time can be readily arranged in the first instance, by filling the cylinders to a greater or less pressure. The next thing to be considered is that of cost; and, for this purpose, ordinary gas shall be taken at the rate of 4s. per 1000 cubic feet in the gasholder, including wear and tear, interest on outlay, &c.; carburetted, so as to make it equal to rich cannel gas, say, 3s. 6d. per 1000; extra labour, &c., for pumping into cylinders, 2s. 6d. = 10s. per 1000 cubic feet. The labour, wear and tear, &c., of cylinders and apparatus would not amount to the expense of trimming lamps, lifting them in and out, and of breakages and repairs; but take them as equal, it then becomes a comparison between gas of high illuminating power at 10s. per 1000 cubic feet, and oil at, say, 4s. per gallon; and the result of experiments has proved incontestably that 120 cubic feet of rich cannel or carburetted gas are equal to one gallon of oil.

The capital expended per carriage would be about double that required for ordinary oil-lamps; but the advantage which the railway companies would have in manufacturing their own gas instead of purchasing it at the ordinary rates, would pay good interest on the additional capital invested, besides contributing, in no small degree, to the comfort and convenience of passengers, which, of itself, is of equal importance with any pecuniary saving. The above engraving represents a first-class railway carriage with three compartments; the cylinder containing the gas is shown in position at one end; it is made sufficiently strong to resist a pressure of 30 to 40 atmospheres, and is provided with handles for convenience of moving about, and a strong high-pressure cock and union for attaching to the pump; the outlet is provided with a regulating-valve on an entirely new principle, and which is believed to be a considerable improvement on any others constructed for this purpose; by its means the gas is adjusted to the minimum pressure required, before passing to the burners, no matter what the pressure may be in the cylinders, and a uniform and steady light is constantly maintained. The cylinder is connected to the supply-pipe running along the top of the carriage, by an union joint, so as to be readily attached or disconnected. The covers of the lamps are readily removed for cleaning, &c., the supply-pipe passing through their lower edges into the lamps; if it should be found necessary to take out the lamps, the supply-pipe can also be easily lifted off for that purpose. The second engraving represents the pump required for forcing the gas into the cylinders. It has two barrels and plungers, the barrels being immersed in water for the double purpose of keeping them cool and

preventing any escape of gas. It is also provided with a drum or strap-pulley for connecting to the engine. To the outlet from the pumps is attached a gauge, capable of indicating a pressure of from 250 lbs. to 300 lbs. per square inch, so that the attendant will be able, with a little practice, to fill the cylinders to the degree necessary for a journey of any given duration.

INSTITUTION OF CIVIL ENGINEERS.

The concluding Meeting of the Sixtieth Session of this incorporated Society was held on Tuesday, the 29th of May—the PRESIDENT (Mr. George Robert Stephenson), in the chair, as he has been on all occasions when the members have assembled during the past twelve months, emulating in this respect the example of his predecessors, as well as of the members of the council generally, who often, at great personal sacrifices, make it a point of honour and of duty to attend, thus contributing in no small degree to the success of this highly popular and useful body.

At this meeting the monthly ballot took place, and resulted in the election of 45 candidates—viz., 13 members and 32 associates. Amongst the former were Mr. Jonas Proctor, borough engineer of Bolton, and Mr. Thomas William Rumble, chief engineer of the Southwark and Vauxhall Water Company. In the latter were included the names of Messrs. Joseph Dawson, borough surveyor, Stockport; Herbert Oliver Thomas, surveyor to the Woolwich Local Board; George Winneb Webb, Gas-Works, Moscow; and George Winstanley, Gas-Works, Coventry.

During the session there have been 23 ordinary meetings, when 12 papers have been read and discussed, with that completeness which always characterizes the proceedings of this society. A brief summary of these communications will show the varied branches of engineering which have occupied attention. In regard to the River Thames, it was demonstrated that the changes in its condition during the last half century, due to the removal of obstructions and other improvements, had added 33 per cent. to the above-bridge tidal volume. The lighthouse system of Japan, the result of treaties between the European Powers and that empire, had led to the establishment of 36 lights, the general form and dimensions of which were described, including the precautions adopted to obviate the effects of earthquake shocks. The repairs and renewals of locomotive engines on some of the leading lines of railway in this country, as well as on the Continent and in the United States, were minutely analyzed, and the causes contributing to the fracture of railway tires were the subject of theoretical investigation. The construction of street tramways, and the use of mechanical motive power on them, was also submitted for consideration. In respect to what might be termed municipal engineering, the supply to be derived from the chalk water system in and around London had been elaborately treated, while the sewage question had been reviewed, and certain conclusions set forth, as to the applicability of various systems and processes under particular circumstances. The history of the modern development of water-pressure machinery was succinctly traced, and the different forms of machines which had come into use were described. The transmission of power by water, steam, compressed air, shafting and ropes, was compared, and in the result it was contended that, where the work to be done was intermittent, the hydraulic system, on the ground of speed, safety, and convenience, was superior to any other. Plans for the combustion of refuse vegetable substances under steam-boilers were discussed, as it was urged that the only method of rendering the use of steam power universal, particularly for agriculture, was to construct the boilers so as to utilize the local supplies of combustible materials of every kind. In a deep boring for coal at Searle, in Lincolnshire, the carboniferous strata had been reached, and it was deemed desirable that the boring should be continued, as the determination of the eastward extension of the Yorkshire coal-field was important, both economically and from a scientific point of view. The series of papers was terminated by a description of "An Economic Method of Manufacturing Charcoal for Gunpowder." Besides the ordinary meetings, there had been eleven supplemental meetings, exclusively for students, when as many papers were read and discussed. The attendances at all these meetings had far exceeded the average.

The annual publications of the Institution now comprise four volumes of "Minutes of Proceedings," each of nearly 400 pages, and amply illustrated. During the last session there has been an effective increase of two honorary members, 69 members, 94 associates, and 58 students, the numbers of these several classes being now 16, 939, 1691, and 458 respectively; together, 3104, as against 2881 at a similar period last year.

On Thursday evening, May 31, the President of the Institution and Mrs. Stephenson received the members and their friends at the annual *conversazione*, which was held, by permission of the Duke of Richmond, in South Kensington Museum. The throne-room of Akbar Khan, in the Indian Architectural Court, was the first reception-room. It was decorated with azaleas and palms, and all the galleries and halls of the museum were brilliantly lighted up and thrown open to the guests. Several engineering models were exhibited, one of them a tube designed by Mr. Upward for passing food and messages written in phosphorus through a mass of coal to miners entombed in choked borings, with a valve to prevent the rush of compressed air. The music was that of the string band of the Royal Engineers under Herr Sawerthal.

THE TREATMENT OF IRON FOR THE PREVENTION OF CORROSION.

[A paper read at the Society of Arts by Professor BARFF, M.A., Cantab., &c., &c.]

While experimenting two or three years ago with my friend, Mr. Hugh Smith, on different methods for preventing incrustation and corroding of steam-boilers, I was led, through the failure of all the processes employed, to believe that, if it were possible to convert the surfaces of iron plates into the magnetic, or black oxide of iron, in such a manner that the particles of black oxide formed in the position of the original particles of iron could be rendered perfectly adherent to the iron surface, which does not become per-oxidized and perfectly coherent with one another, the object would be effected. I do not intend to enter into the chemistry of the oxidation of iron to its full extent; it would take too much time, and it would rather tend to confuse than to enlighten those who are not well up in their chemistry, and would raise questions which would bring on prematurely a collision with the views of some of my brother chemists, which collision, under suitable circumstances, at some future time not very remote, I look forward to with considerable satisfaction, as it will be the means of solving many phenomena which have never yet been explained. A piece of dry iron, its surface being polished, may be exposed for any length of time to dry air without rusting, but it begins to rust at once as soon as the slightest moisture comes in contact with it. We have to consider only two oxides of iron—one containing 56 parts by weight of the metal to 16 parts of oxygen, and the other containing twice 56 parts of iron and three times 16 parts by weight of oxygen. We speak of these oxides as the protoxide and sesquioxide, or as ferrous and ferric oxide.

Immediately the protoxide is formed, it being more moist, it unites with oxygen and becomes gradually converted into the ferric oxide. Now, let us suppose a moist iron plate to come into contact with oxygen. It is clear that the protoxide will be first formed, and this rapidly becomes con-

verted into the higher oxide. Now, suppose you take a solution of the salt of the higher oxide and put into it metallic iron, in time, the air being excluded, this higher salt will become converted into a salt of the lower oxide. Let us now see how this bears upon the rapid oxidation of iron in the presence of moisture. We have seen that when oxygen comes in contact with moisture, the first oxide is formed and becomes rapidly oxidized into the higher one. But this higher oxide is in contact with metallic iron, which will reduce it to the lower oxide, thus becoming oxidized by the oxygen which it has taken up from the higher oxide. You will now see clearly how it is that iron rusts throughout its whole substance with such rapidity, for the oxide of iron serves as a carrier for atmospheric oxygen to the iron to almost any depth. There is another oxide of iron, called the black or magnetic oxide, containing three times 56 parts by weight of iron, and four times 16 parts by weight of oxygen. Some chemists consider this oxide to be a sort of mixture of the two others, and they call it ferrous-ferric oxide; whether this be the case or not does not matter to us this evening. But it is a most important point for our consideration that this oxide undergoes no change whatever in the presence of moisture and atmospheric oxygen. Nor does any temperature to which it can be exposed, in any of the ordinary uses to which iron is applied in the presence of moisture, either decompose it or produce its further oxidation. In every school where chemistry is taught, in the most elementary lecture on hydrogen, the pupils are told that if they pass steam over red-hot iron filings contained in an iron tube, they will be able to collect and burn hydrogen gas at the opposite end of the tube to where the steam enters.

For a long time it was thought that the particles of black oxide formed by this decomposition of the steam were pulverulent, and could not be made to cohere into a solid mass. The result of a considerable number of experiments has been to prove that they can be made not only coherent amongst themselves, but adherent to the body, and that both these produce a proper formation of this black oxide on the surface of iron plates; for, as I will show you later on, the oxidized surface of the iron resists for a long time, and more effectually, the rubbing with emery paper, than does the simple metallic iron itself, and that there is a very manifest difference between the ease with which a sharp rasp is able to cut away the surface of the iron, and the difficulty with which this black oxide is removed from the surface by that same instrument.* The method which long experience has taught us is the best for carrying out this process for the protection of iron articles in common use, is to raise the temperature of those articles, in a suitable chamber, say to 500° Fahr., and then pass the steam from a suitable generator into this chamber, keeping these articles for five, six, or seven hours, as the case may be, at that temperature in an atmosphere of superheated steam. I will presently call your attention to the diagram of the furnace and muffle which I have employed in all our later experiments, and in which all the specimens before you, which will be alluded to in this paper, were prepared. Differences of temperature are employed where different objects are to be obtained. If it be wished to act upon surfaces of polished iron or steel, it is desirable to let the temperature remain at 500° Fahr. until the operation is completed. Articles coated in this way will not resist the action of continued moisture such as has prevailed for the last two months, when exposed out of doors; but they will resist the action of any amount of moisture with which they may come in contact in a house or building; and the reason of this will be very obvious, because only a thin film of the iron on its surface is transformed into the black oxide. This I will explain more fully to you when I call your attention to individual specimens. At a temperature of 1200° Fahr., and under an exposure to superheated steam for six or seven hours, the iron surface becomes so changed that it will stand the action of water for any length of time, even if that water be impregnated with the acid fumes of the laboratory.

Before calling your attention to our failures and successes as they lie before you on the table, I will just allude to a few of the uses to which this process may be, as I consider, successfully applied—to water-mains, also to water connecting-pipes, as well as to the water-pipes used inside the house, which, in this case, would supplant their leaden predecessors. In this hall of hygiene, these words will, doubtless, sound as sweet music to the ears of many of those who have honoured me with their attendance this evening. The greatest objection to the use of iron pipes for the supply of water in houses hitherto has been this, that by rusting they caused the first quantities of water drawn off in the morning to be dirty and turbid; now this will be entirely prevented, if the pipes be first exposed to the treatment which I have just explained to you—of course gas-pipes could with advantage be similarly acted upon—and as the surface, when oxidized, is harder than the natural surface of the iron, the friction of large bodies of water through the pipes, and the friction necessarily employed in fixing them in their places, would be much better resisted than by the untreated iron itself.

I cannot over-estimate the advantages which the employment of this process must confer on architects, who will be by it enabled to employ iron, whether wrought or cast, much more largely, not only in the decoration, but in the construction of their buildings. Last summer I was at a very large house in the country, where the entrance portico, some 20 feet high, was being painted and decorated, when one of the large plaster ornaments of the ceiling broke away from its holdings, and would have fallen to the ground, except that it was caught by a workman. This ornament weighed not less than 25 lbs., and if it had fallen from this height upon the workmen below, it must have killed them. The ornament had been there many years, and was fixed up in the best method possible, it being supported and secured by iron rods. On examination I found that these rods were rusted through completely to the very centre.

I need not make any comment upon this, since I have been able to introduce you to iron treated in such a way that it will never rust. Of course, if the process will answer for architectural ornaments, it will answer for statues, so that iron may be used instead of bronze, which will materially lessen the cost of casting statues, both in the material and in the expense of making the moulds. You well know that when a tinned saucenpan is allowed to get dry on the fire and burns, as the servant calls it, that it is rendered useless until it is tinned again. Now, if such a saucenpan be treated by the method I recommend, it may be allowed to get red-hot without suffering injury, for the protection on its surface is produced at a red heat. We have experimented on some screws, hinges, locks, keys, bolts, with complete success. It has been suggested to me that the iron nipples used in gaslights would not corrode, and would, therefore, be more useful, if submitted to this action of superheated steam.

Wherever iron is used, railings, street gas-posts, iron safes for keeping documents fireproof and thief-proof, the framework of filters, tanks, cisterns for domestic and other uses, iron employed in the erection of temporary buildings—which, I flatter myself, if treated by this process, would become permanent buildings—all these and many other applications of iron to the arts would immensely gain by being submitted to this oxidizing action. I think I need hardly take up your time by enumerating other applications for the preservation of iron, for it appears to me that

* Since reading this paper, I have proved that a flat rasp does not at all affect the surface of iron coated at 1200° Fahr.

they would be commensurate with most of the uses to which iron is applied, save and except those where friction—such as that to which rails and iron wheels are exposed—would necessarily wear away the coating, as they wear away the material itself.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The week has again been a quiet one all round, with only a fair amount of business doing in any direction, even at such of the iron and steel works as had attained a slight accumulation of orders during the period of the Whitsuntide holidays.

Pig iron, and all other raw materials, are in moderate request only, so that it is no matter for surprise that prices still hold quiet. All ordinary ores run at 5s. to 8s. per ton, with rather more money for best kinds. West coast hematites rule at 21s. to 23s., in special lots, but the vendors do not give open quotations in a general way. Forge pigs are just now in rather better request, and a few of the most reliable brands of Yorkshire and Derbyshire foundry kinds are in tolerable demand. Agents here for the North Yorkshire smelters quote about the following rates:—No. 1 foundry, 45s. 6d.; No. 2 foundry, 44s.; No. 3 foundry, 42s.; No. 4 foundry, 41s.; No. 4 forge, grey, 40s. 6d.; No. 5 forge, mottled, 40s. 6d.; No. 6 forge, white, 40s.; refined metal 58s. to 59s.; Kentledge, 46s.; and cinder pig, 40s., all net cash. "Airside Leeds," No. 1 is 54s.; No. 2, 52s.; No. 3, 51s.; No. 4, 50s.; forge, 50s.; M., 49s.; and W., 49s. "Acklam Yorkshire," No. 1, 50s. 6d.; No. 2, 49s.; No. 3, 46s. 6d.; No. 4, 46s.; and forge, 45s. "Barbor's Field" (Staffordshire best), No. 1, 105s.; No. 3, 100s.; and No. 4, 100s. North Lincolnshire qualities range from 47s. 6d. to 52s. per ton, according to brand.

There is no particular change in the prices of castings, mains being £5 5s. to £6, smaller pipes £5 10s. to £6 5s., and irregular castings, such as bends, collars, &c., from £6 to £7 10s. per ton.

The coal trade is rather busier, no doubt owing to the strike in Northumberland. At present steam coal is in best request, but should the dispute in the North prove of any duration, all kinds of fuel may become a little stiffer. It would require a long struggle, however, to send up house coals to any appreciable extent, owing to the immense competition in the trade, and the present exceedingly restricted output.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The strike which will inevitably take place this week at the majority of the pits in West Lancashire is causing a rather firmer tone in the market, as consumers have been pushing for extra supplies in order to cover their requirements for a little time forward. It is uncertain how long the struggle may last; the men, who seem determined, have received the support of the Miners' National Union, and there is at present a very unanimous feeling amongst the masters, who declare that under existing circumstances the closing of the pits is almost preferable to going on. So far as stocks are concerned, it is only in one or two exceptional cases that any considerable quantity has been put down on the pit banks, and the large firms in the Manchester district, which will not be affected by the strike, have nothing to spare. Notwithstanding this, however, there is no fear of any actual scarcity, as supplies can readily be drawn from outside districts, and no alteration in list rates has been made this month. In the gas coal trade one or two contracts are reported to have been placed, but in the majority of cases the inquiries in the market do not yet lead to business, and no doubt both buyers and sellers will prefer to wait the result of the strike in the Wigan district. In house-fire classes of coal a tolerably good demand is kept up, and there has been more inquiry for common coal, whilst engine classes of fuel, both burgy and slack, are scarce, and for these rather more is being asked from new customers. The average pit prices remain at 9s. 6d. to 10s. 6d. for good ordinary Arley; 8s. to 9s. for Pemberton four-feet; 6s. 6d. to 7s. 6d. for common coal; 5s. 3d. to 5s. 6d. for burgy; and 4s. to 5s. per ton for slack.

Shipments of the better classes of coal for export have been a little more active, and rather higher prices have been obtainable, but the coasting trade continues dull.

In the iron trade business continues in a very depressed condition, and although nominally, makers' quotations are without change, the few sales that have been made during the past week have been mostly small, job lots at about 6d. per ton under the current market prices. In finished iron there is no change, and in all branches makers are complaining of the scarcity of orders and the lowness of prices, even the largest and best known engineering firms in this district being now affected by the prevailing slackness of trade.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The main circumstance which occurred in connexion with the coal trade of the North of England last week was the strike of the Northumberland pitmen. It was rather unexpected, as moderate counsels have prevailed in the union within recent years. But the men took the management of affairs out of the hands of their leaders, and declared war against the masters. The strike is not likely to be a long one, however. In all possibility it will be settled within a fortnight. In the meantime it has occasioned a considerably increased demand for Durham coals of all sorts. Shipping turns, which were three days a fortnight ago in the gas coal trade, are now in many instances three weeks. There is not any appreciable advance in the price of Durham gas coals so far. Steam are higher. The market is stiffer. There has been a great increase of vessels put on to load coals at the Tyne Dock, Sunderland, and Seaham.

A good few shipping orders, which were in the market for steam coals, have been countermanded, and freights fluctuate considerably. The shipments of gas coals are steady, both from the Tyne and the Wear. The coasting trade is quiet. Rates are nominally the same, and a middling business is doing to the Baltic and Mediterranean. There were larger shipments of goods to the Continent last week undoubtedly. They consisted of manufactured iron, chemicals, fire-clay goods, and cement. The chemical trade, however, is unchanged. The demand is limited, and prices are low.

The Miners' National Union held their conference in Durham city last week. Various schemes were propounded by delegates to limit the wind of coals, with a view to bring prices up. The subject was remitted to a committee, with a view to a confederation of miners, not only in Great Britain, but throughout Europe, with the object of limiting the production of coal. All the schemes propounded were of a very hazy character, and very little more is likely to be heard of them.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual meeting of the Kettle, Kettlebridge, and Freuchie Gas Company was held a few days ago, when it was resolved to declare a dividend

of 5 per cent. It was likewise agreed to extend and improve the present works.

On Friday last, at a meeting of the Dumfries Town Council—Provost Smith presiding—it was resolved to exercise the powers conferred on the council by the Burghs Gas Supply (Scotland) Act, 1876, by giving notice to the Dumfries Gas Company that the council are prepared to treat with them for the purchase of their works and plant, &c., the terms to be mutually agreed upon or fixed by arbitration, in terms of the Act.

It is reported that the estimates of the Perth Gas Commission, for the ensuing year, are to be framed in accordance with a considerable reduction in the price of gas. The present intention is said to be to fix the price of gas for Perth at 4s. 2d., and for Scone at 5s. per 1000 cubic feet.

The annual meeting of the Levin Gaslight Company, Fifeshire, was held on the evening of Monday, the 29th ult.—Mr. R. Aitken, chairman, presiding. A dividend of 10 per cent. was declared, and it was agreed to carry forward the balance to the reserve-fund, the price of gas to remain at 5s. 5d. per 1000 cubic feet, as formerly. Such a satisfactory result of the past year's affairs is regarded as an indication of excellent management.

It would almost seem as if the recent hint about the condition of the gas in the town of Inverness had determined the Gas Commissioners of that town to let the consumers know periodically what kind of gas they are consuming, so far as scientific tests are concerned. One of the local papers gives the following statement in its last issue:—"The quality of the gas supplied to Inverness during the week ending the 26th ult. was as undernoted:—Maximum, 27.96; minimum, 26.83; average illuminating power, 27.88 candles." The record does not state whether the analysis is done by an official examiner, which is a point of some importance when we bear in mind that the weekly reports of the gas examiner and the gas manager at Dumfries show a considerable degree of disparity—rarely less than half a dozen candles.

A special meeting of the Police Commissioners of Inverness was held on Saturday week, for the purpose of examining the law accounts connected with the passing of the Water and Gas Act, 1875, and to make application to the sheriff to appoint an auditor of the accounts of the Gas and Water Commissioners, in terms of the Act. It transpired in the course of the business that the cost of obtaining the Act, exclusive of engineers' expenses, was £3165, a large portion of which would not have been incurred had it not been for the opposition of the railway company. In moving that the recommendations of the committee be adopted, the provost remarked that whatever expenses had been incurred had been entered into with the earnest desire to benefit the community, and that in a very short time the full benefit would be enjoyed. They now had a most plentiful supply of pure water, and in the course of a year or two they would have gas at a cheaper rate.

At last the great Forfar "event" has come off. After a trial lasting three days—before Lord Craighill and a jury—the action in the Court of Session, at the instance of Alexander Lowson, coal merchant, Forfar, against William Rutherford, factory manager, was decided last Monday, the jury, by eight to four, returning a verdict in favour of defender. Mr. Lowson claimed £1000 damages, alleged to have been sustained through defender having accused him, as chairman of the Gas Committee of Forfar, of receiving bribes and gratuities from coal masters for procuring the acceptance of their contracts by the corporation. The defender, as well as the pursuer, was a member of the Forfar Gas Commission. Having now got this action decided, it is hoped that the Forfarians will go on with their much-needed water supply as fast as they possibly can.

The other great legal event, the one known as the Dundee Water Action, has been advanced a stage in the Court of Session. Counsel for both sides have been heard by Lord Curriehill, and on Wednesday last that legal dignitary, in the language of the Scotch law courts, "made avizandum with the case." As it seems to have points in law only, I suppose it was not proper that it should go before a jury.

During the past week most of the makers have reduced the prices of their special brands of pig iron, but no great increase of business has followed. Warrants have remained somewhat steady. The closing price on Friday was 54s. cash.

The coal trade is not so busy as it was, and inquiries for shipping orders are fewer.

ROTHERHAM CORPORATION GAS-WORKS.—The Corporation of Rotherham have applied to the Local Government Board for authority to raise £67,000, of which sum £14,000 is required for gas-works extensions. Major Tulloch, one of the Inspectors of the Board, held an inquiry at Rotherham last week, to ascertain and report upon the circumstances of the application.

BECCLES WATER AND GAS COMPANY.—At the annual general meeting of shareholders of the company, on the 28th ult.—Mr. Dashwood in the chair, it was resolved, on the recommendation of the directors, to declare and pay a dividend of five per cent., free of income-tax. The directors reported that the price of gas having been reduced in October last to 5s. 6d. per 1000 feet, the gross income of the company had been diminished by about £123. The directors and auditor whose turn it was to retire remain in office.

NEWARK WATER-WORKS COMPANY.—The annual meeting was held on the 29th ult.—Mr. J. Knight in the chair. The directors presented their report, which was as follows:—The addition to the capital account during the last year amounts to £93 8s. 2d. for additional works. The revenue account for the past year shows the gross revenue of the company during that period to have been £2591 15s. 2d., as against £2477 8s. 11d. in the previous year. The anticipation expressed by the directors in their last annual report, that the outlay made two years ago for new mains, &c., would produce a still larger increase of income, has been fully realized. The balance available for dividend is £1345 4s. 8d., being an increase on last year of £273 12s. The directors recommend the payment of a dividend of £8 per cent., free of income-tax, on the paid-up capital of the company, and that the balance of the revenue account, amounting to £225 4s. 8d., be carried to the reserve-fund. The reserve-fund will then amount to £395 11s. 5d. The works are in a good state of repair, and in satisfactory working order. The report was adopted, the retiring directors re-elected, and an addition of £20 per annum made to the remuneration of the board. A vote of thanks was tendered to the retiring auditor (Mr. A. Taylor), and hearty votes of thanks were also given to the chairman, the directors, and the secretary. The latter, in acknowledging the compliment paid him, said it was now 24 years since the company were established, and they had never been in a more satisfactory or flourishing state.

SALES OF PROVINCIAL GAS SHARES.—On the 23rd ult., at the "Red Lion," Colchester, sixteen old and eleven new £20 fully paid-up shares in the Colchester Gas Company were submitted in eleven lots, and were bought at prices ranging from £37 to £36 10s. per share for the old, and from £26 to £25 10s. for the new, the total amount the shares realized being £869. At the Sheffield Mart, on the 29th ult., ten new £10 shares in the Sheffield Gas Company, £3 paid, were offered for sale by auction, and realized £8 10s. per share premium. At Derby, on the 28th ult., seventy-nine New Ordinary 7 per cent. Shares, of £25 each, of the Derby Gas Company, were offered for sale by auction at the offices of the company, and met with ready purchasers at premiums varying from £17 10s. to £16.

On the same day, at Norwich, thirty £20 shares in the British Gaslight Company, were sold by auction for £1245; also for another proprietor thirty-five shares in the British Gaslight Company, Limited, for £1417. On the 31st, a sale by auction took place at Cambridge, of University and Town Gas Stock and Shares. There were eleven lots of £50 Consolidated Stock, which made an average price each lot of £102 7s. 3d. One lot of £17 stock made £34; eleven lots, each comprising seven £10 shares in the same company, the sum of £7 each only paid up, made an average of £68 7s. 3d.; one lot of £9 reached £82; four lots of £5 each averaged £56 10s. Another lot of £25 10s. Consolidated Stock, and one £10 share, £7 only paid up, made £63. At Elland, on the 1st inst., fifty-two shares, £10 paid, in the Elland-cum-Greetland Gas Company were sold at £21 10s., and £21 14s. per share; twenty-three Preference (£4) shares in the same company sold at £4 12s. each.

CAMBRIDGE UNIVERSITY AND TOWN WATER-WORKS.—The foundation stone of a new engine-house, at the works, Cherryhinton Road, was laid on Tuesday, the 29th ult., by the Rev. Dr. Okes. The foundation stone bore the following inscription:—"The Cambridge University and Town Water-Works were opened by the late Rev. W. Whewell, D.D., Master of Trinity College, and Chairman of the Company, on the 23rd of October, 1855; and this foundation stone of a new engine-house, in connexion with an increased power of supply, was set on the 29th of May, 1877, by the Rev. Richd. Okes, D.D., Provost of King's College, Chairman of the Company." The building, the foundation stone of which was thus laid, is connected with one portion of very important additions to the company's works, which have been rendered necessary in order to provide a supply of water for the increasing wants of the University and Town of Cambridge and contiguous places. At the pumping-station further steam and engine power is being provided, which will be capable of raising an additional quantity of water at the rate of 720,000 gallons in 24 hours. In order to ensure a regular supply, and at the same time to increase the effective pressure, a duplicate main has been laid down between Hyde Park Corner and the railway bridge, on the Hills Road, and this will before long be continued to Cherryhinton. Besides this, numerous but important additions have been made to the distributing apparatus within the district of supply, which will effect great improvements in certain parts. New mains have been laid down where required, and the size of many sub-districts has been reduced, thereby adding to the convenience of the consumers of water from the company's works. The whole of the new works have been designed by, and are being executed under the superintendence of the company's engineer, Mr. Henry Tomlinson, A.I.C.E.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

- 2038.—SONNENTHAL, R., Aldermanbury, London, "Improvements in glass water-gauges." A communication. May 25, 1877.
2055.—GORDON, J., Glasgow, "Improvements in valves and apparatus for controlling and regulating the supply of water and preventing waste." May 26, 1877.
2056.—SHANKS, J., Renfrew, N.B., "Improvements in and connected with lavatories, baths, cisterns, water-closets, and other apparatus for the use of water." May 26, 1877.
2069.—BRETT, R. W., Hertford, "Improvements in lanterns for public or private lighting, and in the mode of supporting the same." May 28, 1877.
2085.—BUDENBERG, A., Manchester, and HURTER, F., Widnes, Lancs, "Improvements in pressure, vacuum, and speed gauges and recorders." Partly a communication. May 29, 1877.

- 2094.—CLARK, A. M., Chancery Lane, London, "Improvements in electric light apparatus." A communication. May 29, 1877.
2095.—CLARK, A. M., Chancery Lane, London, "Improvements in valve apparatus for lavatory and water-closet basins, baths, and other similar uses." A communication. May 29, 1877.
2105.—REDWOOD, T., Lower Clapton, and REDWOOD, T. B., North Finchley, "Improvements in the manufacture of gas for burning." May 30, 1877.
2116.—BRADSHAW, A., Accrington, Lancs, "Improvements in the construction of pressure-gauges." May 31, 1877.
2125.—SMEATON, W. M., Strand, London, "Improved mechanical arrangements for preventing waste and regulating the flow of water, specially useful for water-closets." May 31, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 4668.—THORPE, C., and PRINCE, H., Manchester, "Improvements in the construction of direct-acting steam-pumps." Dec. 2, 1876.
4675.—HOWARD, E., Walthamstow, Essex, "Improvements in apparatus for preventing waste of water in water supply to closets, drinking fountains, wash-hand basins, and other water-supply appliances." Dec. 2, 1876.
4784.—CAMERON, J., Salford, Lancs, "Improvements in the construction of steam-pumps." Dec. 11, 1876.
4807.—RITCHIE, C., Brixton, London, "Improvements in or applicable to apparatus for utilizing heat for lighting, heating, and ventilating." Dec. 13, 1876.
4824.—FOULIS, W., Glasgow, "Improvements in drawing retorts, and in the machinery or apparatus employed therefor." Dec. 13, 1876.
952.—HALLSWORTH, S., and BAILES, R., Leeds, "Improvements in the means or method of treating and clarifying sewage or other impure waters." March 9, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

- 1550.—KNOWLES, Sir F. C., "Improved manufacture of gas for heating purposes." May 2, 1874.
1567.—LOWNE, R. M., "Improvements in anemometers and other fluid meters." May 4, 1874.
1589.—LENOIR, F., "Improved apparatus for carburetting gas." May 5, 1874.
1709.—BUDENBERG, A., "Improvements in meters for measuring the flow of liquids." May 14, 1874.
1733.—PONTIFEX, E. A., "Improvements in apparatus to be used in drawing off water and other liquors, and in measuring the quantities drawn off." May 15, 1874.
1799.—ALEXANDER, E. P., "Improvements in liquid-meters, applicable also as a motive-power engine." May 21, 1874.
1820.—WHITEHOUSE, E. O. W., "Improvements in producing electric light." May 22, 1874.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

- 1311.—WEARE, R., "Improvements in apparatus for receiving and treating sewage and other noxious matters." May 7, 1870.
1472.—LLOYD, T. H., "Improvements in the construction and arrangement of valves for regulating the supply or discharge of steam, water, and other fluids." May 21, 1870.
1486.—LONG, A., "Improvements in means for regulating the flow or controlling the supply of water or other fluids." May 22, 1873.

Share List of Metropolitan Gas and Water Companies.

(Corrected by Mr. F. N. GOLDING, Sun Court, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount paid up per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent.	Latest Quotations.	Number of Shares issued.	Amount paid up per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent.	Latest Quotations.	Number of Shares issued.	Amount paid up per Share.	NAME.	Amount paid up per Share.	Last Divd. p. Cent.	Latest Quotations.
10000	£ 20	GAS COMPANIES.	£ s. d.	£ s. d.	£	5600	£ 10	GAS COMPANIES.	£ s. d.	£ s. d.	£	9000	£ 4	GAS COMPANIES.	£ s. d.	£ s. d.	£
5000	20	Anglo-Romano . . .	20 0 0	9 0 0	20-22	56000	50	Hong Kong (Lim.)	10 0 0	0 0 0	18-19	15000	10	United General . .	4 0 0	2 10 0	3-3½
1000	20	Bahia (Limited) . .	20 0 0	2 0 0	14-16	2500000	Sk.	Impr. Continental	43 15 0	9 10 0	91-93	1500	10	Handsw. & Putney	10 0 0	10 0 0	19-20
1000	20	Do., do., redeem . .	20 0 0	2 0 0	25-27	1509000	Sk.	London	100 0 0	10 0 0	208-213	1500	10	Do.	10 0 0	7 10 0	11-12
40000	5	Do., 2nd pref. . . .	20 0 0	7 10 0	21-22	14450	Sk.	Do., 1st pref. . . .	100 0 0	6 0 0	138-143	2557	10	Do.	10 0 0	7 0 0	..
10000	5	Bombay (Limited) . .	5 0 0	7 10 0	6½-7½	4350	Sk.	Do., 2nd pref. . . .	100 0 0	6 0 0	115-120	993	10	Do.	3 0 0	7 0 0	..
10000	5	Do., fourth issue . .	4 0 0	7 0 0	5-5½	7622	25	Do., 3rd pref. . . .	100 0 0	6 0 0	115-120	23000	5	West Ham	5 0 0	10 0 0	8-8½
10000	20	British (Limited) . .	20 0 0	10 0 0	41-43	268052	All	Do., A shares . . .	12 10 0	6 0 0	34-36						
7500	20	Cagliari (Limited) . .	20 0 0	5 0 0	118-119	15000	5	Do., Debent. stk. .	100 0 0	5½ & 6½	..						
5500000	Sk.	Commercial	100 0 0	10 0 0	206-211	6000	5	Malta and Mediter-	5 0 0	2 0 0	2-3						
70000	100	Do., 7 per cent. . .	..	..	145-150	23000	5	ranean (Limited) . .	5 0 0	7 10 0	5-5½						
20000	20	Continental Union .	20 0 0	6 0 0	20-22	25000	20	Do., preference . .	2 0 0	..	½-1						
10000	20	Do., new	12 10 0	6 0 0	par-1	8000	10	Mauritius (Limited)	20 0 0	8 0 0	18½-19½						
10000	20	Do., preference . .	20 0 0	7 0 0	25-27			Monte Video (Lim.)	..	..	..			
75000	Sk.	Crystal Palace Dis-	..	..	..			Nietheroy, Brazil	..	..	..			
		trict	100 0 0	10 0 0	210-215			(Limited)	10 0 0	3 0 0	..	12000	100	Chelsea	100 0 0	6 0 0	144-147
125000	Sk.	Do., 7 per cent. . .	100 0 0	7 0 0	150-155	30000	5	Oriental (Calcutta).	5 0 0	9 10 0	7½-8½	1800000	50	East London . . .	100 0 0	6 0 0	154-157
50000	Sk.	Do., preference . .	100 0 0	6 0 0	135-140	30000	5	Do., new shares . .	3 0 0	9 10 0	13½-2½pm	8000	50	Grand Junction . .	50 0 0	5 0 0	73-76
23400	10	European (Limited)	10 0 0	10 0 0	6 17½-18½	10000	5	Ottoman (Limited).	5 0 0	3 0 0	2-3	5840	25	Do., 4 shares . . .	25 0 0	5 0 0	36½-37½
12000	10	Do., new shares . .	7 10 0	10 0 0	6½-7pm	17500	10	Perà (Limited) . . .	10 0 0	7 0 0	5-6	2160	25	Do., new ditto . .	..	..	..
35400	10	Do., new shares . .	5 0 10 0	10 0 0	4½-5½pm	27000	20	Phœnix	20 0 0	10 0 0	41-43						
3797700	Sk.	Gaslight & Coke A.	100 0 0	10 0 0	0 205-208	3600000	100	Do., new	60 0 0	7 10 0	104-109	547960	100	Kent	100 0 0	8 0 0	194-198
1000000	Sk.	Do. B.	100 0 0	4 0 0	85-90	1440000	Sk.	Do., capitalized . .	100 0 0	5 0 0	106-112	970	100	Lambeth	100 0 0	6 5 0	145-150
30000	10	Do. 5 per cent. pref.	..	..	..	36000	20	Do., new, 1876 . .	..	..	17-18pm	1161	100	Do., max., 7½ p.c.	100 0 0	6 5 0	143-147
50000	10	Do. do., 3rd issue .	all	5 0 0	20½-21	7359	5	Rio de Janeiro (L.)	20 0 0	10 0 0	31-33	442	100	New River	100 0 0	7 0 0	320-330
50000	10	Do. do., 4th do. . .	6 0 0	5 0 0	7½-8½pm	2000	5	Singapore (Limited)	5 0 0	7 10 0	54-53	4475	100	Do., do., 7½ p.c. .	70 0 0	7 0 0	270-300
2000000	Sk.	Do. do., 5th do. . .	2 0 0	5 0 0	7-8pm	1500	32½	Do., preference . .	5 0 0	7 10 0	53-61	400000	100	Do., deb. sk., 1 p.c.	100 0 0	4 0 0	163-165
3000000	"	Do. C 10 p.c. pref.	100 0 0	10 0 0	0 225-235	4000	50	Shanghai	32 10 0	12 0 0	30-32	3036	100	Southwark & Vauxh.	100 0 0	4 0 0	109-112
1650000	"	Do. D do. do. . . .	100 0 0	10 0 0	0 225-235	4000	50	South Metropolitan	50 0 0	10 0 0	106-109	1296	100	Do., pref. stock .	100 0 0	5 0 0	113-116
300000	"	Do. E do. do. . . .	100 0 0	10 0 0	0 225-235	4000	12½	Do.	12 10 0	10 0 0	26-28	..	100	Do., D shares . . .	100 0 0	4 0 0	108-110
600000	"	Do. F 5 do. do. . .	100 0 0	5 0 0	0 114-116	20000	12½	Do., new shares . .	10 10 0	10 0 0	12½-13½	..	100	Do., 4½ preference	100 0 0	4 10 0	106-108
13000000	"	Do. G 7½ do. do. .	100 0 0	7 10 0	0 158-163	15000	10	Surrey Consumers.	10 0 0	10 0 0	20-22	1600	100	Do., new ordinary	..	..	..
6200	5	Do. H	100 0 0	7 0 0	0 147-150	10000	10	Do., new	8 0 0	10 0 0	8½-9½	12172	61	Do., new ord. No. 1	40 0 0	4 10 0	106-108
		Georgetown, Guiana	5 0 0	5 0 0	..										61	0 0 6½ p.sh.	134-136

NOTICE OF REMOVAL.

D. BRUCE PEEBLES & CO.

Beg to announce that they have REMOVED to their New Premises,

TAY WORKS, BONNINGTON, EDINBURGH,

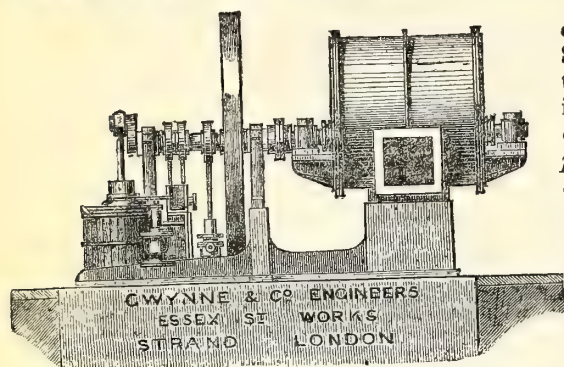
To which all communications should now be addressed.

May 30, 1877.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS;

Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce machinery of the very highest quality, and most approved design and workmanship. The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

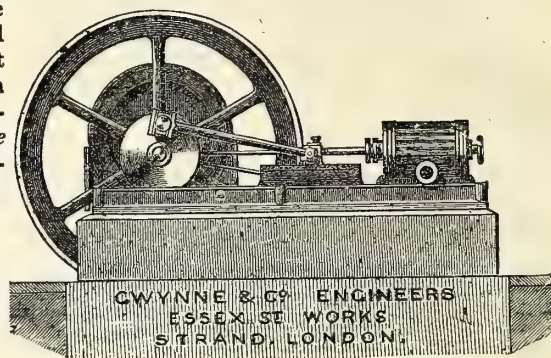
Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO.,** Hydraulic and Gas Engineers, **ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.**

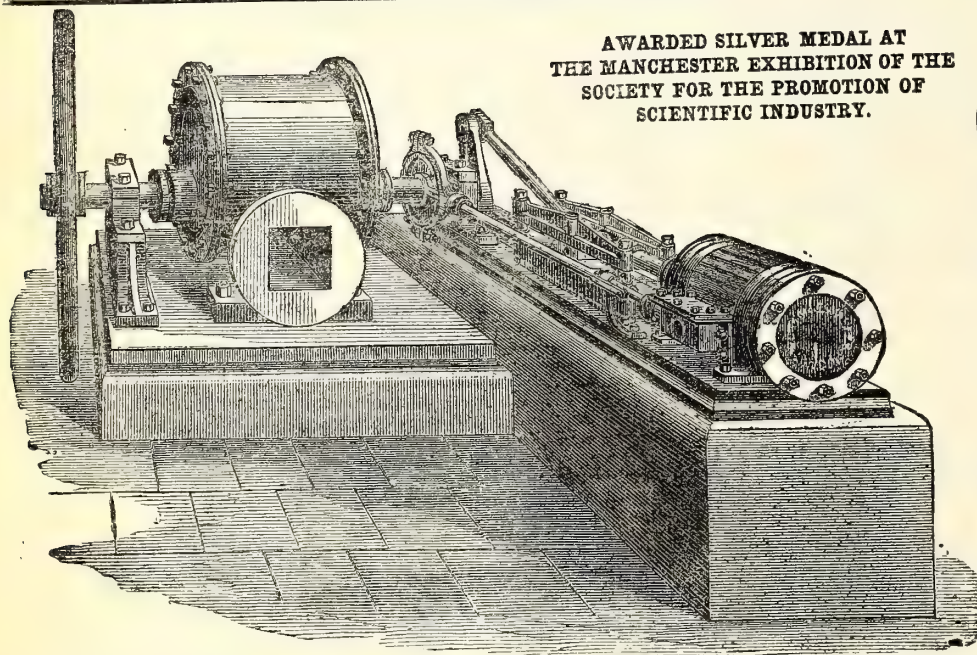
G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines, with many others of all Sizes.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship."

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.



AWARDED SILVER MEDAL AT THE MANCHESTER EXHIBITION OF THE SOCIETY FOR THE PROMOTION OF SCIENTIFIC INDUSTRY.

BEALE'S Improved Patent GAS-EXHAUSTERS WITH ENGINES COMBINED.

Sole Makers, **GEORGE WALLER & CO.**

Makers of
ENGINES, EXHAUSTERS,
INDEX and DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, and other PUMPS,
SCRUBBERS and PURIFIERS,
CONDENSERS, BOILERS, &c.

PHENIX ENGINEERING WORKS,
HOLLAND STREET, S.E.,
AND
STROUD, GLOUCESTERSHIRE.

WANTED, 160 feet of old 8-inch GAS-PIPES (socket).

Address, stating price delivered to the Blackfriars Station of the London, Chatham, and Dover Railway, Mr. B. N. RAYNER, Sittingbourne, KENT.

WANTED, in a Gas Engineer's Office, an ASSISTANT DRAUGHTSMAN, who must be thoroughly acquainted with all kinds of gas machinery, and able to make working drawings and take out quantities.

Apply to NEWTON, CHAMBERS, & Co., Thorncliffe Iron-Works, near SHEFFIELD.

WANTED, a situation by a First-Class Practical RETORT-SETTER, by day or piece-work. Thoroughly understands all repairs, &c., of a gas-work. No objection to go abroad. Twenty years good testimonials.

Address RETORT-SETTER, 16, Grant Road, Clapham Junction, LONDON.

WANTED, a Gentleman with a good connexion amongst Gas Companies, for the SALE of GAS COALS of every description, and Stourbridge Fire-Clay goods. Remuneration, salary or commission, or both, as may be arranged.

Address, in confidence, No. 365, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Working Manager, for a Gas-Works in Lancashire (where the make is about 10 millions annually). Must thoroughly understand the manufacture, distribution, and testing of Gas, also laying mains, fittings, in and out of Works. Residence on Works, with coals, gas, and water, free.

Applications, stating salary required, accompanied by copies of testimonials, to be sent to H., care of G.W. Hughes, Esq., 4, Cable Street, LIVERPOOL.

THE RATING OF GAS AND WATER WORKS.

A Gentleman of experience in the Rating of Properties of Public Companies is willing to undertake, in the interests of Companies, the Valuation of Gas and Water Works for Rating purposes.

Address, in first instance, No. 367, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

Now ready,

THE GAS & WATER COMPANIES DIRECTORY FOR THE YEAR 1877,

EDITED BY

CHARLES W. HASTINGS,

8, BUCKINGHAM STREET, ADELPHI, LONDON, W.C.

THIS WORK IS UNDER THE PATRONAGE OF ALL THE LEADING GAS & WATER ENGINEERS AND SECRETARIES OF THE METROPOLITAN & PROVINCIAL COMPANIES.

Price 5s. in Cloth Covers; by post, 5s. 2d. | Price 3s. 6d. in Paper Covers; by post, 3s. 8d.
PUBLISHED BY MESSRS. MARCUS WARD & CO., OF LONDON AND BELFAST.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

Now ready, price One Shilling, No. 7 (to be continued Monthly) of

A TREATISE ON THE SCIENCE & PRACTICE

OF THE

Manufacture and Distribution

OF

COAL GAS.

LONDON: WILLIAM B. KING, 11, BOLT COURT, FLEET STREET,
OR OF ANY BOOKSELLER IN TOWN OR COUNTRY.

For the convenience of persons resident in remote districts, arrangements have been made by the Publisher to forward the "Treatise" by Post, securely packed on a roller, at the cost of the number and postage only—viz., 1s. 2d. Monthly, or 7s. for the Half Year.

BRITISH ASSOCIATION OF GAS MANAGERS.

ANNUAL MEETING OF MEMBERS.

PROGRAMME OF ARRANGEMENTS.

THE FOURTEENTH ANNUAL GENERAL MEETING

OF THE MEMBERS OF THIS ASSOCIATION WILL BE HELD ON

TUESDAY, WEDNESDAY, & THURSDAY, the 12th, 13th, & 14th of June, 1877,

AT THE
LECTURE THEATRE OF THE BRISTOL MUSEUM,
QUEEN'S ROAD, BRISTOL.

ROBERT P. SPICE, ESQ., MEMB. INST. C.E., PRESIDENT,
Will occupy the Chair.

ORDER OF PROCEEDINGS.

TUESDAY, JUNE 12, 1877.—Morning Meeting.

The Chair to be taken at Ten o'clock.

Inaugural Address by the President. | Admission of New Members.
Reading of Papers and Communications.

Evening Meeting.

A Lecture will be delivered by THOMAS CARGILL, C.E., B.A., T.C.D., President of the Society of Engineers (Author of "The Strains upon Bridge Girders and Roof Trusses"), on "The Strains upon Girders, Trusses, and Braced Structures, and the Mode of Ascertaining and Calculating them."

WEDNESDAY, JUNE 13, 1877.

The Chair to be taken at Ten o'clock.

Reading of Papers and Communications, and the Transaction of other Business.
Election of Officers for the ensuing Year, &c.

At Six p.m. the Members and Friends will dine together at the Grand Hotel, Broad Street, Bristol.
Tickets for the Dinner, 6s. 6d. each, may be had from the Secretary, if taken on or before the 12th of June. After that date 10s. will be charged.

THURSDAY, JUNE 14, 1877.

An Excursion by Rail to New Passage, across the Severn by Steamboat to Portskewet, thence by Rail to Chepstow, where the Castle may be inspected. Luncheon will take place in the town, and carriages will be provided for conveying the party through the beautiful scenery of the Wyndcliffe to the magnificent ruins of Tintern Abbey.

Tickets for the Excursion and Luncheon, 7s. 6d. each.

LIST OF PAPERS AND COMMUNICATIONS

TO BE SUBMITTED TO THE MEETING.

SUBJECT FOR DISCUSSION:

"THE CONSTITUTION AND RULES OF THE BENEVOLENT-FUND."

The Order in which the Papers are to be Read will be determined by the Committee prior to the Meeting, so as to suit the general convenience.

1. "Experience of Körting-Cleland's Steam-Jet Gas-Exhauster, with Notes on its Adaptability and Economy." By R. O. PATERSON, of Cheltenham.
2. "Some Experiments upon the Power and Fuel expended in Exhausting Gas." By C. WOODALL, of London.
3. "Periodical District Pressure-Taking." By W. J. WARNER, of South Shields.
4. "The Supply of Gas to Public Lamps." By R. W. BRETT, of Hertford.
5. "Evidences of Economy in Carbonization by the Use of West's System." By J. ELDRIDGE, of Richmond.
6. "Lighting and Extinguishing Automatically." By A. F. WILSON, of London.
7. "Railway Carriage Lighting." By W. SUGG, of London.
8. "Is the Adoption of the Form of Accounts as Scheduled in the Gas-Works Clauses Act, 1871, by all Gas Companies or Corporations desirable." By ALFRED LASS, of London.
9. "Scrubbing and its Results." By S. R. OGDEN, of Blackburn.
10. "Means of Extending the Use of Gas and Coke, and How their Consumption may be Increased." By W. H. BENNETT, of London.

May 28, 1877.

WILLIAM H. BENNETT, Secretary.

MAIN and Service Layer wanted.
Address, stating age, wages, and present employment, No. 363, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Advertiser is desirous of meeting
with an Appointment as Gas-Works Manager. He has been employed by his present employers eight years, four of which he has had sole charge of the Works, where the annual make is over 30 million cubic feet. Advertiser understands the manufacture and distribution of gas in all its branches, and is willing to be paid either by results or salary. Good references and testimonials can be given.
Address, JOHN HENRY LYON, Gas Engineer, MACCLESFIELD.

AYLSHAM, NORFOLK.

AYLSHAM GAS COMPANY, LIMITED.
WANTED, by the Directors of this Company, a MANAGER for their small works, to make and distribute Gas. The salary is £1 per week, with house, garden, coals, and gas, and to enter on duties at the end of August next.
Applications, with testimonials as to character and fitness for the office, to be sent to me on or before the 21st of June next.
Candidates will be informed if their presence is required on the day of election.
W. HENRY SCOTT, Secretary to the Company.
Aylsham, May 30, 1877.

TO GAS COMPANIES.

WE beg to call attention to our special
STEATITE BURNERS for Street Lamps. Sample gross 8s. Quotations for quantities.
Messrs. TINDALL AND TELLING, Gas Apparatus Works, 74, Wynford Road, Penton Street, LONDON, N.

FOR SALE, CHEAP, owing to extensions, Three PURIFIERS, with valves and connexions, in good order.
Apply to the Gas Company, NORTHALLERTON.

FOR SALE, CHEAP, 400 4-inch Cast-Iron SOCKET-PIPES, coated.
Apply by letter to J. MYERS, 3, Fortress Terrace West, JUNCTION ROAD, N.W.

CHELTEMHAM GAS-WORKS.

FOR SALE, Two Hydraulic Centre-VALVES and 12-inch connexions, suitable for sets of Four and Two purifiers. All in good order.

READING GAS COMPANY.

FOR SALE, as they now stand, and at any reasonable price, as the ground upon which they stand is wanted, four 12-ft. square Cast-Iron PURIFIERS, with centre-valve and connexions, grids, tee bars, &c., complete.
Apply to Mr. E. BAKER, Engineer, Gas-Works, READING.

GASHOLDER FOR SALE.

TO BE SOLD CHEAP, in consequence of the tank being wanted for another purpose, a GAS-HOLDER about 33 ft. in diameter and 10 ft. deep. To be sold, as it now stands, at any reasonable price. Is in good condition.
Apply to Mr. W. T. HEWES, Gas-Works, HENLEY-ON-THAMES.

TO TAR DISTILLERS AND OTHERS.

TO BE LET ON LEASE, or the Interest SOLD, a very handy TAR-WORKS in London. In good order, and capable of working nearly a million gallons per year. Water frontage.
Address No. 362, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MIDDLESEX LUNATIC ASYLUM,
COLNEY HATCH, N.

GAS TAR FOR SALE.—About 5000 gallons of GAS TAR now for Sale at the Gas-Works of this Asylum; to be removed immediately.
Tenders are invited, naming price per gallon and time within which the whole would be removed, to be sent, addressed to me at the Asylum, by Saturday, the 9th of June. Payment to be made on delivery.
J. S. SKAIFE, Clerk.

GASHOLDER FOR SALE.

ONE Telescopic Gasholder, 70 feet by 20 feet, complete, with cast-iron tank, columns, girders, and inlet and outlet pipes, valves, &c., of modern construction. In first-class condition, and made by Messrs. Piggott and Co., of Birmingham.
To be seen at work at the Gas-Works, Birkenhead.
Cause of removal to make room for extensions.
To be sold a bargain, taken down, and re-erected ready for work.

For particulars, apply to Messrs. ASHMORE AND WHILE, STOCKTON-ON-TEES, or to view to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

THE Newport (Mon.) Gas Company
have FOR SALE the following PLANT at their Works, Newport, Mon.:

Two Cylindrical Boilers, 13 ft. by 4 ft., with fittings complete, and steam-pipes to engines.
Two Horizontal Engines, each cylinder 9½ in. diameter, and stroke of each 1 ft. 6 in.
Two Beale's Exhaustors, made to pass 20,000 cubic feet per hour each, with regulators and bye-pass.
The above are in good order, have been working during the past winter, and are now offered for sale because larger ones have been fixed.
Particulars and prices given for the whole or a portion of the Plant on application to the undersigned.
They can be seen at the Works, Mill Street, Newport, Mon.
THOMAS CANNING, Engineer.
May 18, 1877.

PATRONIZED BY THE ROYAL ARSENAL,
WOOLWICH.

FERGUSON, Builder and Contractor.
Kite method of Repairing Church Spires and High Chimneys. Chimneys straightened, pointed, and hooped. Old Chimneys pulled down by a process requiring no scaffolding or stoppage of work, by competent workmen, under personal supervision. For Lighting Conductors—cheapness and method of fixing—apply to C. R. FERGUSON, 12, Canal Road, MILLS END.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

(INCORPORATED BY ACT OF PARLIAMENT.)
The HALF-YEARLY ORDINARY MEETING of the Imperial Continental Gas Association was held at the City Terminus Hotel, Cannon Street, London, on TUESDAY, the 29th inst.,

JULIAN GOLDSMID, Esq., M.P., the Chairman, when the following resolutions were passed:—Resolved unanimously—"That the Report upon the affairs of the Association now read be received, adopted, and entered on the minutes." Resolved unanimously—"That a dividend of £2 per share, and a bonus of 15s. per share, be declared upon the 56,000 shares of the Association for the half year ended the 31st of December last, and that the said dividend and bonus be payable free of income-tax, on and after the 15th of June next."

Resolved unanimously—"That Julian Goldsmid, Esq., M.P., be re-elected a Director of the Association."

"That Nathaniel Montefiore, Esq., be re-elected a Director of the Association."

"That Francis Bassett, Esq., be re-elected a Director of the Association."

"That Joseph Sebag, Esq., be re-elected an Auditor of the Association."

"That the cordial thanks of the Meeting be given to the President and Directors for their able management of the affairs of the Association, and to the Chairman for his conduct in the chair this day."

Upon the motion of the Chairman, Mr. Julian Goldsmid, M.P., a vote of thanks was also given to Mr. G. W. Drory, the General Superintendent of the affairs of the Association on the Continent, and to the Agents, Engineers, and other Officers of the Association.

ALBERT F. JACKSON, Secretary.

By order of the Board.

No. 30, Clement's Lane, Lombard Street,
London, May 30, 1877.

CARDIFF GASLIGHT AND COKE COMPANY.

AMMONIACAL LIQUOR.

THE Directors of this Company are prepared to receive TENDERS for the AMMONIACAL LIQUOR produced at their Works in Cardiff, for One, Two, or Three years, from June 30, 1877.

Sealed tenders, endorsed "Tender for Ammoniacal Liquor," to be forwarded to the undersigned, on or before the 6th day of June next.

Any further particulars may be obtained upon application at the Company's Offices.

HENRY BOWEN, Engineer.

Gas Offices, Cardiff, May 12, 1877.

TO CONTRACTORS, GASHOLDER-TANK BUILDERS, AND OTHERS.

THE Directors of the Sherborne Gas and Coke Company are prepared to receive TENDERS for the construction of a GASHOLDER-TANK in Brick at their Works.

Drawings and specification may be seen, and full particulars obtained, on application to Mr. T. W. R. White, the Engineer.

Tenders are to be sent in on or before Monday, the 11th of June next, endorsed "Tender for Gasholder-Tank," and addressed to the Secretary.

The Directors do not bind themselves to accept the lowest or any tender.

By order,

T. W. R. WHITE, Secretary.

May 30, 1877.

TO TAR DISTILLERS, MANUFACTURING CHEMISTS, AND OTHERS.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works at Rochester and at Gillingham for the term of One year, commencing the 1st of July next.

Particulars on application at the Office of the Company at Rochester.

Tenders may be for Tar or Liquor, separately or together, and are to be delivered at the Office, marked "Tender for Tar or Liquor," not later than Noon of Thursday, the 14th of June.

The Directors do not bind themselves to accept the highest or any tender, and security for due fulfilment of the Contract may be required.

By order,

WILLIAM SYMS, Secretary.

May 29, 1877.

IMPORTANT SALE OF SHARES

In the Woolwich Equitable Gas Company, the Woolwich Consumers Gas Company, and the Clacton-on-Sea Gas and Water Company, Limited, by direction of the Executors of the late Mr. John Webber.

MR. H. H. CHURCH is instructed to SELL by PUBLIC AUCTION, at the Masonic Hall, William Street, Woolwich, on Thursday, June 28, 1877, at Four for Five o'clock in the Afternoon, Seventy-six £10 ORIGINAL SHARES, fully paid up, in the Woolwich Equitable Gas Company, and paying an annual dividend of £10 per cent. Thirty-eight £10 ADDITIONAL SHARES in the same Company, whereon £2 per share have been paid, paying an annual dividend of £7½ per cent. Thirty £5 SHARES, third issue, fully paid up, in the Woolwich Consumers Gas Company, paying an annual dividend of £7½ per cent. Five £5 NEW SHARES in the same Company, fully paid up, and paying a dividend of £7½ per cent. per annum; also Twenty £5 B SHARES, all paid up, in the Clacton-on-Sea Gas and Water Company, Limited.

Particulars and Conditions of Sale may be had of Messrs. FARNFIELD AND SAMPSON, Solicitors, 19 and 21, Queen Victoria Street, LONDON, and Parson's Hill, Woolwich, and of the AUCTIONEER, William Street, Woolwich.

PAMPHLET ON GAS.**COOKING AND HEATING. HINTS ON GAS-BURNERS, &c.**

For GAS COMPANIES to distribute to their Gas Consumers.

Specimen Copy by post Threepence, from the Author, **MAGNUS OHREN**, Gas-Works, Sydenham, S.E.

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Being a Catechism of Gas Lighting for Householders, Gas-Fitters, Architects, Engineers, Millowners, &c.

By ROBERT WILSON, C.E.

CROSBY, LOCKWOOD, & CO., 7, STATIONERS HALL COURT, E.C.

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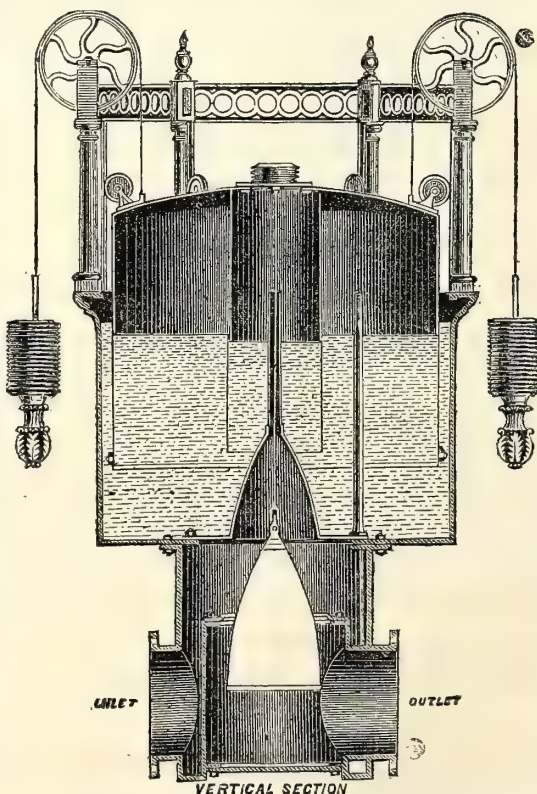
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PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

SUPPLEMENT

TO THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

Vol. XXIX.

LONDON, JUNE 5, 1877.

No. 734.

Parliamentary Intelligence.

HOUSE OF COMMONS.

THURSDAY, MAY 31, 1877.

The Lords amendments to the Longton Corporation, Middlesbrough Corporation, and Sittingbourne Gas Bills were agreed to.

The Bishop Auckland District Gas, Bristol United Gas, and Glasgow Corporation Water Bills were read the third time and passed.

The following Bills, as amended, were considered:—Burslem Local Board; Carshalton Gas; Christchurch Gas; Lowestoft Water, Gas, and Market (Lords).

The Newcastle-under-Lyme Borough Extension and Improvement and Southend Gas Bills, as amended, were considered and amendments made.

The Examiners reported that the Standing Orders not previously inquired into have been complied with in the case of the Blackburn Borough Gas, Water, and Extension Bill (Lords).

The Local Government (Gas) Provisional Orders (Penrith, &c.) Bill was considered in committee, and reported without amendments.

FRIDAY, JUNE 1.

The Woolwich, Plumstead, and Charlton Consumers Gas Bill was reported.

The Lords amendments to the Warrington Corporation Gas Bill were agreed to.

The Bridgewater Corporation Water Bill, as amended, was considered.

HOUSE OF COMMONS COMMITTEE.

THURSDAY, MAY 3.

(Before Mr. D. R. PLUNKET, Chairman; Mr. FOLJAMBE, Mr. STARKEY, and Mr. COURTNEY.)

CRYSTAL PALACE DISTRICT GAS BILL.

(Continued from p. 864.)

Professor Frederick Settle Barff, examined by Mr. CRIPPS.

I am Professor of Chemistry to the Royal Academy of Arts, and I have made it my business to examine into the causes which have an injurious influence upon pictures. I have found in those investigations that the products of the combustion of coal gas are injurious to them—as far as I can trace it to them; and I think I can. In London, where gas is purified from sulphuretted hydrogen, I do not find that the blacking of the white lead goes on as in places where that purification has not taken place. If, however, that happens, it is a matter which can be remedied. By washing the defective picture with peroxide of hydrogen I can restore the colour, if it is not too far gone.

Mr. CRIPPS: Now what have you found to be the effect of the combustion of the sulphur in the London gas?

Witness: Sulphurous acid gas is formed by the combustion. That sulphurous acid gas comes in contact with the moisture in the air, and gets oxidized very very rapidly, and becomes sulphuric acid; and the sulphuric acid is not a volatile thing which will go away like sulphurous acid, but it mixes along with the moisture of the room, and deposits upon the cold parts of the room, as moisture does that is usually upon the walls. If it gets upon the walls, it will get on the pictures; and if it gets on the pictures, it has, in my opinion, this effect. First of all upon water colours. Ultramarine is a colour which is affected, and is perfectly destroyed by moderately strong sulphuric acid, and is gradually destroyed with excessively dilute sulphuric acid; therefore, if it comes in contact with the ultramarine, it simply destroys the colour perfectly, though slowly. After a time it will act upon zinc oxide. Now zinc oxide, or zinc white as it is called, is a thing which is generally used as a pigment among artists at the present time; and the action, if a picture is unprotected, is to convert a portion of the zinc oxide, which is opaque, into zinc sulphate, which is a tolerably crystalline substance; and this substance I have found upon the paintings of several artists. I think Mr. Frith's, with several others I do not remember. As I was called here to-day without the slightest warning, I only got the information early this morning, and I have not been able to verify the names. Therefore I must say I think; but in several of the paintings, where the zinc white has crystallized and become soluble it can be seen by the microscope. This, of course, interfered with the opacity of the picture, and therefore destroyed its effect, besides making it spotty. I attribute that to the presence of sulphuric acid.

By the COMMITTEE: Mr. Frith wrote to me, when I was staying at Cromer, in the summer of last year, as to a picture, and I wrote to him to that effect. It is an opinion which I formed and expressed quite independently of the present inquiry.

Mr. CRIPPS: With reference to canvas also, on which so many pictures are painted, what do you say as to the effect upon canvas?

Witness: I have a difficulty in getting a picture to experiment upon, but I have taken a piece of canvas and exposed it to the action of excessively dilute sulphuric acid for a long time, and this I have shown in my lectures for the last six years at the Royal Academy, and I have shown the students that by keeping this stretched and tapping it, you will be able to knock the canvas through, and a portion of it will come away in dust, quite rotten. I attribute that to sulphuric acid mainly. We know in our laboratory that sulphuric acid does do this. It rots our cloths perfectly. If a picture be covered with mastic varnish, I know from experiment that dilute sulphuric acid is injurious. Mastic varnish is a varnish which takes up moisture, and gives a sort of bloom to the picture which artists do not at all like; and that bloom is owing to the hygroscopic character of the mastic varnish. Then, if sulphuric acid is in the room, and I think

there can be no doubt that it is, and if it cannot get out of the room, and if it is not carried away by the draughts, it must settle somewhere, and it must, among other places, settle upon this mastic varnish; and if it does settle upon it, the effect is to corrode its surface, and take away the bloom; and if the surface be corroded, the picture readily gets dirty, and has to be varnished again. I have made experiments upon a bad painting, done on purpose for experimenting upon, to see what the effect of this might be upon it. The result has been to destroy the ultramarine slowly, and to interfere materially with the zinc white. I cannot say anything as to the other colours, except the iron colours; I think they have been damaged by it, for they, being oxides of iron, would be dissolved up in part by the dilute sulphuric acid, and would therefore be injured, and I think I have noticed traces of injury on the oxides of iron.

Have you, in consequence of the state of the pictures that are in your own drawing-room, been led to give up the use of gas for those reasons?—Yes; since I have bought valuable pictures I have had a gas-burner made with the pipe going into the flue, and another pipe coming from the outside, so that the whole of the particles of combustion are carried away. In my drawing-room I have given gas up altogether, and use nothing but lamps. I found that injurious effects were produced from the gas in the room before it was done away with. Nearly all the friends I have who come notice the difference between the sensation of spending an evening in the room now to that which they felt when they spent an evening in the room before. I have now two 22-candle Silber Argand burners, and before I had only two 3-light bat's-wing burners.

In your lectures at the Royal Academy have you proved the production of those products in the combustion of gas?—Yes. I pass the products of combustion from coal gas, developed by means of an apparatus, through baryta water. I then dissolve up the white precipitate, which is mainly carbonate, in hydrochloric acid. I then have a sulphite of baryta in solution, and I add that to the chlorine water, which oxidizes the sulphite into sulphate, and throws it down as a white insoluble precipitate, and in this way I have determined approximately the quantity of sulphur burnt in the gas from the sulphide of carbon.

I believe that you generally advise artists to give up the use of gas in their studios?—Every one; all the members of the Royal Academy I have advised to do so, and all the students who have applied to me I have advised to give it up, or else to use the arrangement which I have—which is an adaptation of the one that existed before—to carry off the products of combustion.

Is the reason that you give that advice because you think that the sulphuric acid from the sulphur compounds which you detected is injurious?—Certainly, and for no other reasons; because there is no sulphuretted hydrogen in the London gas.

Cross-examined by Mr. PHILBRICK: My judgment is that the combustion of gas, unless under favourable circumstances, is always, more or less, attended with injury to pictures, because there is an amount of bisulphide of carbon in it. I have never tested the difference between 15 or 16 and 40 grains per 100 cubic feet of sulphide of carbon. The ventilating apparatus in my house is a very costly thing; it is not within the reach of many people. The whole apparatus cost me about £45. In the national collections gas is very rarely burned. It is burned at the Royal Academy, but there it is all in sunlight. The ventilation there is not very efficient. I think there are no injurious results produced upon the works of art in the room; at least I am not competent to speak about that, because I have never been referred to, nor been shown any of the pictures.

Mr. PHILBRICK: Then I may take it that, with regard to the national collections, and matters that come officially under you, there has been no complaint of damage from that?

Witness: But I have no official connexion with the national collections. I have nothing to do with the National Gallery; it is only with the Royal Academy.

I do not know whether you are aware that the lighting of the Vernon collection of pictures was fully considered by a committee of scientific men?—Yes, I am.

Was the result of that that gas illumination was adopted?—That I am not prepared to say. I do not know how it is lighted. I confine my attention to my own work at the Royal Academy. I cannot speak to any of the national collections at all.

Cross-examination continued: If you treat with diluted sulphuric acid the pigments ultramarine and zinc white and the compounds that have an iron basis, you may destroy them more or less. You may also in that way destroy the fibre of hemp. Mastic varnish practically requires to be renewed very often. The only thing is that artists put it off because they do not like sending their pictures to varnishers, and they do complain that I have introduced at the Royal Academy a new system of varnishing to get rid of that. An artist does not even like to varnish his picture himself until it has stood for some years for the oil to get hard. Mastic varnish is almost invariably used, because there is no other. They cannot very well use copal; it is a bad varnish for pictures, as it has a habit of dragging the colours underneath if they are not sufficiently hard. You may have seen in art galleries a number of pictures cracked; that is mainly owing to the fact of the varnish being used in too large quantities on a colour which is not sufficiently hardened. To prevent that, mastic is usually had recourse to as being more elastic. I do not know whether pictures in country towns, where gas is not subject to the same conditions which prevail in London, suffer more from the effect of sulphur compounds than pictures exposed to London gas. I do not know whether pictures that are hung high up on walls suffer more than those on the level of the dado. When pictures are sent to me for examination they are always placed on the level, and I cannot tell where they may have been. I have never noticed

whether the gilding of the frames of pictures has been differently affected according to the positions in which they have been hung. I should prefer to hang them on the dado than above it. No doubt the heat itself in the upper part of a room will produce some of the injuries I have mentioned; it will injure the varnish.

Mr. PHILBRICK: You would say if there were the presence of sulphur or sulphuric acid, that, of course, would aggravate it, though the heat would bring it up?

Witness: If it is not troubling you too much, I should like to say a word upon that. In the varnish of a picture you have got different media—you have got one substance that contracts at one temperature, and another substance that contracts at another temperature, a little lower, probably. Those varnishes are not good conductors of heat, and the consequence is that when the varnish gets hot it expands, and is by the heat itself driven through to the canvas below it, and consequently it has a tendency to crack; and I believe that the dry heat in the upper part of the room has a very great effect in producing cracks in pictures, owing to the unequal expansion and contraction of the two materials—the layer of varnish and the layer of paint.

That dry heat, of course, to produce sulphuric acid and sulphur compounds, if sulphurous acid is present, requires moisture?—Exactly so; certainly. Of course, if you had no moisture in the room you would have no sulphuric acid formed, for the sulphurous acid will not oxidize at a high temperature.

That explains what somebody said yesterday, that where there was a drier heat the sulphurous acid has not become sulphuric?—No; but in a room where this is continually going on, at the same time that you have moisture of water, or water vapour, in the room to a large extent, that gets deposited on the walls, and I think the point that should be recollected is that sulphuric acid when once formed remains there and accumulates.

Re-examined by Mr. CRIPPS: The heat alone of a dry atmosphere may do some mischief to the pictures. What I am speaking of is the further injury that I attribute to the action of the combustion of gas. I put the two things on two different footings altogether, one being a matter which probably cannot be prevented—the heat in the room—and the other a matter that, if it can be prevented, I think ought to be prevented. If the varnish cracks on a picture, of course the paint underneath gets exposed, and is much more likely to be acted upon by deleterious influences in the air. I have never been at South Kensington Museum in the evening when it was lighted up. I have been there at two *conversaciones*, but I have never seen the pictures lighted.

Mr. William Charles Young, examined by Mr. CRIPPS.

I am a Fellow of the Chemical Society, and have been analyst for the Poplar District, and a gas examiner at the Beckton testing-station for the last five years for the Metropolitan Board of Works. For the last nine years I have been almost daily engaged in testing gas to examine its purity and illuminating power. For the last three years I have occasionally made experiments to determine whether the sulphur in the gas when burnt is converted into sulphuric acid or sulphurous acid; and the result of my experiments has been to convince me that practically the whole of the sulphur is converted into sulphuric acid, and not into sulphurous only. I attribute very much of the injury caused to furniture and to book-bindings, and, in fact, anything which is said to be injured by the gas, to the sulphuric acid that is produced by combustion of the sulphur. I have noticed, where gas has been burning, that brass fittings in rooms have become coated with sulphate of copper; that zinc has become coated with sulphate of zinc; and this could only be after the sulphur had been converted into sulphuric acid. I have noticed that the surface of painted walls and furniture is distinctly acid, and that the acid is sulphuric acid. I have also noticed as to dust collected in rooms where gas has been continually burnt, and no fire has been lit, that the dust was distinctly acid, and that the acid is sulphuric acid; and I have estimated the acid as sulphuric acid from dust taken from the top of a wardrobe cupboard in a bed-room where gas only has been burnt. The acid found there was equal to .335; that is rather more than three-tenths of a grain of sulphuric acid per square foot of cupboard. Taking the four walls only, and supposing it to be evenly distributed over the walls of the room, I calculated that it would be equal to two grains of sulphur, in every 100 cubic feet of gas, deposited as sulphuric acid. Supposing that which I found was upon every square foot of surface forming the four walls, I should have got sufficient sulphuric acid to indicate that two grains of the total sulphur in the gas burnt was converted into sulphuric acid and deposited upon the walls. The dust which I experimented upon has remained undisturbed upon the shelf for six months, and I calculated there would be rather more than 2000 cubic feet of gas burnt in that time. I cut a piece of the top of the canopy from the top of the bed-hangings, which had been there six months, and I estimated the acid in it as sulphuric acid, and I found nearly half a grain of sulphuric acid per square foot. That, if calculated for the same amount of surface in the same way, would indicate that three grains of sulphur had been deposited per 100 cubic feet of gas burnt; and I think that that is more accurate than the other experiment, because, in the first place, the sulphuric acid absorbed by the wood upon which the dust had collected was not taken into account—the dust was merely swept off the surface of the wood; but in this second experiment, the whole of the sulphuric acid was taken into account, the sulphuric acid that was absorbed by the fabric as well as in the dust lying upon the fabric. A considerable quantity might be taken up by the carbonate of lime in the ceiling in the other case. If the amount could be ascertained that was taken up by the ceiling and of that which was removed from the room by ventilation, I have no doubt that the whole of the sulphur could be accounted for as sulphuric acid in all the gas that had been burnt. I also tested for sulphuric acid upon some advertisement cards that had been exposed in a shop for some time.

Mr. COURTNEY: Before you go away from the room you spoke of, do you happen to know whether the gas supplied in that room was supplied under the 20 grain regulation, or under any regulation?

Witness: No, I believe there is no restriction—the gas was supplied from the Silvertown works of The Gaslight and Coke Company; and I think there is no restriction there as to sulphur impurities.

Mr. PHILBRICK: That is not so.

Mr. CRIPPS: It will be sufficient to let me know where it came from?

Witness: I was under that impression. I know that it is not tested—the gas came from the Silvertown works of The Gaslight and Coke Company.

Mr. COURTNEY: What leads you to say that it was not tested?

Witness: I live in the district, and I know that there is no official tester. It is not tested for the West Ham Local Board nor for the Metropolitan Board of Works.

Mr. CRIPPS: I am informed, I am not sure how it will turn out, that the gas comes from a part of the Chartered district which is not within the metropolitan area, and, therefore, which is not under the ordinary provisions which the rest of the Chartered gas is under.

The CHAIRMAN: Perhaps it would be well for you to give some evidence upon that point by-and-by, as we have identified the place now.

Mr. PHILBRICK: I can give you evidence upon it.

Examination continued: One of the cards upon which I experimented was a large one, which had been exposed in the shop for six months, and I found as much as 1.8—i.e., nearly 2 grains of sulphuric acid upon the whole surface of it, which was about 3 square feet. I calculated the quantity of sulphur that would be deposited as sulphuric acid upon a square foot of surface, and I found that the tenth of a grain would have been deposited from 1000 cubic feet. I obtained a smaller card from another shop, and estimated the acidity upon it, and found it exactly the same, calculating for the same amount of surface as the larger one. I also calculated the acid which was deposited upon the top of an iron box, which had been exposed for some time in another place. I sponged the surface of the top, which was about one square foot, and I estimated the acidity in the liquid. I found the total acid was nearly equal to 2 grains of sulphuric acid. I have further suspended moistened bibulous paper in a room, and have found that two-tenths of a grain of sulphuric acid was deposited on a square foot from 100 cubic feet of gas consumed. I suspended some moistened linen and some moistened flannel in the same room, and obtained precisely the same results. I tried ventilating the room through a hole in the wall, close to the ceiling, so as to create an outward draught, and hung moistened paper in front of the opening, when I found that the sulphuric acid increased very considerably. In all these experiments I know of no other source from which the sulphuric acid could be derived except from the gas which was burning there. There was no coal fire burning—nothing but the gas. I have had my attention called to books that have been on the upper shelves of a large library; and I have noticed that they have been abraded upon the surface, and that they are all distinctly acid—very acid—not merely distinctly acid, but very acid; and I have noticed also that the ridges of the books which project take up more acid than the other parts of the books. I observed it still more with Morocco leather or Russia leather than with ordinary leather. The injury that is complained of is the rotting of the leather of the edges of the covers of a book, so that when the book is opened they crack and break off. The Morocco and Russia leather appear to suffer more, probably on account of the openness of the grain, which absorbs more readily. I sponged the backs of eight volumes—eight octavo volumes, I think they were—and I found a total of two grains of sulphuric acid, of which 1.4—that is, rather less than a grain and a half—was in a free state as free sulphuric acid. Not all the leather, only a part of it had been abraded—the roughened part, that is the edges, was very acid, and is still very acid, although it has been sponged five or six times—a sponge drawn over the surface, not allowed to remain on the book; and that acid is still due to sulphuric acid, and not to any other acid. I have noticed that dust collected in places where much gas is burnt is very hygroscopic; and, moreover, when it is washed and dried it presents all the appearances of charred organic matter—it looks as much like powdered charcoal as anything—in fact, it presents all the appearance of organic matter having been subjected to the action of strong sulphuric acid. I will mention some experiments that I made three years ago, to show that sulphuric acid was formed by combustion of the sulphur in gas, even when the sulphur was there in very large quantity. These are published in the *Analyst* for Oct. 31, 1876. I shall only quote two experiments which I made upon gas which was previously charged with bisulphide of carbon; it was charged by passing the gas over a solution of bisulphide of carbon in olive oil, and the gas was burned very slowly. I think I need not say how the experiment was made; but the result was that the gas showed a degree of sulphur amounting to 444 grains per 100 cubic feet, of which 422, or 95 per cent., had been converted into sulphuric acid. Another experiment was made upon gas containing a still greater amount of bisulphide of carbon; and the total sulphur was 1644 grains per 100 cubic feet, of which 1260, or 76.7 per cent., was converted into sulphuric acid. The object of this experiment was to show that the sulphur compounds are, in fact, converted into sulphuric acid. I may mention that I have collected dust from places where no gas has been burnt, and have invariably found that it was not acid.

Cross-examined by Mr. PHILBRICK: I tested the dust that I last mentioned for the presence of sulphuric acid in precisely the same way that I tested the dust in the room where gas had been burnt. I am not aware of the series of experiments made by Professor Redwood on this point. I cannot call to mind any experiments conducted by chemists of reputation. I supposed that no other chemist had experimented in that direction. For the purpose of determining the quantity of free sulphuric acid present, the absorbent I used was in some cases carbonate of soda, in some cases bicarbonate, and in others caustic soda. It is not necessary that to turn sulphurous into sulphuric acid you must use soda alkalies; there are other things that will do it. If you have sulphurous acid and want to see what quantity of sulphuric acid you can get, it is part of the process to treat it with an alkali; but it is not a part of the process which is designed and adopted for securing the greatest result in the shape of sulphuric acid that the product can yield. I used it to absorb the products of the combustion of the gas. There were no other means of doing it except I used another alkali. You cannot always get sulphuric acid when you have sulphurous acid if you treat it with an alkali. In this experiment I proved that it was not so. An alkali will absorb sulphurous acid, but not convert it into sulphuric acid. It is driven off as sulphurous acid, the sulphuric acid only remaining. It is absorbed by the alkali, and then that which remains is estimated as sulphuric acid. The bed-room hangings from which I extracted the acid were old ones which had been washed five or six times by an ordinary laundress, and starched in the usual way. I have reason to believe that laundresses do use such things as bleaching powder. I did not inquire whether that was the practice of the laundress in question. The shop from which I obtained the show-cards referred to was a druggist's, in which there was a gas-burner in the window, and on two or three others inside. One of the cards had an enamelled surface, the other was ordinary cardboard.

Mr. PHILBRICK: Does it occur to your mind that in the preparation of an enamelled card possibly there is a little source of error introduced that ought to be eliminated?

Witness: I know that in this case the enamel on the card was quite neutral; it was not at all acid. I had another card of the same kind sent to me, and that was quite neutral—not at all acid. There was the ordinary stock of a druggist in the shop—sulphur, no doubt.

Mr. PHILBRICK: You must not put it all upon the gas.

Witness: I give you the facts as I observed them.

Mr. PHILBRICK: Do you put it all upon the gas, then?

Witness: Most decidedly.

Cross-examination continued: The gas was supplied to that shop from the West Ham works, which are not within the London limits. I test the gas at Beckton. My results and those made by the company sometimes agree. At one time I had to complain of the way in which they were conducting their tests, as they were constantly bringing their results in opposition to mine. In the calculation I made as to the quantity of sulphur that was in the dust on the top of the cupboard, I reckoned that the same quantity would be deposited in every square foot of vertical space in the room as that which fell upon the horizontal surface. I did not take into calculation the ceiling at all, nor the floor. I only took the four walls. For the purpose of calculation, I estimated that there would be the same quantity of sulphur on every square foot; I do not say that it is

so. As one of the gas testers, I have not formed any idea of what amount of sulphur should be allowed in the gas. In the burning of gas, I have observed a detrimental effect upon things higher up in the room. I attribute that to the sulphuric acid; I do not say that none of it is attributable to the heat, but I know the effect of the acid more than I know of the effect of the heat.

Mr. CRIPPS (in re-examination): I want you just to explain further about this question of the four vertical walls and the cupboard. Why is it that you took the vertical space round the wall as estimating quantity for calculation?

Witness: I took it so as to make it more intelligible to those who were hearing me. I cannot tell at all how much was absorbed by the ceiling. I might have taken the surface of the floor, but it escaped me at the time; and I did not think much sulphur would be deposited on the floor, because that part of the room is better ventilated than the other part, and, moreover, it gets swept and cleaned. My intention was to give the amount of acid, so far as I knew, that was actually deposited on the four walls in the room.

By the COMMITTEE: Was this shop, in which you found the cards, supplied from the same works as the room was in which you made the experiments?

Witness: No; it was the same district, but two different works—one was supplied from the Silvertown works. I cannot say positively whether those works are under restrictions or not.

Mr. CRIPPS: No, they are not; they are some old works which were acquired by the Chartered Company, and when they amalgamated, the company that took them over kept up the same regulations as to that part of the works as the other company had done before; but they do not come under the regulations.

Mr. PHILBRICK: They are under the Gas-Works Clauses Act of 1847.

The CHAIRMAN: You took no means of testing the gas in the ordinary sense, in either of those places, did you?

Witness: No, I did not.

Mr. PHILBRICK: There is one question that I forgot to ask—namely, whether the dust was from the upper part of the room? I rather inferred that; but how high up was the dust?

Witness: It would be about 2 feet from the ceiling, and I should think 7 feet 6 inches or 8 feet from the floor.

Mr. PHILBRICK: The Silvertown works are part of the undertaking which was acquired by The Gaslight and Coke Company, and the manufacture is conducted by them in the same way entirely as for the Metropolis at Beckton—it is part of their general supply.

The CHAIRMAN: What I want to know is, are they subject to the Referees?

Mr. PHILBRICK: No, they are not.

The CHAIRMAN: Therefore, they make gas in any way they please?

Mr. Matthew Hill Loam, examined by Mr. CRIPPS.

I have been connected for nearly 26 years with the Nottingham Gaslight and Coke Company. For some time I held the position of resident engineer under Mr. Hawksley, he being engineer-in-chief to the company at that time. The works have now been transferred to the Corporation of Nottingham, and I remain as assistant engineer. The works are very considerable, very large; their area of supply being very nearly 150 square miles. In 1851 the largest daily consumption during the winter was 400,000 cubic feet. Last winter it amounted to four millions and a third. The gas supplied has always been of very high illuminating power, and of good quality. Since the transfer of the undertaking to the corporation, great care has been taken to maintain that quality and purity. The gas is tested in the usual way; the illuminating power is ascertained by a Bunsen photometer. With the old 15-inch Argand burner we get $17\frac{1}{2}$ candles. We have never adopted the London burner yet. During the last six months, the average of the sulphur compounds has been 12.65 grains per 100 cubic feet. We purify chiefly with lime, using the oxide of iron in the catch purifier.

Mr. CRIPPS: Now, using lime, and arriving at that amount of purity by it, how do you manage in removing the foul lime from your purifiers?

Witness: The purifiers are cleaned out as rapidly as possible, and the refuse lime is removed to a place of deposit, and covered over with cold refuse lime, the lime which has been already used, and which has gone cold. The nuisance from the foul lime is really not perceptible; it is not discovered beyond the precincts of the works, or very rarely so indeed. The Nottingham works are within the town; the largest of our works are about two and a half miles from the town, and we have another small works at about a mile and a half from the town.

Is there a considerable population round your works?—Oh, yes; the chief population is within the area of the works.

Can you tell the committee a little how you use this spent lime after it comes out of the purifiers?—The cold lime is simply thrown over the warm lime taken out of the purifiers. That is a simple process, and we have occasionally covered the lime over with tarpauling.

You have not experienced any difficulty?—We have experienced no difficulty whatever. At the Nottingham works we are really surrounded by the largest population, and we have never had a complaint to my knowledge.

What becomes of this refuse lime ultimately?—It is sold to the agriculturists, and some is loaded on railway trucks and taken clean away. It is allowed to cool in the trucks, and it is delivered a great many miles away—some 30, 40, and 50 miles, and so on. The other part is kept until it is sold. Some is removed in carts, by the farmers in the neighbourhood.

I am told that you keep a sort of depot there, and that the farmers can come with their carts and carry off what they like with their carts?—Yes, that which is not loaded into the railway trucks is put into a place of deposit, and the persons requiring the spent lime cart it away. Even in that way we have no complaint of a nuisance.

Cross-examined by Mr. PHILBRICK: I have been in the neighbourhood of the Crystal Palace. I do not think I should like to establish a depot for foul lime near the Palace if the works were small. In Nottingham the difficulty has been not so much with the gas as with the sewage. The object of covering the foul lime with tarpauling, or spreading over it some lime which has become innocuous or comparatively so, is to prevent the nuisance of the smell. If we did not take such means we should expect complaints. We carbonize Yorkshire and Derbyshire coal. They are rich in sulphur compounds—one contains more than the other. I have never tested the quantity of sulphur in our crude gas, and cannot give any idea about it. A series of experiments were made some years ago by Dr. Lethbey, Dr. Pole, and others, but I do not remember the results. We are under no restriction in reference to these compounds. We remove them, from our desire to supply a good article. Our gas is better than that of London, and we charge 3s. and 2s. 10d. per 1000. Before the advance in the price of coal we charged 2s. 8d. I have never smelt the foul lime at 200 or 300 yards from our works. We discharge our purifiers about once a day in the winter time.

Re-examined by Mr. CRIPPS: We use lime upon the old plan of purifying, and in that way keep the sulphur down to 12 grains. The lime comes out as carbonate of lime.

The CHAIRMAN: You said, as regards the Crystal Palace works, that you

thought your plan would not be so well adapted for such small works. What do you mean?

Witness: Of course, if the room is very limited, in changing the purifiers the smell would be discovered much sooner than if you have a larger area to deposit the stuff on in the centre of your works, or in the most remote part; that was what I meant. Of course, every gas company would put the lime where it would be removed farthest away from the public; but if the works are small, of course, it does not give them much option.

There is no doubt, I suppose, according to your view, that as to the Crystal Palace Company, your plan, if adopted, would mitigate very much the nuisance?—I believe it would; I fancy they could do it just equally well as we do.

It is only a question of space, which means expense?—Yes, of course; but I should not think it would mean expense to a very great extent in the neighbourhood of the Crystal Palace.

In working your process, do you find the workmen who have to clean out these purifiers suffer in their hands or eyes?—Not materially; we wash out all the purifiers we can with copious washings, so that ammonia, which is the most offensive to the workmen themselves, is removed as far as we can do so by washing. That is not an expensive process.

Do you know whether it would be equally possible to do it where sulphide of calcium, the result, is produced in the lime—I mean to say, if the means that you take to prevent the inconvenience of the smell were adopted?—Of course, in our method every effort is made to prevent the lime from steaming, and the vapour from passing away beyond the limits of the works; and where the lime is really very moist and steaming to a very great extent, it is covered over with the tarpauling, and with the cold spent lime, and that is the most effectual. That could be applied anywhere.

Does the lime under your process come out of the purifiers in a dry or a wet state?—Not particularly wet, but moist; it would hold together—if you take a handful it would not fall to pieces.

I suppose there would not be considerable increase of expense in applying your process, we will say, to the Crystal Palace works, except so far as it might be necessary to use additional space?—There would not, at all. It is the most ancient process in existence, the purifying process that we adopt.

How far is it from the centre, where you place the lime, to the circumference of your works?—About, I should say, 350 yards from the place of deposit to the road. Purification by oxide of iron is much cheaper than by lime.

Can you give any estimate?—There are a great many estimates, and I hardly know which to rely upon.

How do you store your spent lime, or refuse lime?—We have an enclosure, and when the purifiers are changed the stuff is instantly wheeled there, unless we have an order by rail, and then we put it into the trucks themselves. It is not a covered place, but quite open. Sometimes we have a large stock; we have had as much as 1000 tons.

Would not the covering of the refuse lime with dry earth prevent any smell?—Yes; but the difficulty is, in a place like ours, to get dry earth; and the cold spent lime is equally effective.

Mr. John Pattinson, examined by Mr. CRIPPS.

I am an analytical chemist at Newcastle-upon-Tyne, and have been in practice there for about 19 years. During that time I have made frequent examinations of the quality of the gas supplied to the town by the Newcastle-upon-Tyne and Gateshead Gas Company. Since 1869 I have made weekly or bi-weekly tests on behalf of the Town Council, and before that time I made several occasional tests. Those tests included the tests for the amount of sulphur. I have taken the averages out for the last four years. In 1873 the average amount of sulphur in the gas was 7.13 grains per 100 cubic feet; the average for 1874 was 9.4 grains; the average in 1875, 11 grains; and in 1876, 11 grains. The apparatus I used for the purpose of determining the amount of sulphur is that known as "Wright's sulphur test." It consists of a tube about three-quarters of an inch in diameter—a glass tube—which is bent almost at right angles near the middle, and another rod hanging down. In that a small gas-jet is burning, which yields the products of combustion; and for 19 inches of its length it is covered with another tube, and between those two tubes there is water constantly circulating. It is the mode of condensation known as Liebig's condenser. This was the method in use at Newcastle when the Act of Parliament was obtained. Newcastle is one of the places where, by Act of Parliament, the amount of sulphur compounds in the gas is limited. The present limit is 17 grains. My testings have been made on behalf of the Town Council, to see whether the Act of Parliament has been properly complied with. There is a slight difference between my testing and the mode of testing adopted by the Referees in London, and I have determined that difference. I have made several comparative simultaneous tests with the Gas Referees' apparatus, employed in the manner described in their Instructions, and with Wright's apparatus, and the difference in the amount of sulphur which they indicate is from one to $1\frac{1}{2}$ grain per 100 cubic feet, the greater being that of the Gas Referees. An average of 7 grains in Newcastle, if it were tested by the London test, would be $8\frac{1}{2}$ grains. The purifying material used at Newcastle during the last 11 years has been almost exclusively lime. Oxide of iron has not been employed excepting, I believe, in one year for a very short time. During the whole of that time no nuisance has been complained of arising from the use of lime purification; the only public complaints which have been made of any nuisance from the works occurred in the years 1869 and 1870. During those years there were very bitter complaints about the nuisance from the works; and there were deputations to the Town Council to ask them to take means to put an end to the nuisance; and at that time I was asked to report upon the source of the nuisance. I examined the works, and found there were several sources. The principal one was from the manufacture of sulphate of ammonia; another, the process of distillation of coal tar; and another, the imperfect and leaky condition of the scrubbers; and the fourth, from waste lime. After my examination the distillation of tar was discontinued. Some time after the scrubbers were put into good order, and the sulphate of ammonia apparatus was very much improved. The consequence has been that there have been no complaints of nuisance from the works since that time. The secretary of the gas company told me, in answer to my inquiries the other day, that he had had no complaints at all for the last two years. If any complaint had been made to the Town Council I should have heard of it undoubtedly, or if any letters had appeared in the newspapers I should have seen them. There are dwelling-houses in the immediate neighbourhood of the works at Newcastle on the east—some three or four rows of houses; there are also houses on the north-east, north, and north-west. The river is on the south, and of course there are no houses there. Within about 300 yards there are houses of a superior description, the rental of which I should think would be from about £30 to £60 or £80 per annum. The lime at the works is dealt with pretty much in the same manner as the last witness described. When the purifier is emptied the foul lime is put into sacks or bags, and carried on men's backs to the depot outside the works, where it is emptied down, and is immediately covered over with some weathered lime, or old lime which has been oxidized by exposure to the air, to prevent any bad smell coming from it. After lying in that way for some little time it becomes oxidized itself, and the

offensive odour ceases. It is then put into casks and carts, and covered over with a tarpauling of some kind, and in those carts it is removed for about half a mile to a railway siding, where it is put into trucks and sent away to persons who have purchased it—farmers, and so on. I have never heard any complaints of nuisance during that process, which has been going on for a considerable length of time. I believe the use of lime is the best known process for the purpose of purifying gas. There are other processes on trial which may supersede it; but I believe it is the best practical plan. I think that it might be used in London without creating a nuisance. I have made experiments upon the products of the combustion of gas with the view of seeing how far sulphuric acid results from the combustion of sulphur in gas. My opinion is that most of the sulphur is undoubtedly converted into sulphuric acid. When the gas is first burnt I think there is no doubt that most of the sulphur goes off as sulphurous acid; but there is also at the same time some sulphuric acid formed, and I have made experiments to determine that. I burnt a small jet of gas, at the rate of about half a cubic foot per hour, in a Letheby's apparatus—one of the largest sized Letheby's apparatus; and from one-quarter to one-eighth of the sulphur which exists in the gas I found in the form of sulphuric acid. I think that the oppressive feeling felt by many persons in rooms where gas is burnt is due to the presence of sulphuric acid. I am quite aware that the atmosphere of towns contains sulphuric acid and sulphurous acid, and if it were possible to free them from those sulphur compounds I think it ought to be done. There is no practical means of doing that at present, but there are practical means of getting rid of the sulphur in the gas, and that ought to be done, even if it were carried to the point of absolute purity, if possible. It is well known that plants will not thrive in a gas-lighted room, if they are kept there. I attribute that to the sulphurous acid and the conversion of it into sulphuric acid. I think, from my experience, that it is far better the public should pay an increased price than consume impure gas. The whole expense of the purification by lime at Newcastle is only about two-thirds of a penny per 1000 cubic feet, and if twice that amount of cost were incurred, I think none of the consumers would object to it.

Cross-examined by Mr. PHILBRICK: The two-thirds of a penny applies to the cost of purification at Newcastle. I do not know what it may be in London; but supposing it were twice, or even five times as much, it is worth undergoing that expense to get rid of the sulphur. Wright's apparatus, which is employed at Newcastle, gives higher results than that of Dr. Letheby. The difference I found between Letheby's apparatus and Wright's varies from 1·18 grain to 3·57 grains per 100 feet. I do not know why Wright's apparatus was discarded and Letheby's adopted, but it was decidedly a mistake, because Wright's not only gives higher results in sulphur, but is more easy and simple to work. Letheby's apparatus has now been practically superseded in London by the Gas Referees. At Newcastle nearly half the alkali works in the kingdom are established. The alkali does not neutralize the sulphuric acid; I am sorry to say it has the opposite effect. Flowers under glass flourish very well at Newcastle, but on the Tyne, four or five miles below, damage has been done even to flowers under glass from the alkali works. They formerly used Townley Main coal at the gas-works there, but there is none used now. That coal contains very little sulphur. The coal now used comes from the Durham district. I do not know the quantity of sulphur compounds in the crude gas. They do not purify at all in the way suggested by Mr. Patterson. They scrub their gas very considerably, and it is owing to that, I believe, that it is so free from sulphur compounds. The gas is treated with gas liquor, and afterwards with lime. Sometimes the sulphur has jumped up considerably, and I have always found on those occasions that something has been wrong with the scrubbing arrangements—the pumps have gone wrong, or something out of order. The lime from their purifiers comes in the shape of carbonate of lime, and also sulphide of calcium. I can scarcely say whether they distil their gas at a high temperature; they get about 10,000 feet per ton. I think more bisulphide of carbon is produced when the distillation is carried on at the higher temperature, but I have no experiments upon that point. The highest amount of sulphur impurity I have found in the Newcastle gas is 30 grains, and the lowest about 4·5 grains. For some weeks, with several consecutive tests, I have found 4·5 grains extending sometimes over a period of six months. I believe Mr. Livesey, of the South Metropolitan Company, has tried scrubbing with gas liquor for the removal of the sulphur compounds, but I do not know the process, and cannot speak about it. I am not aware that he has failed in his endeavours to do so. The principal action of the scrubber is to take out the carbonic acid and not the bisulphide of carbon. The latter might have some affinity for the ammonia. The foul lime from the purifiers at Newcastle is covered over with a quantity of weathered lime, which, by the process of oxidation, gets rid of the smell. The lime retains the sulphur until it is converted into sulphurous acid; the action of the air then converts that into sulphuric acid without evolving the sulphuretted hydrogen.

Re-examined by Mr. CRIPPS: When I have asked the cause of a sudden rise in the quantity of sulphur in the Newcastle gas, the explanation has very often been, that there was something wrong with the scrubbers. This leads me to think that there is a great connexion between the operation of scrubbing and the presence of the sulphur compounds.

By the COMMITTEE: I have several times been present at the opening of the purifiers. I have not observed that the workmen employed on those occasions have suffered from the operation. If they ever have to complain of their eyes being affected, I should think that would arise from the iron purifying, not the lime; from the evolution of ammonia. I attribute the stuffy or offensive feeling experienced in a room lighted with gas to the evolution of sulphurous acid, and the large quantity of carbonic acid which is also present. I believe it is injurious, but, perhaps, not appreciably injurious, to a healthy person; to a delicate person I think it would do harm. I have never seen the works of the Crystal Palace District Gas Company.

Mr. Stephen Smith, examined by Mr. CRIPPS.

I am a member of the firm of Stephen Smith and Sons, who carry on business at 35, King Street, Covent Garden, as silversmiths. For some time past we have been annoyed by what we believe to be injury to silver from the gas burning. It is an observable thing to any one connected with our trade, the moment one enters into it. We find that the labour required to keep our stock in order during the summer months, when we do not burn much gas, is very much less than in the winter months when we do; it would probably be about half during the summer months. In our trade a very considerable expense is incurred in order to carry off the fumes of burning gas by proper ventilation. I may mention that I rebuilt the premises I am in about seven years since, and I went to a very great expense buying sun burners, and providing other artificial ventilation in the roof, for the express purpose. We formerly took stock as we could, and for two or three years the labour in cleaning the stock has been so severe, from its being exposed to the gas for about three hours at night, that last October we adopted the system of taking stock in early morning with most satisfactory results, and the difference was something very extraordinary. On those occasions the whole of the stock has to be exposed—it is not even kept in the glass cases, but it is all put out to be identified, and of course it gets the worst effect it can from the bad

atmosphere. I find that silver goods which have been exposed to the fumes of gas burning for some time have a sulphurous smell about them. That would hardly be the case with goods kept in glass cases, but speaking of factory goods, which we are not so particular about the exposure of, where they might perhaps be for a month or six weeks lying in a place uncovered, it is exceedingly strong and most offensive; and with regard to the surface, my foreman has called my attention to the fact that it seems to bite into the surface, so that it has almost to be removed again by polish. My father was partner with Messrs. Elkington originally, and I was consulted in the original scheme of opening their London establishments, and for some years after we opened it nothing but oil lamps were used for that reason. Then I may say that these rooms ten years since were very much enlarged, and it was impossible to carry on that system, and we were obliged to give it up, and now we have gas as other people do. It is the case, however, that in some two or three of the old-fashioned style of shops, lamps are still used for that purpose, despite all the cost of them, to avoid the sulphur.

Cross-examined by Mr. PHILBRICK: Having regard to the injury done to goods in our trade, I should avoid exposure to the gas. There is nothing I caution my customers so much against as allowing their servants, after plate has been used, to leave it exposed all night. The result of that will be that the sulphur of the gas will settle down upon it, and the most extremely bad results arise. I do not represent to the committee, that the gas in London injures plated goods more than the gas in Liverpool, or Manchester, or other large towns. The constant remark that I hear from Glasgow houses is that it is worse than it is in London. The expense in my establishment is £150 or £200 a year merely for cleaning, and that kind of thing, beyond what it would be if we could get a pure atmosphere. I do not say it is all owing to the gas. I am not attending to business so closely as I did, and therefore I cannot answer the question, whether the matter has got worse rather than better, but I have not heard our people speak of it. Where gas is burnt there is always more labour in cleaning plate in winter time than in summer. The sulphurous smell I spoke of is only on the metal surfaces of goods in the workshops. I am not aware that other surfaces are affected by it. I do not know what else it can arise from than the gas.

Re-examined by Mr. CRIPPS: This is considered so much a matter of course, that if you asked even a porter who has been employed in the silver trade what it is that tarnishes the silver, he will tell you it is the gas.

Mr. James Slater, examined by Mr. O'HARA.

I am a partner in the firm of Holland, Son, and Slater, carrying on business at No. 16, Jewin Crescent, as manufacturing silversmiths. When I was first in business I did not burn gas. As my business increased, and buyers came in late in the evening, I was obliged to take to it, but though I took to it, I did it very unwillingly, and used it with very great distaste to myself. I found the evil effects of it, even in fine weather, upon my goods. Those effects were most seriously aggravated in foggy weather; gas and fog combined, I think, are the two evils that we have to contend with in London. In less than half an hour after the gas has been lighted, the goods in the upper part of the room in glass cases, near the ceiling, suffer the soonest; but to me it only seems to be a question of time and the size of the room. You have only to get on a pair of steps immediately the gas is lighted, and put your head up to the ceiling, and you feel the heat. After the gas has been lighted a little longer you need not go so near the ceiling to feel the effects from the gas. If you have goods on a table, at the level of that at which we are now sitting, they will be affected. You may say, "Then why not ventilate your room?" That is another weak point in London; people do not ventilate their rooms. I keep fires sufficiently large to keep the whole place thoroughly warm, which is of the highest importance with a stock like mine. I tried gas for the purpose, and had to abandon it in less than a month, for though I obtained heat, the smell was excessively unpleasant.

Cross-examined by Mr. PHILBRICK: I know it is, as a matter of general opinion, that the atmosphere of London and other large towns always contains a portion of sulphuric acid, and I am perfectly aware of the injurious effects produced by exposing plated goods to it.

The CHAIRMAN: Was the injury that you described, as occurring in rooms where you did burn gas, a kind of injury that would arise from the action of sulphuric acid upon plated silver?

Witness: Without being a chemist or a scientific person, I say decidedly so; and if the committee will permit me, I will give a very striking illustration of the difficulty I had to contend with. In my early career, when I objected to the use of gas, I had the misfortune to have some cases wrapped in a peculiar kind of paper. The goods got perfectly black. I had the paper tested, and it was coloured by some mercurial process. I had it removed and plain paper furnished, and my goods were kept with very great satisfaction. Then I introduced gas into the place, and in a smaller degree I had precisely the same results that I had had with the mercurial paper. I am not attempting to go into the question whether mercury and sulphuric acid have the same effects, but I am speaking of a practical result—that, upon the introduction of gas, my goods, if exposed to the action of gas, become tarnished in the same way, and the effect of this matter was so insidious, that instead of its being able to be removed quickly, it took the men some considerable labour. Our goods are polished—that is, polished by a man with rouge on the ball of his hand, and he had to do that. That I suffered from most.

And you attribute that to the effect of the gas, do you?—I make no doubt of it.

Do you desire that it should be purified of this sulphurous element?—I certainly do; and I am very much interested in gas operations. I am very sorry that there should be any depreciation in the quality of the gas, because when a fog comes on suddenly, there is a very short supply, and there is very great difficulty in getting adequate light. In my own house I would not have gas if it were given to me.

But you are not analyst enough yourself to say to what element in the gas this was due?—No; I should be sorry to say anything but what comes under my own practical experience.

The CHAIRMAN (to Mr. Cripps): Have you any other witness to call?

Mr. CRIPPS: I have no more evidence of this class to put before you. There is one other witness upon a different matter. Of course, there comes a time when we must take the responsibility of adapting our evidence. I only wish to guard myself to this extent by saying that I must not be taken to have exhausted the evidence on behalf of the Metropolitan Board and the Corporation. I may have to call further evidence in another case.

The CHAIRMAN: Do not understand me as wishing to stop any evidence that you may have to give.

Mr. CRIPPS: Quite so, sir; but one has to exercise a certain amount of discretion in this matter.

Mr. Samuel Edwards, examined by Mr. CRIPPS.

I am clerk to the Lewisham District Board of Works. That district is supplied by the Crystal Palace Gas Company to a great extent, and also by the Phoenix. Two-thirds of the inhabitants of the Crystal Palace district, I think, are within the Metropolis. I am generally familiar with the district. Within the Metropolis there are 1096 public lamps

lighted by the Crystal Palace Company, and 516 beyond. The former are in Lewisham, Penge, Lambeth, and Camberwell. I know the works of the company very well; they are about a mile from the Palace. The Lewisham District Board of Works are the sanitary authority of the district, and also the authority for the execution of the Nuisances Removal Act. There has been no complaint of nuisance or annoyance at these works from the use of lime, except on one occasion, when the case was investigated, and it was shown—

Mr. PHILBRICK: Do not tell us what was shown.

The CHAIRMAN: How was it shown?

Witness: It was shown by an investigation by the Board of Works. I was not present. It was information that was given to me.

Mr. PHILBRICK: This gentleman, sir, is an officer of the Board who lays informations and takes out summonses against the companies. I rather object to a witness of that class giving evidence of this kind. I would rather he should confine himself to what he knows.

Mr. CRIPPS: The Lewisham Board of Works are the sanitary authority, and he would know of any complaint made to them, and I am asking with reference to that so far as within the Metropolis, of course. (To witness:) You say there was a complaint made some time ago?

Witness: There was a complaint of the river being polluted.

Not a complaint from the use of the lime of the gas-works or the lime purification?—Well, it was incidentally so.

That is to say, the river was polluted by this purified lime being put into it, or carried near it, or something of that kind?—I can explain the exact circumstances. The explanation which was given to me as clerk of the Board of Works, and upon which I decided that no proceedings should be taken against the company, was this—that the lime had been removed and put into a pit in a brickfield some mile from the works, and that, in consequence of a very heavy rain, this pit had overflowed, and carried the liquid into the river, and the injury that was done thereby was of very short duration. I thought it was a pure accident, and therefore no proceedings were taken. That was the only complaint of the use of lime.

You, as representing the sanitary authority, would know the feeling of the inhabitants generally. Are you aware whether the proposal now before this committee is altogether unsatisfactory to the inhabitants there, and undesirable?—I believe it is, and much objected to by the Board for which I act. They object to what is proposed to be done by the Bill before the committee.

The CHAIRMAN: Have you heard no complaint as to the smell when the purifiers have been cleansed?

Witness: No, none whatever.

Have you observed that smell yourself?—No, I have not; the railway goes into the works in close proximity to the purifiers, and, if there was a nuisance, of course it would be complained of.

I suppose you have never been present when the purifiers have been cleaned, have you?—No, I have not, and practically all the adjacent houses are on one side, the north, south, and east sides are open fields.

It is becoming an increasing neighbourhood, is it not?—It has been increased very much within the last 20 years, and is increasing, but it is flat land, north, south, and east. It is in the valley very near the river, and in a very ineligible place for building. I live three or four miles off, but I am in the neighbourhood very frequently, and in constant communication with the residents. The works are at Bell Green, and very near the Lower Sydenham Station. There are no houses, within a mile of these works, which are not shown upon the plan produced.

Do you happen to know whether the land about there is very expensive, if it was desirable for the company to acquire additional ground?—I should think it was the least expensive ground in that district, from its being flat, and also from the proximity of the works.

You cannot give an estimate of what it is per acre, can you?—No; the land has been recently purchased by the company in extension of their works. The works are about 1000 feet long and 500 feet wide. The purifiers are about 500 or 600 feet from any habitation, and those are the residences of the men employed at the works.

Mr. PHILBRICK, in replying upon the whole case, said: Sir, as my learned friend, Mr. Cripps, on the part of the Metropolitan Board of Works, has concluded his case, the matter is now ripe for the decision of the committee, so far as the evidence is concerned. In the discharge of the duty that I owe to my clients, I must make a few remarks to the committee upon some of the evidence; but I trust that I shall not unduly trench upon your time. Let me first of all call your attention very briefly to the position in which we are as a company. We are a suburban company in a district which has just been pointed out to you, which is becoming rapidly built upon—which is built upon with property of an exceedingly good character—a villa, and a residential, neighbourhood, in the suburbs of London. We are manufacturing our gas, not under the restrictions of the Metropolitan Acts at all; we have been deliberately excluded more than once (and in spite of an attempt of the Metropolitan Board of Works to include us within their net) from the category of metropolitan companies; and I think I may say, I trust not unfairly, on the part of those whom I represent, that there is not the slightest reproach that can be cast upon this company, either in the way in which they conduct the manufacture of their gas, or the way in which they treat their customers or the public at large. We are here with a directory composed of gentlemen of scientific eminence who manage their concerns with a due regard certainly to the interests of the public; and I do put it to you very strongly that the company have claims on the consideration of Parliament when it is shown to you that with the capital we had it in our power to raise at 10 per cent., we raised £50,000 at only half of that rate. When we came to Parliament again and obtained leave to raise new capital at 7 per cent. (the rate that is now allowed for gas companies on new capital) not one shilling of that capital has been raised, except as absolutely called for by the requirements of the district, and to enable us to supply the gas which we are bound to supply in our district. We have kept down the price of gas to private consumers outside the Metropolis, and in a district where our mains are necessarily long, and not as productive as in a more densely-populated neighbourhood, at the rate of 3s. 11d. I say under these circumstances the company do come with something like a fair case, I do not say for favour, but for the consideration of Parliament, in asking to have the restriction, which they feel to be an oppressive restriction, removed. My learned friend, Mr. Cripps, on behalf of his clients, as to whose opposition I have not one word to say, states that the Metropolitan Board constitute themselves, or are constituted, the guardians of the public interests. They do not seem to have very many of the public in this district, or any one who takes sufficient care or pains about the matter, to come forward here and say, "We object to that which the gas company are proposing to do." They do not bring forward here a single consumer who says, "We think this restriction ought to be kept, and ought not to be removed, because we would rather have the increased purity of the gas and have these sulphur compounds taken out, than have the restriction removed with a corresponding benefit in the shape of a reduction of price accorded to us." But my learned friend says, "Here was a statutory bargain come to between Parliament and the company in 1873; you then had power to raise your capital at 7 per cent., and you had the restriction put upon you of the 20 grains of sulphur." I was very

much obliged to one of my learned friend's witnesses yesterday who gave us a history of the matter, I think it was Mr. Heisch, who was in a little difficulty as to the exact time when the restriction came into force. The Act of 1860 had prescribed a certain quantity as a hard and fast line. The Act of 1868 put it upon the Referees to prescribe other conditions that we have all heard of in this room. The Referees did not immediately proceed to discharge their duty in that respect; they awaited the result of certain investigations; and the result of their experience was stated in answer to a question of the chairman, that at the end of 1872, or the beginning of 1873, the present limits, or the limits that were first prescribed, were laid down. Now that is a most important date for me, because in November of 1872 we had given a parliamentary notice for a Bill, which became the Act of 1873. We were before Parliament in the session of 1873, and Mr. George Wilson Stevenson, whom we called before you, was examined before the committee in that year. The regulations of the Gas Referees had just come out, and he, advising as he was the Metropolitan Board of Works, said, in answer to the question, "Don't you think that there ought to be some test for purity?" "Yes, I think it quite right." "What?" said Mr. Horace Lloyd; "ought it to be 20 grains?" That was what he had in his mind; 20 grains was what the Referees had prescribed. That was the first amount settled when they came to discharge their duty under the Act of 1869, and therefore most naturally Mr. Stevenson answered 20 grains; and so, without a single word of comment, without chaffering, I may say, it was accepted at once and put into the Bill, in clause 17, which we seek to alter. So far from that being a bargain, I venture to say this: If it was a question of a bargain it was an unfair bargain, and we come with good grace to Parliament to be relieved from it; but it was nothing of the kind. It really was a restriction put upon us without due consideration at the time, without a thorough appreciation of what the practical working would be, or the difficulties that it would entail, and therefore we come here, finding what the results are, to have it removed. Now, sir, let me be, as I feel sure I can be, in doing ample justice to the case of my clients—let me be candid with the committee about this. We have had here to-day some evidence that has struck me, and I am sure it must have struck the committee, as being remarkable. We have had a gentleman from Nottingham who tells us of the results. We have had a gentleman from Newcastle who tells us of results that they obtained there, and as to those results, the question arises in a moment, why cannot you do it in London? The answer is, I think, conclusive—because the conditions are different. In the first place, you have at Newcastle, and also at Nottingham, an entire choice of coal, and you have a different coal to carbonize. It may be said we could get the same coal in London; it is a question of money only. The answer is that practically we cannot, and what has Parliament thought was the right thing to do with reference to the Metropolis? Not to lay down a hard and fast line in the matter of these impurities, but to enact that it shall be left to a tribunal—the Gas Referees—composed of gentlemen practically conversant with the subject, from time to time to ascertain with what degree of purity the companies can reasonably be required to make and supply gas continuously without occasioning a nuisance to the neighbourhood; and the Referees do prescribe the maximum amount of impurity that should be suffered to remain in the gas. Now, what have the Referees done? They have said, if you manufacture your gas within a crowded area, on account of the nuisance, injury, or the risk of injury which must inevitably be entailed by the process of lime purification, we will allow you to have a greater amount of sulphur compounds than if you manufacture gas out of the limits of the Metropolis, where the use of lime would not be so objectionable. And I say that what the Referees have done under that Act was a matter that might fairly enough warrant this company in coming to Parliament. But in our case we have a hard and fast line of 20 grains. We supply a district where the houses are not those of a poor class—not an artisan district or a populous neighbourhood, but houses of a superior and villa description, and we are put under a hard and fast line, which is the most rigid line of any company in the kingdom that I have heard of, except Newcastle, and far harder and worse for us than the limits of the metropolitan companies. I say that alone would make a justifiable case for our coming to Parliament. I have called your attention to the particular circumstances of this company, as their local position, and the exceedingly hard limit which is put upon us on this question, places us in a worse position than any of the great London companies. The Commercial Company, who are, perhaps, under exceptional circumstances, are working at 30 grains, which is 50 per cent. more than we are. I dare say it may be altered, but we know that in the winter 25 grains are allowed to an urban manufactory. But I turn to the evidence called on behalf of the Metropolitan Board themselves, and I cannot appeal on that matter to higher authority than to their own consulting chemist, Mr. Keates. And what did he tell us? He said, "I am myself rather in favour of relaxing the limit. I think a little above 20 grains may be allowed, but I think it would be the greatest possible mistake to remove the restriction altogether." And then he is asked: "How much would you give them?" and he says, "I think even 25 or 30 grains might be allowed." I dare say no honourable gentleman could have sat upon a committee without noticing the various phases with which witnesses come forward. Sometimes we have witnesses that will not answer; sometimes we have a witness that wants to talk a little too much; sometimes we have one who is jocular; but here is an answer, not from a person who has come to give a hasty opinion, and from whom an ungarded one is extracted on cross-examination, but a gentleman who is put forward by the Metropolitan Board themselves—their own chemist. My learned friend, Mr. Cripps, with his great experience in these committee-rooms, never asked Mr. Keates a single word as to the expediency of these sulphur tests as applied to this company, but left it; and if it had not been that this question was put accidentally by me to Mr. Keates, one never would have known his real opinion upon the matter. Therefore, the evidence comes before you very strongly indeed; first, from the fact that my learned friends were not instructed to bring it out, or did not bring it out; and, secondly, because they knew that in that way, from his being candid enough, as you might expect from a gentleman in his position, and sound enough, I may say, to say, "I think it may be relaxed." I think he said, "When you consider the expediency between a nuisance created and an advantage to be gained, I think 30 grains may be allowed." I do feel a difficulty in this case on another matter, where, upon a question not of absolute truth and verity, but upon a question of degree, Mr. Keates puts it to us as a matter of expediency. He says in one case a nuisance could be created, and possibly on the other an advantage might be gained. No doubt. I never sought to conceal from the committee that having gas absolutely pure would be a great advantage; to have it relatively pure would be also advantageous. It is a question as to what degree of purity can fairly be got. Now, what have we to see to? We have had here to-day a number of gentlemen absolute purists in matters of gas, and who think that all gas burning is injurious. I dare say it is. I dare say it destroys the plated surface of silver, more or less, but gas burning, after all, is a necessity; and because of the particular refinement of the silversmith's trade, gas cannot be put out either in public thoroughfares, or in shops and warehouses. I pass that by at once, and I say that that class of evidence can satisfy you of nothing when the question

is how much impurity it is right should be allowed to remain; and how much of it the Legislature ought imperatively to exclude? Therefore, I should ask you, when you come to consider it, to look at the quantities of the impurity, and the effect that they have shown to have been produced. We have had here the whole opposition of the Metropolitan Board of Works. It is a singular fact, but it is a fact not without its significance, that they have not brought before the committee a single experiment, or set of experiments, which affect to show the result of combustion of the ordinary gas unpurified from the other sulphur compounds. They have refrained, or, at least, they have not been able, to bring before you any results of the condensation of gas which contained, as Dr. Odling's and Mr. Russell's experiments did, 33 grains of this sulphur compound in 100 cubic feet, but they content themselves with bringing to your notice the evidence that has been referred to the committee by order of the House—namely, the evidence given before the committee of 1866 or 1867. They have referred to that, and they have called before you one or two chemists, and they have—well, I was going to say, produced before you a portmanteau, which Mr. Heisch very prudently withdrew. We have not had proved a complaint on the part of a consumer in the Crystal Palace district, nor of a consumer of gas at all, except that of a gentleman who says: "I would not use gas at all, pure or impure; it affects my wires." You have not, I say, a single complaint of any consumer, with regard to gas. True, it is said that brasswork is injured; but, apart from the sad instance of two or three crystals of copper found on the bell-wires in Dr. Frankland's house at Lancaster Gate, I have not heard of any brasswork actually injured. Some one of the witnesses said that there was not so much injury on the floor, that the bright places on the grates and stoves were not injured—I think it was Dr. Frankland who said so—or not so much injured. I pressed him, and he said there was no injury in that part of the room. Well, I asked, in the upper part of the room, where the picture rods and wires were; was there much upon them? I could not make out from him that there was any definite or tangible amount, nor could I make out that the heated zone, in a badly-ventilated room, where gas was burnt, or, indeed, where oil was burnt, was due to sulphur or sulphur compounds. It is said that you have sulphurous acid gas. I agree you have sulphurous acid gas at the point of combustion, but you have no sulphuric acid at all. We were told by Dr. Frankland that the greater the ventilation the better the condition of the room, and the more likely was it that a minute quantity of sulphuric acid would be produced at once, but if you have the condition of ventilation, with sulphuric acid produced, you have that condition in a minute degree, but rapidly carried off; whereas if you have a hermetically sealed hot box in which these products are placed, you have a condition which prevents that combination, and therefore you have sulphuric acid. Then it is said, as long as it is hot it is all very well, but afterwards, when cooling takes place, there occurs condensation and precipitation. If there is precipitation, one would suppose that on the articles in the lower portion of the room you would find the effects of that precipitation; that it would fall down, and that that which had been in suspense in the heated atmosphere above would descend and make its effect apparent on all that was in the room below. But do we find that? I venture to say that the whole of that portion of the evidence is speculative, assumptive, theoretical, and not practical and reliable. And then, when we come again to the statements of Professor Barff, who gave his evidence with singular candour and fairness, he told us undoubtedly that sulphuric acid, even diluted, will affect ultramarine with certain zinc pigments in it, and if it continue long enough, it will destroy the fabric and fibre of the hemp canvas itself. Agreed, but does it practically do so? It is said these compounds do the mischief. I answer by pointing to Dr. Odling and Mr. Russell, whose figures, and theories even, have not been combated; those experiments have been untouched by any of these gentlemen, and not in any degree controverted. None of the witnesses say that these sulphur compounds have any influence upon the health of healthy persons. I think one of them did say it might occasion distress and suffering in the bronchial tubes, or in breathing to an invalid; but the answer was clear, first of all, that the quantity which was respired was the quantity which was in the middle zone of the atmosphere which Dr. Odling described to you, and was very minute in it; it is not what is in the zone next above that an invalid would be subject to in the least. These conditions are not generally found, but are conditions when gas which is charged with these compounds is burnt, all the products of combustion most carefully condensed and saved for the purpose of giving you, not what actually occurred, but what could by any possibility occur in the worst condition of things that could possibly exist. Now, sir, I say, in the face of that, that there is nothing beyond the merest speculative opinion upon the part of these gentlemen that these sulphur compounds really do cause detriment. The conditions of burning in a laboratory for the purpose of chemical results are far in excess of anything that is really effected in the ordinary method of combustion. When it is said that these impurities are very objectionable indeed, producing the stuffiness of the rooms and the atmosphere, and so on, the answer is that a good deal of carbonic acid is necessarily evolved during the progress of combustion. That must be so whatever your gas contains, and the nausea and headache are the consequences. I think one of the witnesses said it would possibly account for these results. The answer, I think, is that there is abundantly sufficient to account for it in the presence of carbonic acid, and the matters that have been referred to, without putting it down to sulphur. I will not weary the committee upon this any longer, except to make one concluding remark. We have heard a good deal about the outcry against sulphur. It is supposed to be the parent of all these evils. I say deliberately, after having heard all that has been stated, that there has not been traced home to these other sulphur compounds any one of these evils. If they do exist, they can possibly be assigned to other causes. It has not been proved that they arise from the sulphur. Then let me ask where is the harm of allowing this company to manufacture their gas in the way they propose to do? It is not supposed for a moment that they are going to force sulphur compounds upon the public from any desire on their part. They admit them to be objectionable. They would be glad to get rid of them, but they object to be under this restriction as to the use of lime in their neighbourhood. It is not a question of cost. If it were a question of cost in removing the lime merely, I should not be here to ask you to remove the restriction; but we submit that the best test of the difficulty of working is one of the elements in it. One of the witnesses said there was no annoyance to the men who discharged the purifiers, but he was speaking of the time when the old lime process was in use, and not of the state in which these horrible products are employed to absorb the sulphur compounds, in order to carry out the system of the Referees. Mr. Livesey told us that though the men had masks on, and he had practically tried all kinds of things, the men did complain bitterly of it. I do not wish to make too much of that, yet it is one of the matters attending the manufacture of gas under the condition in which we are. I venture to say that no case has been made out why we should be dealt with in a worse way than the metropolitan companies, and I say that the evidence which has been given on the part of the Metropolitan Board has shown that 30 grains might be conceded to us, or half as much again as we have now. But I am asking you to remove this restriction altogether, not, as I say, that we

would import a single impurity into our gas, but that we may carry out to perfection our own purification by the peroxide process, and not be driven to the necessity of having the lime in the condition that we have to use it. It is said that there is no great nuisance to the neighbourhood; but then we have to work always under the fear of penalties, with the knowledge that a nuisance may arise at any moment, beyond our control. We have to work always to the standard, and whereas under the more favourable conditions of the London companies, who are allowed a three days average, we are on a hard and fast line of a single day, and may be sued by the Lewisham Board if we transgress by only half a day. We have also the knowledge that tests are not particularly accurate, even though there is great experience used in making them. We have the fact further, that these sulphur compounds themselves are not proscribed in any of the cases in which the Board of Trade grant Provisional Orders. They are not proscribed in any case in which corporations carry on gas-works throughout the kingdom. They are not proscribed in Paris, where works of art are considered, and as highly thought of, as they are here, and where our neighbours are as particular as we are. I venture to submit that upon the whole of this case the only solid and definite ground under your feet to go upon is that found in the actual results of the experiments made by Dr. Odling, by Mr. Russell and Mr. Stevenson, and that those results show how utterly unfounded is the cry that has been taken up, "*Omne ignotum pro terribili est.*" They did not know what it was, and therefore they were afraid of it. The moment you test it you see the result, and find that there is nothing in the presence of these few occasional grains of sulphur compounds, the presence of which can fairly be said to be the source of these evils. It is not a question of trying to get rid of them altogether; no one pretends that it is the question of adapting any one of these processes suggested, none of which have been carried into operation, but it is a question of reducing from one-fifteenth to one-tenth the total quantity of these. I venture to say that the company have made out their case, and even upon the evidence that has been given I respectfully ask the committee to declare the preamble proved.

The committee-room was then ordered to be cleared, and the committee consulted. After some time the counsel and parties were called in, and

The CHAIRMAN stated that the committee had decided that the preamble of the Bill was not proved.

WEDNESDAY, MAY 9.

THE GASLIGHT AND COKE COMPANY BILL.

Mr. POPE, Q.C., Mr. RICHARDS, Q.C., and Mr. MICHAEL appeared for the promoters; Sir E. BECKETT, Q.C., Mr. CRIPPS, Q.C., and Mr. O'HARA for the Metropolitan Board of Works and the Corporation of the City of London, petitioners against the Bill. The Board of Trade were represented by Mr. ROUND.

Mr. POPE, in opening the case for the promoters, said there was a very grave distinction between the case of The Gaslight and Coke Company and that of any smaller concern in the country, where, whatever might be the regulations prescribed, either by Act of Parliament or by the action of the Gas Referees, the processes could be so much more easily dealt with, and the results of those processes disposed of with so much greater facility. When it was recollected that The Gaslight and Coke Company represented, in fact, the gas supplied to very nearly three-quarters of the Metropolis, it was obvious that the questions involved affected not only great interests on the part of the company, but equally large interests upon the part of the consumers; and it was matter for rejoicing that the whole question would be thoroughly sifted by the gentlemen who were interested upon the part of the public, and who would take care that the whole matter was investigated so far as might be necessary for arriving at a decision. Originally the Chartered Company was one of thirteen companies supplying the Metropolis with gas; but, in pursuance of powers conferred upon them by Parliament, they had gradually absorbed most of the companies north of the Thames, and thus constituted one large undertaking. The gas companies which were merged in the Chartered Gas Company were the Imperial—which was the latest amalgamation, in 1875—the Independent, the Western, the Equitable, the Victoria Docks, the Great Central, the City of London, and some other smaller ones. The Gaslight and Coke Company manufactured gas at ten stations, but there were, of course, other stations which were not manufacturing, and others which had been abandoned. As the committee were aware, the Chartered Company some years ago extended their works to Beckton for the express purpose of carrying a large proportion of their manufacture as far as possible out of town. The largest manufacturing station, therefore, was at Beckton, and the gas manufactured there was conveyed by mains passing through the Commercial Company's district. The actual acreage which the company had at Beckton was about 150 acres, of which some 70 or 80 acres were covered with buildings, and the remainder of the unoccupied land there was used for the deposit of the foul lime which was the result of the purifying process at their various stations. Passing towards the west from Beckton, The Gaslight and Coke Company had another manufacturing station in the immediate centre of the Commercial Company's district, which they did not, of course, supply; and passing still further west they had the station at St. Pancras. Both Shoreditch and St. Pancras were formerly stations belonging to the Imperial Company, and the committee would find, with reference to those stations, that, having changed hands since 1875, the same processes which were resulting in difficulties with them were still resulting in difficulties with the Chartered Company. There was also a manufacturing station at Lupus Street, Pimlico, on the margin of the river, close to the neighbourhood of St. George's Square—a neighbourhood of which the committee would hear a good deal in the course of the case. The stations in London of The Gaslight and Coke Company's district were a manufacturing station at Fulham, and a large station at the extreme west at Kensal Green. The committee had already been made acquainted, in the course of the inquiry which had taken place, that the insisting upon a certain amount of purity from sulphur compounds was practically insisting upon purification by lime; and the two questions which arose as regarded the public and as regarded the nuisance, were simply, first, as to the nuisance arising from the process in the neighbourhood where it was carried on; and, second, what was to be done with the enormous mass of refuse which was the result of that process. The latter point, it would be seen at once, in the case of The Gaslight and Coke Company, immediately assumed an importance (simply by reason of the size of the operations carried on) which it did not assume in the case of a small company where they were dealing with a comparatively small manufacture of gas, and had only a limited amount of refuse to dispose of. In the present case, when the committee were told that the amount of refuse lime deposited by The Gaslight and Coke Company covered an area of ten acres of land to a depth of nine feet every year, it became a very serious question, what was to be done with it, if purification by lime was insisted upon as a statutory matter. At Kensal Green—the extreme west, and with no immediate access to the river—they did the best they could in disposing of their lime upon the spot; but with that exception, all the spent lime had to be conveyed either by river direct, or partly by canal and river, to Beckton, where it was spread upon vacant land, Beckton being out of the reach of those who complained of the nuisance; but it would be for the committee to consider whether,

dealing with a question of that magnitude, that disposition of refuse could go on for long, because, unless some means other than the use of lime could be discovered or suggested for the purification of gas from the sulphur compounds, the day must come, and at no distant date, when there would be no means for the disposition of that refuse lime, unless it were taken into an estuary of the sea, and thrown into the water, when they would doubtless have Hastings, St. Leonards, Margate, Ramsgate, and all the watering-places, coming to Parliament and complaining of the enormous nuisance deposited by the tide upon their beaches. That being the exact state of facts as regarded the manufacture, he (Mr. Pope) would point out what the position of The Gaslight and Coke Company was. The committee would find that, whether during the course of transit or during the process of emptying the purifiers, from the neighbourhood surrounding those works, constant and most serious complaints were made of the nuisance which was created at Shoreditch, at St. George's Square, at Fulham, and all round the districts where the works were surrounded by habitations; not only sentimental complaints, but complaints which had culminated in threatened indictments, and in a real public nuisance to those who surrounded the works. Upon that point evidence would be called as to what the real matter was; and the committee would doubtless be satisfied that whatever nuisance was occasioned, by the use of the lime system of purifying, was inevitable in the use of that system; but every possible suggestion which could be offered in order to minimize the nuisance was adopted, and the greatest possible care was taken to prevent it from being a nuisance to the neighbourhood. It could be well understood that, although the passing of a load of spent lime simply caused a smell which was obnoxious for an instant, and which did not seem to be a serious nuisance, yet it would be found that the result of personal experience upon all hands was, that those who made light of it at first very soon came to regard it with respect; because, although at first the smell was slight, and the nuisance not very intolerable, the result of it in the disturbance of the bodily economy was very considerable indeed; and that was exactly the description of the state of matters, notwithstanding all the precautions that could be taken, where the stations were surrounded, or were in the centre of great populations. By the City of London Gas Act, 1868, Gas Referees were appointed for the first time, and provisions made with regard to their powers of testing the illuminating power and purity. The 29th section was as follows:—"The Board of Trade shall, as soon as may be after the passing of this Act, appoint three competent and impartial persons, one at least of them having practical knowledge and experience in the manufacture and supply of gas, who shall be called the Gas Referees (and who are in this Act referred to as the Gas Referees) and in case of a vacancy happening among them by death, resignation, or otherwise, shall appoint a competent and impartial person to fill the vacancy, one at least of the three being always qualified as aforesaid." It was obvious that the Legislature in 1868 felt that the circumstances involved in testing for purity, and in the regulations made for securing the purity of gas, were of so special a character, that one at least of those who were to have any control over the matter, and in whose discretion a great power was placed, must be in point of fact a practical gas manufacturer, who would be acquainted with the difficulties of dealing with the question as a matter of practical manufacture, not as a matter of laboratory chemistry; and the worst that could be said of the tribunal seemed to be, that it was difficult to secure, under the provisions of that section, the competency and impartiality united which were so desirable, because if they had a gas manufacturer, he, generally speaking, must be connected with one of the companies, and could hardly be called impartial, although he was competent; but, on the other hand, the section itself seemed to indicate that if they had a chemist who might be perfectly impartial, not being connected with gas manufacture, he could hardly be reckoned as competent. The main source of difficulty, therefore, arose, not from any want of knowledge theoretically upon the part of the Referees, but upon the difficulty of associating with theoretical knowledge the peculiar competency which was recognized by the section, and which competency of itself necessarily gave a certain bias and want of impartiality. He (Mr. Pope) would at that point say, once and for all, that although probably it might be necessary to criticize what the Referees had done, he should do so in a spirit not only of the greatest respect, but of the most sincere acknowledgment of the honour and knowledge which they brought to bear upon the subject, and it was simply because that tribunal was found to be unworkable from the very nature of its constitution, and the powers which were committed to it, that the inconvenience was found to arise for which a remedy was now sought. By the 36th section it was enacted that "The Gas Referees shall from time to time ascertain with what degree of purity the said company can reasonably be required to make and supply gas continuously without occasioning a nuisance to the neighbourhood in which the works are situate, and shall thereupon prescribe and certify the maximum amount of impurity in each respect with which gas supplied by the company shall be allowed to be charged, and the time from which the allowance thereof shall be enforced as against each company, regard being had to the necessity for any alteration of works by a company consequent on any such certificate." Taking that section in connexion with the provision as to the competency and impartiality of the Gas Referees, it would seem to be as elastic and as favourable to the gas companies as possible, but the experience of the few years which had elapsed had shown that, although it appeared to be elastic, it was, in fact, so arbitrary and so inconvenient that there was no resource left to the companies excepting to ask the interference of Parliament for its modification. The first Referee who was appointed was a gentleman who had been connected with the manufacture of gas, and who on all hands was admitted to be a gentleman of the highest competency, and certainly having practical knowledge and experience in the manufacture and supply of gas, and with him were associated two other gentlemen. Finding the extreme difficulty of prescribing the amount of sulphur compounds, so long as the Referees had the advantage of a practical acquaintance with the supply of gas, they declined to prescribe any specific amount of impurity, but declared that the companies must keep a register of the amount of sulphur impurity, in order that the matter might be fully and freely investigated, both as to its result on the consumers, and its possibilities with regard to the companies. Mr. Evans subsequently resigned, and his two colleagues, Mr. Patterson and Mr. Pierce, having become connected with some large coal supply, were not re-appointed on the termination of their year of office.

The COMMITTEE: The only impurity we are asked to consider is the impurity of the sulphur compounds?

Mr. POPE said quite so. There was no complaint whatever about the sulphuretted hydrogen or any impurities about which regulations were made. Mr. Evans resigned because it was felt by those representing the consumers that they could not regard him as impartial, he being a gas engineer, and that really showed the unworkability of the section.

Mr. O'HARA: Was he not the engineer to the Chartered Gas Company, and not a gas engineer merely?

Mr. POPE said that was the case. The present Referees were Mr. Vernon Harcourt, Dr. Pole, and Professor Tyndall. Without saying more as to what their powers were the result was that they had prescribed that in the gas made at Beckton, Bow, and Bromley, the maximum amount of sulphur allowed should be 15 grains per 100 cubic feet; for gas made at the other works of The Gaslight and Coke Company, and for the works of

the South Metropolitan Gas Company it should be 20 grains, and for the gas made at the works of the Commercial it should be 30 grains. Those regulations were to be enforced from March 31, 1877, until superseded by future notification. It was, however, only right to mention that that was a notification for the summer part of the year, the previous notifications which would bear upon the winter not being quite so severe, because they allowed a further margin of 5 grains, being 20 grains to Beckton, Bow, and Bromley, and 25 to the other works of The Gaslight and Coke Company. The plan adopted by the Referees from 1868 to 1872 was as follows, adopting their own words:—"The gas shall be considered to be impure, rendering the company which issues it liable to the penalties prescribed in the Act, when it contains more than 5 grains of ammonia in each 100 feet, or when it shows the least trace of sulphuretted hydrogen. The quantity of sulphur compounds other than sulphuretted hydrogen shall, until further order, simply be recorded."

The CHAIRMAN: Was that system of fixing a certain number of grains adopted in 1872?

Mr. POPE said it was, and was continued up to the present time—at first not so strictly as now, but for the last two or three years it might be taken that practically the notification he had given the committee had prevailed and was prevailing at present, of 20 and 25 grains.

The COMMITTEE: During the period when these things were simply recorded, were there occasional remonstrances, regarding the sulphur compounds, addressed to the company?

Mr. POPE said at that time the lime process was not used, and there were none of the complaints as to the nuisance. According to the present condition of things it was perfectly plain that, to comply with the decision of the Referees, purification by lime was absolutely essential. The company were between two fires—they were threatened with indictments for their purification, and with penalties for non-compliance with the Referees; and, although it was perfectly true that in 1876 the penalty provisions were relaxed, in a sense, making them penalties on an average amount, and not on any particular delinquency on any particular day, still they were subject to penalties on the one hand, and indictments on the other, and it was a difficulty from which they very naturally desired extrication. Dealing with the question of what Parliament intended with regard to this matter, he (Mr. Pope) would ask the committee to refer to the Act of 1871, which amended the Gas-Works Clauses Act of 1847.

The CHAIRMAN: Is the penalty under the 74th section of the Act of 1868 £50 a day?

Mr. POPE: Yes, sir.

Mr. O'HARA: That is all changed now.

Mr. POPE said it was only changed in the sense he had mentioned. It was £50 a day, but instead of being a penalty, as it was in 1868, for every day, it was modified by section 51 of The Gaslight and Coke Company's Act of 1876:—"If on an average of three days the gas supplied by the company from any station is of less purity than it ought to be under this Act, the company shall forfeit a sum of £50 for each station in respect of which they are so in default;" so that instead of being a penalty of £50 a day for one day, they had taken an average of three days, with one penalty of £50, and then another three days would be another penalty of £50.

The COMMITTEE: It might come to the same thing in the way of penalties. Monday, Tuesday, and Wednesday are three days, and Tuesday, Wednesday, and Thursday are another three days.

Mr. POPE said he hardly thought they could inflict penalties in that way, because it would not be another three days. If the committee turned to the Gas-Works Clauses Act of 1871, at section 12 they would find all the provisions which in 1871 were thought necessary to be made with regard to the question of purity:—"The quality of the gas supplied by the undertakers shall with respect to its illuminating power be such as to produce at the testing-place provided in conformity with this Act a light equal in intensity to that produced by the prescribed number of sperm candles of six in the pound, and such gas shall as to its purity not exhibit any trace of sulphuretted hydrogen when tested in accordance with the rules prescribed in that behalf in Part II. of the Schedule A to this Act annexed." In other words, in 1871, for companies not under the jurisdiction of the Gas Referees, no provision was made for any sulphur compound except sulphuretted hydrogen; and of course all gas-works which were regulated by the Gas-Works Clauses Act had no provision with regard to sulphur impurity, and it was unnecessary for them to incur any of the disagreeable alternatives which the action of the Gas Referees had placed upon his clients. Passing to the Chartered Gas Act of 1876, the committee would see that from section 27 onwards there were re-enacted, subject to the modifications of section 51, the penalties to which attention had been previously called, and which were as binding upon the company as the other provisions of the Act of 1868. Section 30 re-enacted exactly the provisions of the 36th section of the Act of 1868 already quoted, subject to the modification by section 51, the penalty being calculated upon an average of three days, instead of under section 74 of the Act of 1868. This was the position of the company at present, and he (Mr. Pope) would briefly state what they asked the committee to do. The company found themselves between two fires. They found, whatever might be the appearance of elasticity about these clauses, that they were, in fact, arbitrary and unworkable, and, therefore, the Bill before the committee asked that those powers and those provisions might be entirely repealed. It was quite possible they might come to the conclusion that some restriction, at all events upon sulphur impurity, was desirable; but if that were so the company contended that it would be entirely within the province of the committee, while not repealing those provisions, so as to leave the company absolutely and entirely free from restriction, as they would be if they were not under the Gas Referees at all, so to relax those provisions as to introduce as an instruction or a control upon the Referees, fixing a minimum amount, beyond which their discretion should not pass, and which would, in the words of the Act of Parliament, render it possible to maintain a "reasonable amount of purity," without causing a nuisance to the public. The words of the statute were: "That the company is to be required to furnish gas with such an amount of purity as they can reasonably be required to make, and supply continuously without occasioning a nuisance"—words very large, words very wide, words which seemed to indicate that Parliament had at that time in its mind the very difficulty which had arisen, and from which the company were unable to escape, and as to which there was no use throwing off to the future the discussion of a question which, after all, had better be discussed at that time. The company therefore asked to be taken out of the jurisdiction of the Gas Referees as regarded sulphur impurities, though not as regards any other sort of impurity. If the committee doubted the prudence of that, at all events they might grant relief by putting such a minimum as would prevent the company being reduced to the uncomfortable position in which they found themselves, and from which they asked equitable relief from a committee of Parliament.

The CHAIRMAN: Was this clause objected to when you sought your Bill last year?

Mr. POPE: I think not; I have made inquiries, and I think there was no fight upon the Bill of 1876.

Mr. O'HARA: I may say that when the clauses in the Bill were settled it was a matter of convenience to them, and the three days average was the only thing the company struggled for; the degree of purity was not objected to, but it was said to be a hardship that the impurities of any one day should be taken as a test, and therefore it was agreed that the average of three days should be substituted. The action of the Referees was not objected to, only the mode of enforcing the penalty.

Mr. POPE said no doubt that was so; but the real truth was that The Gaslight and Coke Company's Act of 1876 was passed before the result of the amalgamation with the Imperial Company had really been ascertained. At that time the Chartered Company were removing their manufacture to Beckton for the purpose of getting rid of the particular difficulties which would cluster round their works, but on their amalgamation with the Imperial Company they also acquired the *damnosa heritas* of that company. As had been already pointed out, the Shoreditch, the Haggerston, and the Fulham stations were all legacies brought to the Chartered Company by the Imperial, and it had really only been since they had become amalgamated that the difficulty had arisen of carrying on that process in manufacturing stations surrounded by dense populations.

The CHAIRMAN: I wish to know whether any of the directors who obtained this Act in 1876 had had experience before that of the control of the Referees?

Mr. POPE: No doubt the Chartered Company were always under the control of the Referees.

The CHAIRMAN: I mean to say including the Chartered Company, because they had their works at Beckton, and they did not suffer so much.

Mr. POPE: What you wish to know is, whether it was the Imperial directors or the amalgamated directors. Mr. Phillips tells me that they had joined The Gaslight and Coke Company's board immediately before the Act of 1876 was passed.

The CHAIRMAN: Therefore, having had experience of the Referees when they were directors of the Imperial Company, they made no struggle against this clause.

Mr. POPE: That must be accepted as a fact.

Mr. O'HARA: That is the fact, and must be accepted as such; but the way the Act of 1876 came to be passed was this: The matter had been contested hotly in 1875; but the Bill was not proceeded with in consequence of the lateness of the session. The main provisions of the Bill of 1875, settled before Mr. Forster's committee, were re-adjusted by agreement between the Companies and the Metropolitan Board of Works, the Corporation, and the Board of Trade.

The CHAIRMAN: Then there was a discussion about it before Mr. Forster's committee?

Mr. O'HARA: No, the discussion about the average took place upon the settlement of the Bill by consent in 1876.

Mr. POPE: That is as to the average of three days, but what the chairman was asking about was, whether this old purity question was before Mr. Forster's committee.

Mr. O'HARA: Undoubtedly it was fully discussed there.

Mr. POPE: The legislation of 1876 was practically based upon the decision of the committee of 1875.

The CHAIRMAN: It was thoroughly discussed there.

Mr. O'HARA: Yes, it was threshed out.

Mr. POPE: No, hardly threshed out; it was discussed.

The following evidence was then called:—

Mr. Frederick John Evans, examined by Mr. MICHAEL.

I am a civil engineer, and a member of the Institution of Civil Engineers. I have been connected with The Gaslight and Coke Company for more than forty years, and for many years had the management of the Goswell Road and Westminster stations. When I retired from the company's service I was the chief engineer. I am well acquainted with their system of purification. I designed and constructed the Beckton Gas-Works, which are the largest in the world. They were constructed under the powers obtained by the company in 1868. I was selected by the Duke of Richmond, who was then the President of the Board of Trade, as one of the three Gas Referees to be appointed under the Act, on account of being practically skilled in the manufacture and distribution of gas. I held that appointment for eighteen months, but ultimately resigned, in consequence of being repeatedly attacked by the Metropolitan Board of Works, and by the Corporation of London, for not fixing the standard of purity as far as sulphur was concerned, and they used to make some very severe remarks, saying that I was prejudiced in favour of my own company. At last it became so unbearable that I sent in my resignation to the Board of Trade, but they declined to accept it. They said, "We will write to the Corporation, and very likely you will not be annoyed in this way." However, the annoyance went on, and I resigned again, but the Board of Trade still declined to accept my resignation, because they were so well satisfied with the way in which I performed my duties. Eventually, things became so bad that I insisted upon their accepting it, which they did in May, 1871, and sent me a very complimentary letter, regretting the cause of my having to resign. I was at that time the only member of the Board of Referees who had any practical acquaintance with gas manufacture. In 1872 I resigned my position as engineer-in-chief to the gas company. I was then elected to a seat on the board. There was a special clause in the company's Act of 1872, empowering me to be appointed as a director. The directors themselves had no power to appoint a director, as the board was filled up, but by that special clause I was appointed to act as a director, and I have so acted since. Since that time I have taken an active part in the affairs of the company, in the engineering and manufacturing departments. In the early period of gas manufacture lime was used for purification. The lime was mixed with water, put into a wet lime purifier, and the gas was allowed to bubble through the lime water, and this purified the gas from the carbonic acid and the sulphuretted hydrogen. The refuse water was at that early time—I am talking of 40 years ago—run into the sewers, and it got into the river, or we used to run it into the ground—in fact, we got rid of it as best we could. However, a stop was eventually put to that, and I think it was in the year 1825 that the complaints became so numerous that the Secretary of State of that date, I do not know who he was, appointed Sir William Congreve to investigate the gas company's works, and he found that this refuse lime—"blue billy," as it was termed then—was causing the nuisance, and he gave instructions, and recommended to the Secretary of State, that the whole of the works should be puddled round outside, which was done, but it effected very little good. After the gas had been passed through the milk of lime there were no other means adopted for purification. At that day we knew nothing about sulphur, and all we considered necessary was, that if the gas was free from sulphuretted hydrogen, it was practically free from any impurity. I believe at that time the presence of sulphur was very little known. I have a book here—Matthews's "History of Gas Lighting"—in which the presence of sulphide of carbon is distinctly denied by Dr. Dalton, and by John Thomas Cooper, the great gas chemist of that day. This was given in evidence before Parliament on the Westminster Oil Gas Bill in 1825. The chemists of that day did not believe in bisulphide of carbon, and said it did not exist. We said, "As long as the gas is free from sul-

phuretted hydrogen, it is quite good enough," and the public thought so too. Carbonic acid was not considered an impurity, but we took it out because we could not help it; if it took out the sulphuretted hydrogen we must take out the carbonic acid. After a time the company adopted another process; they allowed the "blue billy" to settle in the tanks, the solid matter fell to the bottom, and the thin liquid was evaporated under the ash-pits. The thick stuff was then burned in ovens, and used over again for purifying. The nuisance became so great that we, about 1840, adopted the dry lime process, which consisted simply in passing gas through a vessel containing lime in a sort of moist state—slack lime, in fact. This lime is placed upon trays, and the gas goes through it. The same amount of impurity is taken out—carbonic acid and sulphuretted hydrogen. A difficulty soon occurred, and that was the immense trouble we had with the refuse lime. When I say that it took double the quantity to purify the same amount of gas with the dry lime process that it did with the wet, it will be seen that the quantity of lime we had to dispose of was very great indeed. Each ton of coal takes about a bushel of lime, or about 60lbs. There are 18 bushels to a cubic yard or ton, and a yard of lime when it is slaked produces two yards of slaked lime. We tried every plan we could think of. We used to ventilate it—that is to say, before the lime was taken out of the purifiers we used to drive atmospheric air down through the lime, and it went up a chimney. That was carried on some time, but the evil was not lessened, because it simply drove out the sulphuretted hydrogen from the lime. It went up the chimney and fell down in the neighbourhood, and a curious thing was—I am now talking about the Westminster station—that it used generally to fall down in Dean's Yard, and we used to have complaints from Dr. Buckland and other residents there. The Chartered Company were at that time indicted for a nuisance by the parish authorities. We used to convey the lime away in covered carts, but the informers used to follow the carts, and lay hold of them, and take them to the greenyard, and the contractors were taken before the magistrates and fined; but, independently of that, there was a great difficulty in getting rid of that refuse lime. An immense quantity of it was deposited in Belgravia; in all the roads and the fillings-in there are thousands and thousands of cubic yards which have been shot there; but at last that was shut against us, as Mr. Cubitt said, "I cannot have any more of this filth here." Then it was taken away into the country, and we had to pay as much as £1 a yard to cart it away, and what the end of it would have been I do not know—we must have shut up our works, I am afraid; but about the year 1840 we discovered that peroxide of iron, or hydrated peroxide of iron, could be used for purifying gas, and that it could be used over and over again without any nuisance whatever; no sulphuretted hydrogen was given off on exposure to the air. The sulphur that had been absorbed by the iron was thrown out again on exposure to the air, and was left in the material as pure sulphur. This material could perhaps be used for twelve months, and at the end of that time the material was sold at a profit, and we had no further trouble at all until within the last few years. It acted also in this way, that the sulphur kept continuously increasing in the purifying material until it became worth the while of manufacturers to extract it for the purpose of making sulphuric acid. We were in consequence enabled absolutely to sell it at a gain, and then have the material brought back again after the sulphur had been taken out. That method, which entirely superseded the use of lime as a purifier, continued in use up to the appointment of the Referees in 1868. The question of the sulphur in gas arose during the proceedings on the Act of 1860; but previous to that the attention of the public had been drawn to it by the late Dr. Letheby in 1854 or in 1852, I do not know which. He exhibited before the Court of Sewers a little bottle containing oil of vitriol, saying he had obtained it from the combustion of 100 feet of gas burning in a room. The Court of Sewers were astonished at it, the papers got hold of it, and it was shown that this destructive compound would very soon, as he stated, destroy not only the atmosphere, but destroy life, destroy furniture, and in fact would destroy everything. At that time there was a denial in the scientific world as to the bad effects of sulphur in gas, and also as to the production of sulphuric acid. I should, however, tell you that when Dr. Letheby and other people at that time were condemning the gas companies for making such impure gas and destroying everything—when he got these 21 grains of oil of vitriol in 100 feet of gas—that that 20 grains only represented 7 grains of sulphur, which shows how little he knew of it; and yet when the Act of 1860 was passed, it was only by Dr. Letheby showing that, the 20 grains of sulphur, which really represent 60 grains of oil of vitriol, was inserted. In the Act of 1860 there was no prescribed mode of ascertaining the quantity of sulphur in the gas, nor was there any apparatus defined; but there were heavy penalties for non-compliance with the Act, I think amounting to £20 a day.

Mr. MICHAEL: You will find that the 25th section of the Act of 1860 is, "The quality of common gas supplied by any gas company shall be, with respect to its illuminating power at a distance, as near as may be, of 1000 yards from the works, such as to produce from an Argand burner, having 15 holes and a 7-inch chimney, consuming five cubic feet of gas an hour, a light equal in intensity to the light produced by not less than 12 sperm candles of six to the pound, each burning 120 grains an hour; and the quality of candle gas supplied by any gas company shall, with respect to its illuminating power at the distance aforesaid, be such as to produce from a bat-wing or fishtail burner, consuming five feet of gas per hour, a light equal in intensity to 20 such sperm candles; and each such gas shall, with respect to its purity, be so far free from ammonia and sulphuretted hydrogen that it shall not discolour either turmeric paper or paper imbued with acetate or carbonate of lead, when those tests are exposed to a current of gas issuing for one minute under a pressure of five-tenths of an inch of water, and shall not contain more than 20 grains of sulphur in any form in 100 cubic feet of gas: Provided that any gas company, and the local authorities of the district supplied by such company, shall be at liberty to agree upon any other or different test by which to ascertain the purity of the gas, or to vary the amounts of ammonia or sulphur in any form hereinbefore allowed, and thereupon the company shall be thenceforth liable to have the purity of their gas tested in the manner so prescribed." Then comes the 26th section, which prescribes the penalties: "If the gas supplied by the gas company be at any time of less illuminating power or of less purity than according to this Act it ought to be, the gas company shall for every such offence, on a summary conviction before a police magistrate, forfeit a sum not exceeding £50, and also, in addition to that penalty, and whether that penalty be recovered or not, a further sum of £10 for every day after notice in writing from the local authority during which the offence continues: Provided that such police magistrate shall not convict under this section, if it shall be proved to his satisfaction that such defect of gas was occasioned by any unavoidable cause or accident." Now those [pointing to a model] are little bits of bibulous paper wetted with acetate of lead in order to determine whether or not sulphuretted hydrogen is present in the gas.

Witness: Yes. We ordinarily employ such apparatus, which is continuously in action, in order to show day by day whether sulphuretted hydrogen has been present in the gas or not. If it is present, it causes the bibulous paper so wetted to become brown or black. We keep a register

of those pieces of paper every day; but a similar apparatus is used at the testing-places by the testing chemists.

The CHAIRMAN: Are we concerned with this part of the case—sulphuretted hydrogen?

Mr. MICHAEL: Only as it bears upon the question of the sulphur. I think we may take it generally that all the metropolitan gas is absolutely free from sulphuretted hydrogen. I do not think any question will arise upon that.

Examination resumed: The provisions of the Act of 1860 were never carried into effect at all. There was never a case in which a company—although they were constantly infringing the amount of 20 grains—were convicted.

Mr. MICHAEL: In fact, was anything whatever done by the gas companies to diminish the quantity of sulphur which was left in the gas after it had been purified by the oxide of iron?

Witness: I think not; as far as my own company were concerned, that was so.

Have you any means of knowing how the quantity of 20 grains in the Act of 1860 was arrived at?—That was done by an apparatus called Dr. Letheby's apparatus. It consisted in burning the gas in a trumpet tube, and the products of combustion were condensed in a glass cylinder; instead of an upright thing, it went into a cylinder like that [pointing to a model], and the products of combustion with the water that was formed fell to the bottom. Those products were afterwards taken away and operated upon, and the amount of sulphur contained in the gas was ascertained.

Have you been able subsequently to determine whether or no the apparatus that was then devised really gave an accurate representation of the quantity of sulphur contained in the gas?—No; it did not. The difference of Dr. Letheby's apparatus and that apparatus was equal to about 8 grains in 20—that is, 20 grains would be made into 28 grains by that apparatus.

It was not the fact, therefore, that the cylinder was diminished in size in order to prove a smaller quantity of sulphur, but in reality to prove a larger amount of sulphur?—Yes.

It was not that a larger cylinder gave a larger quantity of sulphur than ought to be represented, but in truth it gave a smaller quantity than the actual quantity present?—Yes.

By the use of that cylinder you get a more accurate representation of the total quantity of sulphur, other than sulphuretted hydrogen, contained in the gas?—Yes. I may say that the Referees, when they first fitted up the testing-stations, had a large cylinder, but the result obtained was not to be depended upon at all; they then put a small cylinder, about four inches in diameter, and that gave a better result, but the amount was so uncertain that the thing was not to be relied upon at all; and then we contrived the apparatus which has been used ever since. I do not say that that gives the full amount; but at any rate there is more uniformity in its results, and it gives a very fair average; and one thing in its favour is that it is so easily worked, that it requires no skill, labour, or special talents.

The CHAIRMAN: Perhaps I might interrupt you for a moment, but I do not know what this evidence is leading up to.

Mr. MICHAEL: This is giving you the history of legislation with respect to sulphur, and to show under what circumstances the limit of 20 grains was fixed.

The CHAIRMAN: Is your contention that 20 grains ascertained by the old process is more than 20 grains under the modern one?

Mr. MICHAEL: 20 grains under the old process really represented 27 grains, if correctly determined; the quantity ought to be according to the experiments, not put at 20 grains, but at 27 or 28 grains.

Witness: It also shows this, that the public, while they were thinking they were only burning 20 grains, were really burning 28 grains, and made no complaint.

Therefore, we may fairly assume, if the apparatus had been as perfect then as it is now, that 27 or 28 grains would have been put in the Act instead of 20 grains?—Yes, I think so.

The CHAIRMAN: You say, in fact, that it was 27; your contention is that practically it was 27 grains?

Mr. MICHAEL: Only, having that error, it was put in at 20 grains, when it was intended to be 27 or 28 grains.

The CHAIRMAN: That does not follow.

Mr. MICHAEL: I can only put the case in the best way possible. When we have to go back 17 years it is very difficult to define what was in the minds of the committee or the Legislature.

The COMMITTEE: It is not a question of "mind," is it? Your contention is that the Act prescribed a limit of 20 grains, according to the apparatus then used, while the new apparatus limited it to 27 grains.

Mr. MICHAEL: Quite so. (To witness:) Dr. Letheby gave evidence very frequently with respect to the sulphur question in gas Bills, did he not?

Witness: Yes; he was the great authority.

Mr. MICHAEL: Did he not constantly say there were no known means of eliminating the sulphur from the gas?

Mr. O'HARA: You must produce that if Dr. Letheby said so. If you have any treatise of Dr. Letheby's you may produce it, but do not give your views of what Dr. Letheby said.

Witness: You have the notes of his evidence there.

Mr. O'HARA: Then my learned friend can use them, but I do not want your remarks on that.

Examination resumed: In 1868 the sulphur question came before Parliament again, but the committee felt there was not sufficient information for them to determine, or for them to fix an amount of sulphur, and they thought the best plan would be to appoint three gentlemen as Referees, who were to investigate the question, and they were then to determine what the amount should be, carrying out that clause in the Act which says that they are to act with all due regard to a nuisance not being created. Practically it comes to this, that there was no fixed limit put in the Act of 1868. I was one of those Referees, and there were two other gentlemen appointed, who were not specially acquainted with the process of gas manufacture. The Referees investigated the various modes with reference to the sulphur question. Our first endeavour was to devise means for testing the illuminating power of the gas; and that apparatus is now in use. My colleagues were Mr. R. H. Patterson and Mr. Pierce. We investigated the question of the sulphur, and I showed them all the experiments, and also what our duties were, and how the sulphur could be taken out. When they applied to me to know whether I could not fix a standard, I said, "No, I cannot, if I conscientiously carry out that Act of Parliament. I am not in a position to determine any amount of sulphur. There is only one mode of reducing the amount of sulphur, and that is by the use of lime." I then told them that that always created a nuisance, I showed them the lime, and everything else, and said I could not recommend a thing which I knew would be a nuisance to the neighbourhood, and a nuisance to the public generally.

Mr. MICHAEL: What did that eventuate in on the part of the Referees—what was the plan you adopted?

Witness: There was nothing done during all the time that I was a Referee. I never could fix the maximum amount of sulphur; the other Referees felt with me that it would be a very great hardship upon the

companies to fix a standard, having regard to that clause in the Act of Parliament.

I think you recorded the amount of sulphur?—We did; we gave orders that the amount of sulphur, as tested by this apparatus, should be simply recorded; the object of that was to see whether the amount of sulphur in the gas was uniform, or whether it went up and down with fits and starts. In fact, we wished to see exactly what took place under this new state of things. I left after 18 months, for the reasons I have given, and I think the Referees themselves, after I had left, were till 1872 before they fixed the standard. When I resigned, Dr. Pole, one of the present Referees, was appointed in my place. In 1872 the places of Mr. Patterson and Mr. Pierce were filled by Professor Tyndall and Mr. Vernon Harcourt. Those gentlemen had a knowledge as chemists, but I do not think they had a practical knowledge of the manufacture of gas. I do not think, if they had known all the circumstances of the gas companies at the present time, they would have fixed 15 or even 25 grains. We made some very extensive and expensive experiments upon a plan originated by Mr. Harcourt, costing upwards of £1500, but up to the present time no practical mode has been devised, without the use of lime, by which the amount of sulphur in gas may be limited. The Referees decreased the maximum amount of sulphur to be allowed, so far as Bow, Bromley, and Beckton were concerned, which obliged us to use an increased quantity of lime. Up to that time we had in some cases used lime in conjunction with oxide of iron, to take out the carbonic acid. From that combined process no nuisance resulted, but owing to the more stringent regulations of the Referees we were obliged to increase the quantity of lime used for the purpose of reducing the sulphur compounds, the result being that we brought down the amount of sulphur to the requirements of the Referees. There was no difficulty; I knew all along that lime would do it, but I always objected to the use of lime, on account of the nuisance it occasioned, and not only the nuisance, but the difficulty of getting rid of the refuse lime. The use of oxide of iron was, therefore, discontinued altogether, and lime substituted in its place, which is a retrograde movement altogether—it is a reflection upon science. We were actually in 1875 going back to the old time of 40 or 50 years ago, when the directors at that time saw the nuisance and ceased to use it; they abandoned it, and now we are compelled to go back to it again.

The COMMITTEE: The two processes are combined, are they not; you use both?

Witness: We should, if we were allowed to go back to the oxide of iron again, use a little for the carbonic acid.

Mr. MICHAEL: I do not think you have quite apprehended the honourable member's question; do you at the present time use oxide of iron with lime?

Witness: No; we are obliged to give up altogether the use of oxide of iron, and revert to the process of lime simply, in consequence of the restrictions put upon us by the Referees.

But before that you had used the combined process of oxide of iron as a purifying medium, with a small quantity of lime, which, as I understand you, created no nuisance, in order to get rid of the carbonic acid, which deteriorated the illuminating power of the gas?—Yes.

I also believe there are some injurious effects, which are hardly well ascertained to be due to the excess of carbon in the gas burnt?—I do not know anything about that.

Did you make any representations to the Referees, asking them to reconsider the determination at which they had arrived with respect to the amount of sulphur?—Yes, we did repeatedly; and in the result the Referees said, "We think you can do it; we think you are not using sufficient care, and we shall not alter our maximum."

Do they inspect your various stations?—Yes.

Have they ever pointed out to you any processes which you might adopt, and which you have refused to adopt?—No; we have adopted everything they have suggested.

Has it eventuated in this, that in adopting this process, and reverting to the use of lime, you are constantly told that you are creating a nuisance?—That is so.

Will you explain to the committee, as shortly, but as fully, as you can, how that nuisance arises?—The lime, after it has purified the gas, is combined with all the sulphuretted hydrogen, and some of the sulphur compounds, and it forms a sulphide of calcium; that lime, when it is taken out of the purifiers and exposed to the air, or the oxygen in the air, throws off all the sulphuretted hydrogen that has been formerly absorbed by the lime, and it goes into the atmosphere, and causes these complaints. We take every possible care—the purifiers are covered up, the waggons are covered up, the barges are covered up, and still you cannot prevent this emanation of sulphuretted hydrogen. I was on Saturday with Mr. Pope down at Fulham; every care was being taken, but there was no mistake about the smell. I put a bit of acetate of lead paper on my hat; it did not go black, but it got brown, showing the presence of sulphuretted hydrogen.

First, have you used an excess of care, and all means at your disposal, to prevent the production of sulphuretted hydrogen in the air when you have the lime removed from the purifiers?—I believe every possible care is taken by our engineers, but we cannot prevent a nuisance being created. The total quantity of lime in a year we have taken from our various works is about 100,000 cubic yards—about enough to fill up 8 or 9 acres of land 6 feet deep. There is great difficulty in disposing of it; it has all to be taken down to Beckton. There are 150 acres of ground there, but in time all that will be filled up, and where we shall have to go then I do not know. We have been continually threatened with injunctions, and complaints have constantly arisen, owing to the nuisance created by the removal of the lime. There are the Fulham works, about which there have been complaints; and there are the Bromley works, and several other stations where there are great complaints—at Shoreditch and at St. Pancras—in fact, where the lime is used, it is a nuisance, and you cannot get over it.

Supposing oxide of iron, and the small quantity of lime which you represented, were again to be reverted to, would there be such an amount of sulphur left in the gas as to occasion any injury either to life, health, or property?—Certainly not; it is perfectly absurd about that question of sulphur; and before I have done I think I shall be able to show the committee the absurdity of the sulphur acid question and the whole of the sulphur question altogether. If it were not so serious to the companies, this question of the sulphur in gas would be simply ridiculous, because the quantity is so small that if it was deposited in the way that we have heard stated in this room it would have no injurious effect; but I contend that sulphuric acid could not be formed, and is not formed, and I will show that by experiment. I have practically studied this question, and looked at its effect as gas is ordinarily burnt in rooms.

Have you endeavoured to find out whether any of these alleged disastrous consequences result under any circumstances from the ordinary burning of gas?—It is perfectly ridiculous. That picture [pointing] I have had for 25 years; and, according to the theories we have heard, it ought to have been utterly destroyed by the oil of vitriol. It was hung in my dining-room. It is true the ventilation is very good—there is ventilation into the chimney. That [pointing to another picture] I have not had so long; I have had it eight or nine years. That has been in a hall 16 feet

by 12 feet; but there is a gas-stove in it, and I burn that gas-stove all through the winter; and there is a gaslight as well, but no one would ever say that the painting is injured, or the gilding injured.

Have you ever found these crystals of sulphate of copper and sulphate of zinc deposited from the burning of the gas?—No; it is rubbish; certainly not. We have heard that cordage was affected most tremendously by sulphuric acid. I took a bit of this cord [produced], and wetted it with a little distilled water, and I certainly did expect that there would be an acid action, but it was alkaline. There is the cord there, and anybody may try it if he likes. I should tell you that that picture has been in other rooms under not such good circumstances for 25 years. In that room there were 400,000 cubic feet of gas burnt. According to the theory, supposing you had 30 grains of sulphur in 100 cubic feet of gas, that 30 grains ought to have produced something like 90 grains of oil of vitriol, and during that time I should have had between 15lbs. and 16lbs. of oil of vitriol in the room in which that picture has been hanging. It ought to have been running down, and there ought not to have been a piece of the painting left. The principal nuisance, I believe, derived from gas is from the bad ventilation, nothing else. I will show you again the absurdity of this sulphur question. Take 100 cubic feet of gas, which will produce 75 cubic feet of carbonic acid, it will produce about 200 cubic feet of vapour of water, and about 100 grains of sulphuric acid in the room in which that picture was, which is about 5300 cubic feet capacity. You have a proportion of carbonic acid of 1 in 46. I will assume if all the products of an evening, say of seven hours, are put into the room at once, in that case you would have 1 in 46 of carbonic acid, and 1 in 60,000 of sulphurous acid. Now, sulphurous acid and carbonic acid are equally fatal to life; the one is as much a poison as the other. I have tried it on rats, and things of that sort. If you take carbonic acid and put a rat in it, it goes dead instantly, and the same takes place if he is put into sulphurous acid; so that really the absurdity is this, that you are actually dealing with a thing which only contains 1-60,000th part—that is assuming that there is no ventilation; but if you have good ventilation, it amounts to one part in 5,000,000. You have to deal with that and the carbonic acid, which exists to the extent of 1 in 46. Whoever heard of the explosion of a coal mine taking place, in which the men were killed by sulphurous acid? It is always the carbonic acid which kills them.

There is a large quantity of carbonic acid, no doubt, and there is a great deal of discomfort where there is no ventilation in a room in which gas is burnt?—That is the cause of annoyance.

You have very heated and very dry air?—Yes; and you get an oppressive feeling from the want of oxygen.

I think you have tried an experiment as to turning on the gas and not burning it in a room?—Yes. I gave that evidence in favour of the Metropolitan Board in their Subway Bill; it was a question of ventilation in a subway. I went home one evening from the committee on that Bill about four o'clock, and the gas was alight. I turned off one of the burners and then turned it on again. My wife and other people were there, and they never smelt the gas. They went to bed at half-past ten, and I said, "That is a capital experiment." This burner had been escaping all the time, and they had never smelt it, which shows that all the products of combustion were being taken away, and therefore if any sulphurous acid was formed it was taken away directly. But I go further, and say that sulphuric acid is not, and cannot be, formed. I will show that to you directly.

The COMMITTEE: Is this sulphuric acid formed in any way before combustion takes place?

Witness: No, afterwards.

You say you did not ignite the gas?—That was for a different object—viz., to show the amount of ventilation; it was allowing the pure gas to escape. Of course, it was not burnt. We should have smelt it directly if the ventilation had not been there?

Mr. MICHAEL: At the same time also, if there be any injurious effects from the gas, you have the carbonic acid in the carbon compounds to account for it, and you have the heated and dried air, totally irrespective of the question of sulphur?

Witness: Yes.

I ask you again, have you in the course of your investigations, seen anything to prove that there is any deposit, either of free sulphuric acid or sulphuric acid in compound with metals, deposited from the use of gas?—No. You have got a certain proof. Nothing can be stronger than that picture. It is true you may bring some specimens which have got some damage, but I believe it arises then from other causes.

May I put it to you in this way: If it be good to take away all the sulphur except 15 grains, it would be better to take it away altogether?—That we cannot do.

There are no known means by which the whole of the sulphur could be taken away?—No. You may use lime to any extent, and there is something like 8 or 10 grains of sulphur that you cannot take out.

And if you do, you could not use the gas, as it would not be odorous?—I do not think the odour of unburnt gas is due to any sulphur; it is the natural odour of the hydrocarbon.

I believe the Bill of 1875, which was introduced by the Corporation and the Metropolitan Board of Works jointly, contained no provision whatever as to sulphur?—No, and they were perfectly right—they knew the absurdity of it; they had some eminent chemists to advise them, and they said, "Do not have anything to do with it, it is perfectly absurd;" and they acted upon that advice.

That was a Bill by which it was intended to lodge the supply of gas in those two bodies?—Yes.

Can there be any reason why, if it were requisite to put restrictions on a company, that those restrictions ought not to apply to the Corporation or the Metropolitan Board of Works?—If they thought that the sulphur was a matter of any moment, they were bound to have put the clause in; but they thought it was of no moment whatever.

The COMMITTEE: What was the company you are referring to?

Witness: It was not a company; it was the Corporation and the Metropolitan Board of Works. They brought in a Bill to make their own gas.

Mr. MICHAEL: That Bill contained no clauses with respect to sulphur purification?

Witness: None whatever.

Had this question of nuisance anything to do with the removal of the company's stations into the country?—Oh, yes; in fact, it was one of the great motives of our going to Parliament to enable us to get to Beekton. The complaints which were made at the Westminster station and the City Gas-Works at Blackfriars, and other stations, rendered it desirable to go away; and the result has been that we have disbanded four stations for the manufacture of gas, simply on account of the nuisance that resulted from keeping the lime in those populous districts.

Examination continued: At the present time, at the various stations where we are obliged to employ lime, the same nuisance is continually arising, and will be, so long as lime is employed for that purpose. I wish to explain to the committee that it is almost impossible to get sulphuric acid by the combustion of gas. [Witness explained some apparatus and made some experiments in illustration of his statement.]

By the COMMITTEE: We all admit that sulphurous acid is produced; but

the argument is that it turns into sulphuric acid, and destroys all your articles.

Mr. MICHAEL: You have been now showing the committee experiments of gas burnt under circumstances which are totally diverse from the circumstances which prevail in the ordinary combustion of gas, but even where you have put it under most favourable circumstances, as is shown by the least cloudy bottle, you fail to produce anything but a very small quantity of sulphuric acid?

Witness: That is so.

When you get ammonia present, you put it under different circumstances, and you get a very much larger quantity of sulphuric acid; and, therefore, if there be a quantity of sulphur in the gas, and you have this apparatus in which to burn it, and you have ammonia present, that sulphuric acid may be found?—Yes.

Without that, under ordinary circumstances, no sulphuric acid is found?—No.

Therefore the laboratory experiments you have for determining the quantity of sulphur tell you nothing as to the ordinary circumstances of burning gas in the open air or in the air of an apartment?—Quite so.

You have to prepare something particular in order to produce sulphuric acid, and even then, unless you have got ammonia, it is a very minute quantity?—A mere bagatelle.

Does it not come back to the general question: Is there any sulphuric acid found under ordinary circumstances at all injurious to health, or life, or property?—Most certainly not.

Cross-examined by Mr. O'HARA: I am not a professional chemist, but I know enough of the chemistry of gas lighting to suit my purpose. I am not aware that Mr. Patterson made any discoveries which improved the process of gas-making materially. I have heard of what is called Mr. Patterson's process, and I do not say it is not a desirable process; but I say it is not his process, because it existed ever since lime was used for purification. Mr. Patterson, from his want of practical knowledge of what had been done years ago, thought he had discovered something new.

Mr. O'HARA: At all events, he did think, and other people thought, that he had discovered a new process?

Witness: I never thought so.

You have got your own views upon these matters. Is Mr. Patterson conducting or carrying on a lawsuit, which is now in the House of Lords, about this very process?—Yes; he is appealing from the Court of Appeal.

Therefore, as far as Mr. Patterson's process is a new one or not, the decision of the ultimate question has not been arrived at?—It has not.

In the meantime, you have decided the question in the way you have just told the committee?—In my own opinion, certainly.

You have decided some other things. You have decided that the presence of sulphur in the gas is all a delusion—I mean the hurtful influence of it?—I state nothing but facts. It is not a question of science at all; it is a question of fact, and I contend that if the statements made of the amount of sulphur and its injurious effects are true, it did not want a scientific man to decide it. Any gentleman who has books or pictures can himself tell whether they are destroyed or not.

Do you contend that the question of the presence of a certain amount of sulphur impurity in gas is a delusion in the public mind—the hurtful effects of it?—Certainly, I do.

Had you, between 1869 and 1870, prescribed any limits of impurity as to the sulphur in the gas?—No.

You said that the Metropolitan Board of Works and the Corporation said such things of you that it made your position quite unpleasant; was there any pressure on the part of the public with reference to the non-prescribing of the maximum impurity?—They said so; but the company did not find that their customers complained to them about it. You would think if a man is complaining about his meat being bad, or his wine being bad, he would not go to a person of any other trade; he would go to the man who supplied him with it.

Let me put a hypothetical case. Supposing a man had a house steward, do you not think he would make a representation to him, and not bother himself about running after the butcher, the baker, the tinker, and the candlestick-maker?—We have got many thousands of consumers, and I tell you we never had any complaints from them of the badness of the gas. We know no difference now when the gas is at 30 grains from what it was when it was 30 to 40. The public cannot appreciate it, they know nothing at all about it.

Therefore, you think they ought to have no protection of this kind provided?—I say it is unnecessary, and that all these injurious effects are a delusion, and do not exist; and I believe this, that if the committees in 1860 and in 1868 had had the question put before them in a practical and proper way, they never would have passed 20 grains.

You think that honourable members who are sitting here, if they had had the thing put practically and properly before them, would have arrived at a different decision about the purity of the gas of the Crystal Palace Company?—They might take a very different view from this. I cannot know what is in their minds. I hope they will take a different view in this case, that is all.

Cross-examination continued: In 1860 the Chartered Company made a great fight against the 20 grains which were then put in the Act, but at that time we did not know as much as we do now. In 1868 the great struggle of 1866 and 1867 ended in the passing of the City of London Gas Act. During those years we showed the committee that the knowledge of the amount of sulphur, and of the sulphur question altogether, was very much in the dark. I do not know whether the committee recommended it, or whether we suggested it; but, at any rate, the difficulty was got over by having Referees appointed, but no maximum was fixed by Parliament. I remember the inquiry before Mr. Forster's committee, when it was agreed that the Referees were to remain just as they are now. We did not make a fuss about the purity clause in 1875, because the Referees had not fixed the maximum so low as it is now; and secondly, we had not had experience of the use of lime to the extent we have at present. As soon as we found we could not do it without creating a nuisance, we asked the Referees to allow us a little more sulphur, which they did not do, and that is the reason we are here.

Mr. O'HARA: Last year, when you came to Parliament for a Bill, you inserted that clause in the Bill—it was your own Bill. The Metropolitan Board and the Corporation had a fight with you in Parliament in 1875, and, consequently, in 1876 this Bill was practically your own Bill?

Witness: Quite so.

It was a Bill to be assented to by the Metropolitan Board of Works and the Corporation, as fixing for a definite period the gas question. Do you remember Mr. Burke stating in evidence, in 1875, that all he wanted was finality in this matter?—Yes. Having got what you call finality—

Mr. POPE: That was as regards dividend and money. I do not think Mr. Burke entered into the purity question.

Mr. O'HARA: I think Mr. Burke said, "We shall be very happy to give you this, that, and the other, if you will only let us alone."

Cross-examination resumed: We do not wish to disturb the Act of last year; we only want to repeal two clauses, because they press very harshly against the company.

Mr. O'HARA: Did you intend this settlement last year to be a final settlement, or did you not?

Witness: You cannot tell. Certain things have taken place since then; the maximum has been increased, and the difficulties have been increased. We have amalgamated with the Imperial Company, and the difficulty of getting rid of this refuse lime has now become so great; and that alone, even if there were no nuisance, would be sufficient for the repeal of the Act in that respect.

At what period did your directors resolve to come for this alteration of the law?—I think just before the time that we could give notices. In October.

About the 11th of August, 1876, the settlement or compact between the Metropolitan Board of Works, the Corporation, and The Gaslight and Coke Company had been finally sealed with the Queen's Assent, but within three months of that you made up your minds to come to Parliament to disturb it?—Yes.

Did you in last session make an alteration in the clause that prescribed the penalty for impurity in the supply of gas?—An alteration was made. We showed that it was not fair to take one day, and three days were allowed us.

Why did you not, when you asked to have the law changed in that respect, make those representations that you do now?—Simply because the full effect of this lime question had not been felt; and it has not fully come into operation yet.

Have the Referees, since the passing of the Act, altered the maximum impurity for sulphur compounds?—Certainly not since last year.

Notwithstanding that, you think it right to come to Parliament to ask for an alteration in your Act?—Certainly; because we begin to find that the restrictions placed upon us of the 13 grains, and all that, have necessitated an alteration in our apparatus. We have had to spend a very large sum of money—over £100,000—in new purifiers, in order to meet that. The effect of the alteration and the increased amount of lime was only begun to be felt last year.

Do you say that it was felt between the 11th of August and October?—And before that too.

If it was felt before that, why did not you ask to have a change made in the Act of Parliament?—Because the matter was left to the Referees, and we thought that, taking all the circumstances into consideration, they would then give such a maximum as we could honestly carry out without the use of lime.

The maximum prescribed by the Referees then was the same maximum as is prescribed now?—I am perfectly aware of that, but I gave you a reason why; in order to meet that maximum we had to lay out an immense sum of money to make these purifiers. They take one or two years to make, and they are only now coming fully into operation, but we find that using those purifiers with lime involves such a nuisance that we come here for relief, because the Referees will not give it us. If the Referees had met us and said, "We think there is something in what you say—"

The COMMITTEE: I do not understand what your evidence is; as to the requirements of the Referees before last August, what was the purity that they exacted from you previous to August last year?

Witness: 20 and 25, and 15 and 20 grains, the same as now. We have complied with their request as far as we could. Sometimes we ran up a long way, but when the gas examiner came we explained it to him. The great inconvenience we suffered from complying with the order was that we were obliged to use lime to a larger extent. The amount fixed, 15 and 20, and 20 and 25 grains, necessitates the use of lime, which causes a great nuisance. We have experienced greater difficulty since last August because the quantity of gas we have to make is now very largely increased, and, in addition to that, we are using a much larger quantity of lime; whereas, in the way we did it before, we managed to keep it down. Another thing is, that, although they fixed that maximum, we were very often above it, and we could not comply with it. We have never been charged or prosecuted under this clause. On several occasions Dr. Williamson has been down, and he has said, "Seeing the alterations you are making, so as to do away with any risk of going up above the standard, I shall report that you are doing what you can, and I shall recommend you not to be fined." Dr. Williamson is the Chief Gas Examiner.

Cross-examination resumed: In the year 1876 we used nearly 1,100,000 tons of coal, and of lime at the rate of a bushel for every ton.

Mr. O'HARA: Why have you given up the two processes of taking the sulphuretted hydrogen out by means of peroxide of iron and leaving the lime for the other sulphur compounds? Why have you divided the thing in two?

Witness: If you take out the sulphuretted hydrogen from the gas by oxide of iron, how are you to make the sulphide of calcium which acts upon the sulphur compounds? It is very likely that other people are of a different opinion to myself.

In 1867 Mr. Hawksley was asked: "If, therefore, there was a proposal for a new supply at a considerable distance from the inhabited districts, the sanitarian philosophers would not object, and we might have the advantage of using lime for the purification of gas?" His reply was: "Certainly; but I think that a better mode has been discovered than has yet been spoken of, and that is to continue the use of oxide of iron for taking out the sulphuretted hydrogen, and then only using the lime for the purpose of taking out the remaining bisulphide. Now, that is not an offensive process. By the combination of the two processes, my opinion is that the works can be carried on where they are; but the effect of the double process is to incur the cost of about a penny per 1000 feet." What do you say to that? Is that a common practice?—I think Mr. Hawksley has been misreported there.

Let me go a little further, because Mr. Hawksley is here, and I had the advantage of asking him the question before I put it to you. He says he is very well reported. Let me ask you, is that process enunciated by Mr. Hawksley in that answer a common process now?—I am not aware of it. There are some works that are using oxide of iron and lime; but, as a rule, they generally use oxide of iron first. That takes out all the sulphuretted hydrogen, and therefore what is the use of passing the gas through the lime afterwards?

Supposing the lime was so arranged as to take out a portion of the sulphuretted hydrogen, would you still object to it?—That is a totally different thing, and I believe that is what Mr. Hawksley meant.

Suppose you give in your own way what Mr. Hawksley meant, and tell me whether that is a process that can be adopted?—It may be adopted, but still you are bothered with the difficulty of getting rid of the lime; you make much more offensive lime than it would be if the whole of the lime was used.

Cross-examination continued: We gave up using oxide of iron at Beckton four or five years ago, directly the agitation began about this question of sulphur. At Fulham our purifiers are in the open, and I should not advise them to be enclosed.

Mr. O'HARA: Do you think it is better to expose the contents to the wind, and so on, and so discharge them all over the district?

Witness: It is the getting rid of the lime. The lime is taken away in trucks in the open air, so that if the lime was taken out of a purifier which was

in a room the exhalations must escape from the windows or openings, so that it is only a question of keeping it in the room for a little time. I do not see any advantage in that at all, and it is injurious to the men. If the Referees had allowed us a few more grains we should very likely have tried to get over the difficulty.

Having had your capital, price, illuminating power, and all those things settled, and everything out of the way, you thought it a good move to come to Parliament this year?—No; you quite mistake the thing. We were acting under the Referees, and whatever they suggested we carried out. And we say, and have said all along, that if the Referees would only act conscientiously upon that clause in the Act of Parliament we should not have been here now.

The COMMITTEE: So far as the Referees have acted conscientiously, they were doing so before you obtained your Bill of last year.

Witness: We did not get to the extent of the nuisance.

When you got your Act of last year you foresaw that you would have an increase of business, and therefore you might have foreseen, whether you did or not, that the public would suffer to that extent from the nuisance?—We amalgamated with the Imperial and with the Independent Companies, and that brought us five more stations.

Still you took your Bill with that clause, and now you come to protect the public against your own Act of Parliament?—You may call it our own, but we say it is the Act of the Referees.

Cross-examination continued: There was a prosecution in connexion with the Bromley works for making a nuisance by the smell of the purifying process, instituted by the West Ham Local Board. There is no way in which we can dispose of this refuse lime to the farmers; the quantity is so large, and the difficulty we meet with in railway trucks so great—in fact, the railway companies will not take it. We shall have a witness here to prove the result of a railway truck being unloaded. It made the people ill. At present there is no difficulty in getting rid of it. We have got this large amount of ground, and we put it there; but in the course of a year or two that will be filled up, and then we shall not know where to go. Another thing is that the farmers do not care about it. We had better put it on our own ground than go to the expense of carriage for taking it away. We do all we can—we give it away; some of the farmers do take a few loads away in the course of the year, but it is not used extensively, and that is the whole question. In country gas-works there is no difficulty; a railway truck would last perhaps a month or two months.

Mr. O'HARA: This lime, affected in this way, if exposed to the air, becomes pure after a certain time, does it not?

Witness: It has not so much smell.

In fact, it becomes innocuous after a little time. Now, the Bromley-by-Bow prosecution, how did that eventuate—did you get a dismissal, or were you condemned?—I think it was decided in our favour.

It was held that you made no nuisance?—Yes.

Re-examined by Mr. POPE: On March 31, 1874, the Gas Referees reduced the standard to its present point; before that it was 20 grains in summer at Beckton, Bow, and Bromley, and 25 at the other works—that would be in September, 1874. The order in March, 1872, was 5 grains more, and the next order, on Sept. 30, 1874, reduced to the present maximum. After August, 1876, complaints were made by the Shoreditch Vestry and the inhabitants of St. George's Square. In consequence of that, before November, 1876, application was made to the Referees to alter the standard of impurity. Finding they did not alter the standard of impurity, we gave notice for this Bill. During the whole of the winter those negotiations with the Referees were continued with a view to induce them to give us the relief sought for, but they were unsuccessful. If they had been successful we should have withdrawn our Bill. In August, 1876, the matter was left with the Referees exactly as it had been before. It is not of the Referees personally that I complain, but the fact that they have formed a view which seems to me not only inconvenient to the public, but unjust to ourselves, and that is the reason we are asking Parliament to rectify it.

By the COMMITTEE: I was present here during the hearing of the former case, and heard the evidence of Mr. Loam, of Nottingham. He said there had been some demand for gas refuse from the small farmers in the district. We could not send ours down the river to the Essex marshes, because the agriculturists there would not take it. We advertise it in the public papers, but the quantity is so enormous that we cannot get rid of it. With small works there is no difficulty, but when you come to treat of such enormous quantities as we have to deal with, there is considerable difficulty. I heard Professor Barff's evidence about finding sulphuric acid as a fact, but I have tried all my life to produce it, and cannot do so. This is evidence that my statement is correct. [Referring to one of the samples.] That ought to be covered with acid, and I say the same about books. The effect on the books, I believe, is entirely due to the moisture of hot air. Any one who could produce sulphuric acid by exposing sulphurous acid to the air would make an enormous fortune. The sulphuric acid makers would give anything if it could be done.

The COMMITTEE: Suppose, as a matter of fact, there were books in a library in which gas had been burnt, and they had remained on the shelves of that library for some years, and that afterwards a chemist, by washing them, did get off a solution in which sulphuric acid was present, then what should you think?

Witness: I should think very likely it came from the paste. All paste contains alum. I have got three books which were on a shelf alongside a number of other books, and those three books only were attacked, the whole of the binding being destroyed.

Major-General William Harrison Askwith, examined by Mr. POPE.

I live in St. George's Square, but formerly resided at Waltham Abbey, where I was superintendent of the gunpowder factory. While resident there, in consequence of spent lime being brought from the gas-works, I became familiar with the character of the offensive smell it possessed. Lately, myself and the other inhabitants of St. George's Square have been very much annoyed with the smell proceeding from the gas-works at the top of the square.

Mr. POPE: Could you recognize, from your previous acquaintance with spent lime, whether it had any relation to the same sort of smell?

Witness: Exactly the same, and it has been a serious annoyance to the inhabitants, so much so that in November last Mr. Slater-Booth, myself, and the other inhabitants, presented the following memorial to the company:—

St. George's Square, S.W., Nov. 23, 1876.

Sir,—We, the undersigned, inhabitants of St. George's Square, beg to call your attention to the very serious annoyance that we have received by the mismanagement of the company's Pimlico Gas-Works. In the course of last night lime purifiers were, we believe, opened, and quantities of most offensive gas allowed to escape. The smell caused by this was so great that people were awakened in the night by it; all of us, with our families and servants, have suffered more or less by the nuisance caused by the servants of the company. The smell complained of is not the usual smell, always more or less offensive, to be perceived on passing this station, or when the wind is in the east, but a far more concentrated and sickening smell. Some of us have repeatedly complained, both to the agent to the Square Trustees (Mr. Smith) and to the company's officers, of the state of things committed at this station. The events of last night have occurred several times before, and as we do not intend to allow our families and our-

selves to be made sick, and our property depreciated, by the conduct complained of, unless we have at once some real and satisfactory assurance that this will never be repeated, we shall be compelled to apply to the Court of Chancery for an injunction.

We are, Sir, your obedient servants,
G. SCLATER-BOOTH.
(Signed also by 23 other principal inhabitants of the Square.)
J. O. Phillips, Esq., Secretary.

'There is a general complaint about the smell, which was stronger during last winter than during the year before, although it has always been very bad.

Mr. POPE: Is it the general feeling of the inhabitants of the neighbourhood that this really is a substantial nuisance, of which complaint is justifiable?

Witness: In all my communications with them I have understood that it is considered to be a decided nuisance.

Cross-examined by Mr. O'HARA: I have been living in St. George's Square since March, 1868, and the smell has been always very bad. I cannot exactly say when I first made a representation of the unpleasantness to the gas company, but on several occasions during the last three or four years I have done so to the manager of the gas-works; to Mr. Smith, who is agent for Cubitt's people; and to Mr. Dines, from whom I purchased my house. We should have been glad if we could have got rid of the gas-works altogether. I was not aware at that time in what manner it was caused, although I am now aware of it. I was the author of the memorial, and took it round myself for signature.

Mr. O'HARA: Did you ever threaten the gas company that you would indict them, or anything of that sort?

Witness: No; it was mentioned by Mr. Dines, in the course of conversation, that we should do so if we got no redress.

By the COMMITTEE: We received a very civil reply from the company, relative to the Act of Parliament which appointed three Referees, stating also that the gas was to be of a certain purity, and that the Referees did not seem inclined to make any alteration relative to the purity of the gas, and therefore they were bound to use lime for the purification of it. We had made a previous application, and I had a note from Mr. Phillips, the secretary of the gas company, as follows:—

The Gaslight and Coke Company, Horseferry Road, Westminster, S.W., Oct. 30, 1876.

Sir,—I regret very much to learn that you have suffered annoyance at the time our people at the company's Pimlico station were clearing out the lime purifiers.

The system of purification by means of lime now adopted in London gas-works, has been forced upon us by a Government Board called the Gas Referees, with whom the directors are now in communication, with the hope of inducing them to permit some other mode of purification.

In the meantime, I have given the strictest instructions to the engineer, Mr. Kitt, on the subject, and I beg to assure you that no pains shall be spared to prevent further inconvenience to your neighbourhood.

I am, Sir, &c.,
J. O. PHILLIPS, Secretary.

Major-General Askwith, 119, St. George's Square.

I had verbally, and frequently, in the course of conversation with Mr. Dines and other people, made complaints about the nuisance for several years back; but the answer I received was that they themselves had represented it to the gas company, but could not get any alteration.

Mr. George Dines, examined by Mr. MICHAEL.

I was a builder in Grosvenor Road for many years, but have now retired from business. From 1833 to 1860, I was with the late Mr. Thomas Cubitt and his trustees. I was engaged on their behalf in very large building operations in South Belgravia. I have latterly, on my own account, built in St. George's Square, on a portion of their estate, a large number of houses, and have sold a great many of them. I own a considerable amount of house property there, and in the immediate neighbourhood. The houses in St. George's Square vary at the present moment from a rental of £160 a year to £600 or £700. I should think the average is £240 a year. The east side of the square abuts rather closely on to the works of the late Equitable Gas Company, which was absorbed into The Gaslight and Coke Company. I have known the gas-works for 40 years, and have been in the habit frequently of going through the works.

Mr. MICHAEL: How do you think they manage their works?

Mr. O'HARA: How does he know how gas-works are managed? Is he a gas engineer?

Mr. MICHAEL: Let us have his evidence, at any rate, for what it is worth. Witness: They were kept very clean and nice, and things looked as if the place was kept as tidy as possible. I remember when the company purified by milk of lime. Thirty years ago, or rather more than that, the nuisance was something frightful on account of the stink. I cannot fix the exact time when that process was abandoned, and oxide of iron used in its place. The nuisance recommenced only a few years back, and there is a nuisance at the present time arising from the lime. I know the smell of sulphuretted hydrogen. I was in the neighbourhood last Friday; I am there every week. I went to the gas company's wharf to see what was being done there. I passed along in front of their works. When I got to the eastward of them—and the wind was blowing from the east—the smell was rather strong, so I thought I would go back, and I did so. The process of conveying the lime into the covered barges was going on, and the smell was very bad. It appeared that every precaution was then being taken to carry out the process without, if possible, creating a nuisance, and I saw the whole process. The purifiers were uncovered, and men were shovelling the stuff out into carts. When the cart was filled, it was covered with 3 inches of breeze or ashes, and was then taken out across the public road to their wharf on the banks of the Thames, where they had a barge with boards over it. A hole was cut in those boards, and a shoot was inserted which came up to the edge of the wharf. It was large enough to put the end of the cart in, and the front of it was covered over with a curtain or tarpauling, but that did not succeed in preventing a nuisance.

Cross-examined by Mr. O'HARA: I used to be a good deal about there when I was building my houses. I finished my last house about two years ago. The gas company get their coal in underneath by a tunnel.

Mr. O'HARA: Did it strike you at all that a tunnel would be a very good way of getting rid of that stuff, instead of bringing it across the public road?

Witness: Yes; they might do it in that way, by means of a barge, but exposing it is a nuisance. It is all over the place in a moment. It cannot be got rid of.

Do you not think that the longer you expose it the more likely is the smell to be offensive? Would you not rather that they tried to keep it underground as long as they could?—They would not let it rest when they got it underground.

Would you bring it across a public road if you could bring it underground?—Decidedly not.

Re-examined by Mr. MICHAEL: I believe that the greatest amount of nuisance is caused when the purifiers are opened and the lime emptied out into the carts.

Mr. MICHAEL: So that the nuisance was not in taking it along the road, but at the time of opening the purifiers and shooting the lime into the covered barge?

Witness: That was when the greatest amount of nuisance was occa-

sioned. But the cart that had it in could be smelt for half a mile off. This is a map of St. George's Square, if the committee would like to see it [producing the same].

By the COMMITTEE: I have seen every brick laid on Eccleston Square. The houses there vary from £240 a year upwards; they are not double.

Sir Edmund Hay Currie, examined by Mr. MICHAEL.

I am a distiller, and chairman of the London Hospital. My distillery is situated on the Middlesex side of the river Lea—at Bromley—and my private residence is within 50 yards. I am very much annoyed by the smells from the gas-works. We have other smells, and plenty of them; but those are the worst that come from the gas-works. It is such an intolerable nuisance, that it makes my female servants ill; and the younger members of my brother's family, when they come to see me, are actually sick. I have traced that clearly and distinctly to the gas-works. I have made inquiries to satisfy myself that the gas company did all in their power to prevent the occurrence of the smells; and have always found the company very polite. They never refuse us admission at any time to see their premises. I should say that I have no knowledge whatever of the working of gas companies, and cannot give any information upon that subject, but I speak on behalf of 40,000 or 50,000 people who are suffering from the grievance. I have lived for 23 years in the East-end of London; I am the representative of the district at the School Board for London, and chairman of two or three hospitals, and know the feeling of the inhabitants thoroughly. I know all my neighbours very well. I have made myself acquainted with the circumstances under which this nuisance arises, and understand it is from being obliged to use the process of purification by lime, and we wish that system to be altered.

Cross-examined by Mr. O'HARA: We have been suffering from this nuisance ever since the Bromley Gas-Works were started, which was, I think, about two years ago. I ask the committee to do what they can to relieve my neighbours and myself from a nuisance which is as bad as anything can possibly be, and which renders life very uncomfortable there.

Mr. O'HARA: Let me call your attention to the section of the Act of Parliament the company seek to have repealed. [Section 36 read.] You see, Parliament has taken care of you already.

Witness: I do not see that it gives me any remedy there. What is it?

Mr. O'HARA: By indictment.

Mr. MICHAEL: That he had before.

Mr. O'HARA: Parliament has told the company that they must do a certain thing, but that they must not do it so as to become a nuisance.

Witness: Yes; I see that.

Supposing that this Act of Parliament saved your rights, and preserved you from the nuisance, would not that be satisfactory to you?—I do not quite follow you. My difficulty is that you say I may indict this company. That will cost me a great deal of money. I do not see why I am obliged to do anything of the kind.

You have got 40,000 or 50,000 sympathizers?—But they are poor people.

One shilling each from them would go some way?—Yes; but we have not many shillings to spend down there. At any rate the poor people have not. I think I am the only person at all of any means who lives in that neighbourhood for any distance.

Your contention is that the gas-works should be removed altogether?—No, I do not think so at all. I do not think that follows.

What do you want more than protection against the nuisance, when the Act of Parliament says that they shall not do anything which shall cause a nuisance?—I simply come here to ask the committee if they will be kind enough to consider the position in which we are placed in the East-end of London. The inhabitants there have very great confidence, I believe, in myself, and they ask me to represent that they are suffering from a nuisance of a character which I do not think anybody sitting round this table can have any conception of. I can go and live elsewhere, if I choose, to-morrow morning, but these poor people cannot. They must live near the East and West India Docks, where they get their livelihood.

You represent that there is a nuisance, but you have taken no steps, either at law or otherwise, to put an end to this nuisance. Do you know whether or not the law is sufficient to enable you to put an end to it?—I have not gone so far as that. I have a great hatred of law, and would far sooner come here to see if I can get a remedy in a cheaper manner, by spending half an hour in this committee-room.

I see, you come here to do it cheaply?—I am quite prepared to spend my money in hospitals, and things of that kind, in the East-end of London, but I do not see why I should put my hand in my pocket to spend money in litigation.

Do you not think it would be as well to minister to the health of the people outside the hospitals as well as inside?—I have done that all my life.

Would you not effect that if you were to spend a little money, so as to put the law in force?—No; I do not see it.

Re-examined by Mr. MICHAEL: It is because this clause has not been a sufficient protection to us that I ask the committee to alter it. I do not think any one can have any conception of what we are suffering at the present time.

QUALITY OF THE BIRMINGHAM GAS.—The reports of Mr. Thomas Jackson, the gas examiner, show that during the month of May, at the four gas-making station of the corporation, 19 examinations of the illuminating power of the gas supplied to the borough were made. The maximum light in sperm candles was 18'48; minimum, 16'72; average, 17'41. The parliamentary standard is 15 candles, with Sugg's No. 1 "London" burner.

QUALITY OF THE NEWCASTLE-ON-TYNE GAS.—Mr. John Pattinson reports as the results of his examinations, for the month of May, of the quality of the gas supplied to the borough by the Newcastle-upon-Tyne and Gateshead Gas Company:—

Date.	Illuminating Power		Grains of Sulphur		Sulphuretted Hydrogen.
	in Sperm Candles.	100 Cubic Feet of Gas.	in 100 Cubic Feet of Gas.		
May 1 . . .	14'9	14'57	12'64	Nil.	
" 4 . . .	15'0	12'64	7'19	"	
" 8 . . .	14'3	7'19	6'38	"	
" 11 . . .	13'8	6'38	7'39	"	
" 15 . . .	15'0	7'39	7'12	"	
" 18 . . .	14'5	7'12	6'04	"	
" 22 . . .	14'6	6'04	6'42	"	
" 25 . . .	14'8	6'42	7'84	"	
" 29 . . .	15'2	7'84		"	

A Sugg-Letheby standard Argand burner is used in testing. According to Act of Parliament, the gas should not be of less than 14 standard candles illuminating power, nor contain more than 17 grains of sulphur per 100 cubic feet of gas.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 12, 1877.

Circular to Gas Companies.

THE verdict has been given by the Select Committee of the House of Commons, who considered the Bill promoted by The Gaslight and Coke Company, and we regret to say it was entirely adverse to the proposal of the Company. The Committee simply declared the preamble of the Bill not proved, and thus did not, as the Chairman led us to expect they would, suggest any alternative arrangement. Thus the Company are thrown back upon the Referees, who are fully empowered to take into consideration the evidence given in favour of the Company's Bill. With the facts and opinions detailed in the course of this inquiry before them, we have little doubt that the Referees will see their way to make some relaxation, and to such an extent, perhaps, at some of the manufacturing stations of the Chartered Company, as will allow the use of lime to be dispensed with. It must, however, be confessed that we are somewhat in the dark as to the amount of "sulphur" which ordinary London gas contains when purified by oxide of iron and scrubbing with liquor alone. It seemed to be assumed rather than proved that, under such circumstances, not more than thirty-five or forty grains of sulphur are present; and it will be remembered that this latter quantity was the amount proposed by Mr. Baxter, on the part of the Companies, when

the Bill of 1860 was under consideration. But we cannot help thinking that a much larger proportion is present, and it would be of little use to fix a maximum of thirty-five grains, as was proposed, if the amount was liable to run up occasionally to sixty or seventy grains.

The decision of the Committee, however, leaves matters exactly as they stood, and the Referees in full power. It is to them, therefore, we have to look for relief to the Company, if possible, and, we are bound to add, protection to the public. These latter, it would appear, are doomed to suffer inevitably. They must either be "poisoned" (to use the figurative expression employed on both sides) by the emanations from foul lime, when purifiers are discharged at the gas-works, or they must submit to a slower—a very slow process of extinction by "sulphur," witnessing all the while a dismal change in their wares and household goods. Now, the only way of avoiding this double catastrophe is to discover some means of purifying gas from sulphur, which, while accomplishing its object, would involve no offence. The strongest objection against the Chartered Company's Bill that occurred to us was, that its success might have—we are far from saying that it would have—led the Company to relax their efforts towards perfect purification. The complete abrogation of a law sets people free to do as they like. If there were no commandment, "Thou shalt do no murder," with a hangman to avenge its infraction, we believe that homicide would be a much more frequent occurrence. There is not, it is true, any reason why the Chartered Company, any more than ninety-nine out of every hundred Gas Companies, should be subject to restrictions in respect of sulphur. On the contrary, they were fairly entitled to the immunity granted to other Gas Companies, and nearly every Corporation possessing gas works. The Committee, however, have decided that the Company shall continue subject to such restrictions as the Referees may impose, and it is to these, as we have said, that we have now to appeal. There remains also that resort to the Court of Chancery threatened by the complaining Local Authorities, which would compel the Referees to justify their Instructions and requirements. Now, we have, of course, no word to say against any one of these gentlemen. Mr. Vernon Harcourt, who was a most candid and exemplary witness, admitted that the difference between twenty-five and thirty-five grains of sulphur in a hundred cubic feet of gas was a matter of no consequence. But it is the removal of the difference (ten grains) which causes the alleged nuisance, and puts the Gas Company to a very large expense. We have hinted above that the total amount of sulphur in gas is unknown, but we know very well, by comparative tests, how much lime removes, and the difference must be regarded as immaterial. It being granted that only thirty-five or forty grains are present when lime is not used, and that we cannot confidently rely on the steady and continuous removal of more than ten of these grains by the use of lime, then it would seem absurd to occasion a nuisance for so small a result. It may be that the Committee saw the matter in this light, and, by rejecting the Bill, simply left the question to be dealt with by the Referees, as provided by the Act of 1868 and subsequent enactments. We must leave the matter here for this week, expecting that, before our next publication, we shall know something of the intentions of the complaining Local Authorities.

We may mention here that a rumour was current in the committee-room that a process had been quite recently devised, by the aid of which the whole of the "sulphur" in gas could be easily, cheaply, and inoffensively removed. Of course it was a secret until it was patented, which was to be done immediately. We give the story for what it is worth, but we must say that we shall greatly rejoice if any inventor can show us a way out of our present difficulties.

On last Tuesday evening a number of gentlemen, provided with tickets, went to the West India Docks, to witness experiments with M. Jablochhoff's "electric candles." Those who attended early were gratified with a short display; but, before we arrived, the steam-engine which drove the magneto-electric machine had broken down. Another was brought, but some accident happened to that; and, by-and-by, the last train to the City was announced, and a general stampede of the disappointed visitors took place. In relating these facts, it must be clearly stated that we insinuate no doubt as to the success, such as it is, of M. Jablochhoff's invention. We merely mention them to show one of the accidents to which this system of illumination is liable. Three weeks, we were told, had been spent in preparing for this experiment, with the result stated. It has happened that a town has been thrown into darkness by an accident at a gas-works, but such an accident has been of extremely rare occurrence. Without stopping now to describe the arrangements

made for the display at the West India Docks, which we shall have the opportunity of doing when the exhibition comes off, we may here quote some remarks on the Paris experiments, made in the contemporary we referred to last week—*Le Journal des Usines à Gaz*—of which we shall shortly give a full translation. Our contemporary admits, as we do, that the invention is, to a certain extent, a valuable one, and points out that the discovery of the divisibility of the electric current is not due to M. Jablochhoff, but belongs to our countryman—Mr. King—who patented an invention in November, 1845. We have not yet had the opportunity of referring to Mr. King's patent, so cannot say exactly what he claimed. But we find it stated in the journal we quote from that the invention was quite forgotten, until M. Lodgvine, a Russian physicist, invented a small lamp on the same principle, which was perfected by two other Russian inventors. Then came the invention to which we now refer. The illumination of the Salle Marengo is, we are told, effected by eight electric candles, supplied by two of the electro-magnetic machines of the Alliance Company, each driven by a six-horse power steam-engine. The illumination by gas is effected by eleven gaseliers, having, in all, seventy-four burners. To cut the story short for the present, we may mention that our contemporary calculates that the cost of the electric light is just about four times that of the gas light. We pass on to the reasons given for supposing that the electric light will never supersede gas in a drapery establishment like that of the Magasin du Louvre. It is pointed out that where gas is used, it is lighted as twilight comes on, and the illumination is increased as darkness increases. Shutting-up time arrives, but some light is still wanted that the shopmen may see to clear up. Half the burners are turned out, and the consumption of the others is reduced. Presently the cashiers only remain, who require but one or two burners to enable them to see to make up their accounts. But if the electric candle were employed, the six-horse engines must have been working away all the time, to supply electricity to even one candle. As a matter of fact, it has not been found possible to dispense with the use of gas during these experiments at the Salle Marengo. M. Jablochhoff's carbons will only last for from half to three-quarters of an hour, and when it is necessary to replace them in one candle, we believe that all the others are extinguished—that is, all the others supplied by the same machine. It is easy to see that a system subject to such derangements, however ingenious, can never take its place as a practical mode of illumination. Further, we will only quote that the entire Magasin du Louvre is lighted by 3000 burners, and if, to replace 100 of these, two machines and two six-horse engines are required, it follows that, to entirely substitute electric candles for gas, would necessitate the employment of sixty magneto-electric machines, and a motive force equal to three hundred and sixty horses. Our contemporary adds, that the siliceous fumes given off, in consequence of the volatilization of the "kaolin" around the carbons, irritate the air passages, and that ladies do not like the light, for the reason that it gives their faces a pale, cadaverous look.

We have mentioned before, that the present modes of estimating the value of ammoniacal liquors are not reliable, and may be very much to the disadvantage of the liquor seller. Twaddell's degrees are all twaddle, and the saturation test is, of course, a delusion, when the liquor contains fixed salts. An accurate determination of the ammonia can, therefore, only be made by setting it free by the agency of a caustic alkali, distilling it off, and fixing it by means of an acid—for convenience, sulphuric. Mr. F. W. Hartley has published a very useful little pamphlet* in which plain directions are given for carrying out this mode of estimation, and we strongly recommend all gas managers, who have liquors to sell, to adopt this method of determining their value. We may presently have occasion to refer to this matter again, and content ourselves now with the simple announcement of Mr. Hartley's publication.

Recent parliamentary proceedings with respect to gas matters, have, apart from the great case to which we have above alluded, possessed considerable interest. The United General Company succeeded with their Bill in the Commons, having, however, to submit to some reduction of capital, which will not prejudice them, inasmuch as we believe they did not really want it. The impecunious Corporation of Limerick, however, have resolved on carrying their opposition to the House of Lords, and the unfortunate ratepayers in the "City of the Violated Treaty" will be mulcted in the expenses thereof. We, happily, do not pay rates in Limerick, or we should know what to do. The Bill of the Waterford Gas Company has also been passed by a Committee of the Commons. The works being leased, the Company are in

a somewhat peculiar position, and an attempt was made to suspend the action of the Gas-Works Clauses Amendment Act, 1871, for some years, so far as the publication of accounts was concerned. It was not, however, successful. The Committee passed the preamble, with the proviso that the Act of 1871 should come into immediate operation. This is a matter of no importance to the company.

That Mr. Raikes is not disposed to be too hard on Gas Companies is clearly shown by his special report to the House on the Bill of the Woolwich, Plumstead, and Charlton Consumers Gas Company. They are a Company subjected to competition. They have a capital of £60,000, of which only £12,000 is entitled to ten per cent. Their opponents have also a capital of £60,000, all of which is entitled to ten per cent. The Bill before the House asked for power to raise further capital to the amount of £60,000, which the Company are allowed to raise in two portions; £30,000 are to be allotted to existing shareholders as in olden times, when Mr. Raikes was not a predominating power. The other £30,000 are to be disposed of by auction or tender, as required by the new Standing Order. We are always grateful for small mercies, and thank Mr. Raikes accordingly.

We now get two reports of the quality of Newcastle gas. The Borough Examiner tests the illuminating power with a Sugg-Letheby burner, and the Company test with a No. 1 "London" Argand, which they wish the Town Council to adopt. The matter has been the subject of negotiation between the Council and the Company. Fourteen-candle power being prescribed by the Special Act, the Town Council offered to change the burner, if the Company would consent to guarantee a minimum of sixteen-candle power. To this the Company would not agree, offering, however, fifteen candles—a proposal the Council would not accept. Thus the Sugg-Letheby remains the official burner. Among the tests reported, we find some made on the same dates with each kind of burner, which we give for what they are worth, not knowing whether they were made at the same place, and at the same hour:—

	Sugg-Letheby.	No. 1 "London."
	Candles.	Candles.
May 29	15.2 ..	17.2
June 1	14.0 ..	15.8

As the quantity of sulphur in Newcastle gas was the subject of some discussion at the recent inquiry, we may mention that the amounts returned on the above-mentioned dates are respectively 7.81 and 7.50 grains per 100 cubic feet.

The Gas Committee of the Corporation of Dundee have made their annual estimates of income and expenditure, and have resolved on a further reduction of 3d. per 1000 in the price of gas.

The Town Council of Southampton having conned over the last accounts of the Gas Company, have discovered a balance which they say ought properly to be devoted to a reduction in the price of gas. The difficulty, of course, is in persuading the Company to see the matter in the same light. It is quite possible that the Company may find other uses for the money. Is their reserve-fund full, and have they a substantial insurance and depreciation fund?

We mentioned some time ago that the Town Council of Hull had written to the British Gas Company, asking whether, and on what terms, they would undertake the public lighting of the old town. An answer has been received, which is not made public, but we may surmise that it was unfavourable to the design of the Town Council, for they have resolved on invoking the aid of the Local Government Board in bringing the Gas Companies to reason. They have asked the Board to send down an inspector to make a full investigation into the circumstances of the gas supply at Hull. Now, at the present moment we are ignorant of the existence of any Act of Parliament which would authorize the Board to engage in an inquiry of this kind; but we shall presently learn their decision.

The Town Council of Halifax have just made their coal contracts, some of them for three years, at what we may call full prices. Of course, there was a little squabble, and the Gas Committee were blamed for making contracts for so long a period in a falling market. They justified themselves, however, by mentioning the fact, that many of those who tendered refused to contract for more than one year. We share the opinion expressed by some in the Council, that coals have reached their lowest price, and believe that Gas Companies must prepare themselves for a rise.

* "Ammonia Liquor Tests." By F. W. Hartley, A. Inst. C.E. Wright and Co., 55, Millbank Street, Westminster. 1877.

PUBLIC LIGHTING AT NORWICH.—At the meeting of the Norwich Town Council on the 29th ult., the tender of the gas company to light for three years the public lamps at £3 4s. each per annum (9s. a lamp less than the last contract) was accepted.

Water and Sanitary Notes.

THE accounts of the Southwark and Vauxhall Water Company, to be presented to the shareholders on Thursday next, do not reveal so favourable a state of affairs as we could have desired. The profits applicable to dividend on ordinary stock and shares only admit of the payment of four per cent. Nor is the report of the Directors assuring. A good deal of money must yet be spent out of revenue in getting the filter-beds and other plant into thorough working order. And then, Mr. Bateman has reported that the Nunhead Reservoir is not in a condition to be brought into service, and has recommended considerable alterations. Affairs at Richmond are but lightly touched upon in the report; but we shall, no doubt, hear more about them at the meeting.

We are sorry to learn that the boring at Messrs. Meux's brewery has been definitively abandoned, and that the lower part of the bore is to be filled up, so as to restore the well to almost its original condition. The failure is much to be regretted, but it does not decide the great question of the possibility of obtaining a supply of water from the lower greensand under London. For a decided answer to this we must wait the result of the boring at Crossness. In the meantime, this failure, and the fact that the Legislature will probably refuse to sanction any further abstraction of water from the river, have induced people to consider further the resources of the chalk districts north of the Thames, and we are given to understand that proposals will be made to furnish additional supplies from the chalk formation. In the meantime, it is to be regretted that so few endeavours are being made to lessen the great waste of water in the Metropolis. Under the intermittent system, waste is inevitable; but by the constant service universally applied, the consumption per head ought to be easily reduced to sixteen or eighteen gallons a day—no mean saving. The difficulties in the way are, no doubt, great, but they have been overcome in other places, and can hardly be insuperable to the great Water Corporations in the Metropolis.

As we suggested some weeks ago that the failure of the Birmingham Corporation to raise a loan at home might, in part, be attributed to alarm created by a speech made in the House of Commons by the late Mayor (Mr. Chamberlain), in which he was reported to have said that some municipal loans ought not to be paid off, it is due to that gentleman to mention that in a letter to *The Times*, which escaped our notice, he denied having made the statement. We are still surprised that more public spirit was not displayed in Birmingham, where there must be a large amount of accumulated wealth, but the Corporation have no reason now to regret the failure. They have borrowed the half million they require, for their projected sanitary improvements, of the Bank of England, at three and a half per cent., thus saving a considerable sum of money and a world of trouble.

The scheme agreed upon for the formation of an united drainage district for Birmingham and its surroundings has, we are glad to say, been approved by the Local Government Board, and a Bill is already prepared to obtain the necessary parliamentary sanction.

The Lower Thames Valley Drainage scheme, or, perhaps, we ought to say the draft Provisional Order of the Local Government Board, is strongly objected to by the Local Board and parishioners of East Moulsey, and it will, no doubt, have to encounter the opposition of the Corporation of Kingston, and some other Local Authorities. A common agreement among these bodies is impossible, and unfortunately there is, in this case, no predominating influence like that exercised at Birmingham, which can reduce the objecting Boards to submission. There are but two courses which can be followed in this case. Either things must be left as they are, or the full powers of the Central Authority must be exercised to compel combination. It was said at East Moulsey that the Order proposes no scheme for the disposal of the sewage. Now, the United Board is formed to deliberate and decide upon a scheme, and objections to any one proposed would be attentively considered. If it were a question of carrying the sewage of the united district to be utilized on a large farm behind Hanwell Lunatic Asylum, we are certain that the proposal would not be listened to. We feel confident that much less expensive and more effective plans will be brought before the Board when it is formed. As to inequalities of representation, we all suffer from that more or less, but we do not see that the smaller places included in this scheme have much to complain of.

PROPOSED PURCHASE OF THE LITTLEBOROUGH GAS-WORKS.—At the meeting of the Littleborough Local Board on the 17th inst., a resolution was passed in favour of effecting a purchase of the undertaking of the gas company, and a committee were appointed to negotiate terms with the directors.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXXXVIII.

SUBWAYS (*continued*).

It has been a favourite project with those who have interested themselves in street improvements, ever since the plan was first mooted, to obviate the nuisance and inconvenience of opening the roadway of great thoroughfares for laying and repairing gas and water mains, by making subterranean galleries or passages under the principal streets, in which the mains might be deposited with great facility, without annoyance to the public, and to the advantage of the companies interested. The readiness of access to the pipes in the subway, the opportunity afforded for frequent examination, and for the connexion of the service-pipes with the mains, are the chief advantages, of which it was supposed the gas and water companies would have gladly availed themselves, and which they would have been anxious to possess, even at an increased cost. The principle was considered to be good in itself, even by those who opposed the construction of subways most strenuously; but it was believed that their cost was such as to place them outside the pale of practical projects, and that the methods of ventilation proposed by their advocates were altogether inadequate for that purpose.

The expense necessarily attending their formation was undoubtedly such as to limit their application to the busiest thoroughfares of large cities, but in such positions their value and economy are indisputable. The objections on the score of ventilation have vanished before the best of all tests, that of actual experience.

It was supposed that the difficulty of ventilating a subway so effectually as to prevent the light gas which might escape from lodging in arches or recesses, whence it would issue on the least fall of the barometer, and probably form an explosive mixture with the air, would be so great as to prevent absolute security from being attained. These surmises have been proved, both by experiment and actual use, to be erroneous. On consideration, it will at once be seen that there is no analogy, as has been urged, between a subway and a coal-mine in this respect. The latter is a *cul de sac*, and encourages stagnation, unless a strong current is being constantly drawn or driven through it; whereas the former, from the nature of their construction, have a regular draught passing through them; and, if the gratings opening into the street are of sufficient size, it is clear that any escaping gas would, from its lighter specific gravity, necessarily rise to the crown of the arch, and rapidly make its escape out through the ventilating shafts, before the law of diffusion could practically operate.

The Metropolitan Board of Works was constituted in 1855, and from an early period after they came into existence, their attention was directed to the system of subways, owing to the great increase of breaking up the streets for laying gas and water pipes and other things.

In 1857 they advertised for designs to be sent to them for the best mode of constructing subways for taking these pipes. The designs were to be of two classes—subways for first-class streets, and subways for second-class streets. Thirty-nine different designs were received by the Board, and these were referred to a committee for adjudication, consisting of men of great eminence. The following were the committee:—Mr. Robert Stephenson, Mr. Hawksley, Mr. George Lowe, Mr. Wyatt, Mr. Thwaites, Mr. W. Cubitt, and Mr. A. Wright, assisted by Mr. Bazalgette, engineer, and Mr. Marrable, architect to the Board. Three premiums for designs for a first-class street were awarded; one hundred guineas for the best, fifty guineas for the second, and ten guineas for the third; and for a second-class street, three premiums, of fifty, twenty, and five guineas each respectively. The committee stated in their report that the difficulties in the way of arriving at a satisfactory decision had been very great; no general principles were found to apply, nor was it possible either to approve or condemn all the parts of any of the designs submitted to competition; they therefore selected those designs which appeared to them to be most susceptible of such practical adaptations as would render them most generally applicable to the circumstances of the Metropolis.

None of the premiated designs was adopted in its entirety, but Mr. (now Sir) Joseph Bazalgette, the engineer, and Mr. Marrable, the architect of the Board of Works, applied their minds to the subject, and subsequently improved upon the suggestions of 1857.

The first subways constructed in London were those by the Metropolitan Board of Works, in the new street leading from Cranbourne Street to Covent Garden, and in Southwark Street.

That in Covent Garden is a tunnel of a half circle, with a radius of $6\frac{1}{2}$ feet; it is, therefore, $6\frac{1}{2}$ feet high, and 13 feet wide. The Southwark Street subway has a 6 feet radius, and is 12 feet in diameter. From the subways there are side galleries, communicating with the cellars of the houses—one gallery for every two houses—so that by passing up the gallery the service-pipes can be laid without disturbing the surface. These side galleries are 3 feet 9 inches high by 2 feet 6 inches wide. The floor of the subway is solid above the sewer, and is of gravel.

The Thames Embankment subway is 7 feet 3 inches high, and 9 feet in width.

The Covent Garden subway, which is $320\frac{1}{4}$ feet long, cost, taking all the side galleries and ventilating shafts, and everything connected with it, £2 15s. per foot run. The Southwark Street subway, 3292 feet, and side ways, cost £3 12s. 6d. per foot run.

Small pipes, supplying both gas and water, were laid in the last named as early as the year 1861, and the results were considered satisfactory; but the water and gas companies generally, were averse

to the scheme, on account of the anticipated expense, and the supposed danger associated with subways, and refused to voluntarily make use of them in the manner and to the extent proposed by the authorities.

In 1864 a Bill of a very extreme character was brought forward by the Metropolitan Board of Works, proposing to deal with all the streets and thoroughfares in the Metropolis, and involving a very large outlay for the construction of subways. It was met by the determined opposition of the water and gas companies. The Commons Committee, to whom the Bill was submitted, whilst passing a resolution with reference to the expediency of doing away with the annoyances and inconveniences arising from the breaking up of the streets, limited the operation of the Act to the water companies only. In consequence of that limitation the Board did not think it worth while to proceed with it, and, therefore, they withdrew the Bill.

In the year 1867 the matter was again brought forward in a much modified form, and then a Bill was investigated by a committee of eleven in the House of Commons. After an inquiry lasting ten days, the preamble was declared proved. Owing, however, to Lord Redesdale not being able to form a Committee of the House of Lords, the Bill fell to the ground.

On its introduction again in 1868, it passed through the House of Commons without opposition. The Bill then came before a committee of the House of Lords, and after a six days inquiry, the committee announced their opinion that the promoters had made out their case. Thus, the Metropolitan Subways Act, 1868, received the Royal Assent on the 25th of June of that year.

Its provisions are limited to the subways already authorized to be constructed by the Board of Works. The water, gas, telegraph, and other companies are compelled to lay their pipes in these subways, under a penalty of £20 for each offence in breaking up the streets after the passing of the Act. The cost of removing pipes already laid in the ground and placing them in the subways is paid by the Board. The subways are maintained by the Board in an efficient state of ventilation and repair. All pipes placed therein are maintained by the companies, bodies, or persons to whom the same belong, under the supervision of an officer appointed by the Metropolitan Board.

The City of London Subways Act, 1869, received the Royal Assent in June of that year, and was passed for the purpose of compelling the gas, water, and other companies to use the subways then in course of construction in the Holborn Viaduct and the new streets connected therewith. The provisions of this are similar to the other.

In the years 1861 and 1862 the Corporation of Nottingham purchased land in the centre of the town, and formed two new streets—Victoria Street and Queen Street. In both of these, subways, which now contain the water and gas mains, and the telegraph wires, were made down the centre, with a side way or side connexion to each house for the drain, and gas and water service-pipes. The subway in Victoria Street is 10 feet wide, 6 feet 6 inches high, and 450 feet long; that in Queen Street is 8 feet wide, 6 feet 6 inches high, and 100 feet long. Each has ventilators into the street, consisting of openings in the crown of the arch, covered with gratings 19 inches by 8 inches in size, and at distances about 60 feet apart.

The companies laid the pipes at their own expense, and no charge is made by the corporation for the use of the subways. The side passages are made a charge on the adjacent property. The party who builds upon the land pays the cost of the works, according to the length of his frontage. A subway was subsequently (in 1865) constructed in Lister gate, but the gas and water companies, acting on the advice of their engineer, declined to lay their pipes in them. In this latter the ventilation is by double openings or shafts placed together and covered with gratings.

Gas-pipes have been laid in the subways, or rather in the large sewers, of Paris, less or more, since 1821. The Municipality engineers, however, have, as a rule, discouraged the use of the sewers for that purpose, owing to certain explosions that have occurred in them from time to time for want of adequate ventilation, and some of the pipes so laid have been removed. It would appear, on the other hand, that the engineers of the Ponts et Chaussées entertain a more favourable opinion of their value, as many years ago they introduced gas-pipes in a subway in the Louvre, and under the Place du Carrousel, and also in those of the bridges crossing the Seine, which are in use to the present time.

The advantages arising from the use of subways in busy thoroughfares are so obvious as scarcely to need enumerating. When once formed, the breaking up of the streets, except for the necessary repair of the materials of which the latter are composed, is entirely obviated. The roadways are not interfered with, save by the traffic on their surface, and are consequently more durable, and can be kept in better order. A great source of accident, obstruction, and inconvenience is removed. The saving to the companies interested is immense; there is practically an absence of leakage from mains so laid, and the first cost of laying them is reduced, whilst the pipes, from the facility of inspection, repair, and painting, are better preserved and necessarily less liable to corrosion and decay. Defects are readily detected, and the liability to fracture is reduced to a minimum. The temperature of the air in subways* is more equable than that of the external atmosphere, and there is consequently less tendency to the drawing of the joints of the mains and services. These are better jointed in the first instance; there need be no

hurrying with the work, as in busy and narrow streets. The joints, being open to inspection, are not scamped, and the workmen, being sheltered from bad weather, are able to do the work deliberately and in comfort. The pipes are not subject to vibration from the concussion of traffic; and the danger of their settlement is removed, there being no superincumbent pressure, or undermining for sewerage works; and, lastly, there is no liability of contaminating the soil and the water-pipes, as is the case under ordinary circumstances.

It is scarcely creditable to the engineering and chemical professions, taken as a whole, that the opposition to the subways on account of the supposed danger attending their use should have been so strong and persistent. Doubtless, it is easy to be wise after the event, but surely in being wise before the event consists the prescient genius of the human mind. Engineers, unlike mere cloudy theorists, are generally believed to be practical and far-seeing, and it is a misfortune that the judgment of such men should ever be warped by narrow prejudices. Remembering the long struggle that eventually resulted in a legislative victory for the advocates of the subways, it is melancholy to reflect that so much effort and ability should have been expended in opposition to a project, the utility of which is now beyond all cavil.

(To be continued.)

WATER SUPPLY OF CITIES AND TOWNS.*

SECOND NOTICE.

In resuming our notice of this work, we come to the Second, or Theoretical Division, which is in three chapters, giving us the chemical, the meteorological, and the geological elements. This division, as might be expected, is more elaborate than the previous one. We have a treatise on water and its properties, and also the various sources from which potable waters are obtained, as rain, lakes, streams and rivers, and wells. The comparative purity of these various sources of supply is illustrated by detailed analyses, and the question of river pollution is entered into very fully. This chapter we regard as of special value, with reference to the limited power possessed by the chemist for detecting and removing sewage impurity.

It is boldly stated "that no process of filtration that has yet been devised will remove choleraic dejections from water; and, as it is generally believed that the noxious matter of sewage exists there in the form of minute germs, which are probably smaller than blood globules, a filtration through even a considerable stratum of chalk cannot be relied upon (as some maintain) to free the water perfectly from such germs."

The action of water on lead—a subject not sufficiently considered by professional men—is also entered into. We took special notice of this, from knowing, as a fact, that the lead pipes fixed in a mansion in the county of Surrey had to be renewed, and proper precautions taken, within a comparatively short period of its erection; and on submitting the water to an eminent chemist, he declared that the action on the pipes arose from the extreme purity of the water.

Hard water is also treated on, and Clarke's Softening Process is given at length.

Rainfall and evaporation is the subject introduced in the following chapter, and appears to be complete in all its details, giving us a description of rain-gauges, tables of various kinds for various districts and countries, and experiments on evaporation conducted in France, South America, the East Indies, and of course Great Britain; summing up, as far as the latter is concerned, in these words: "There is no trustworthy basis for generalization as to this question; it is one now under examination, and all that can be said is that the annual loss from a large water surface seems to be about 20 or 25 inches, that the summer loss is least from the largest and deepest bodies of water, but that they lose more in winter than shallower reservoirs."

We cannot give the analysis we desire of the chapter in which is considered the subject of springs and the water-bearing formations of various districts. Of course, allusion is made to Mr. Prestwich's "Inquiry respecting the Water-Bearing Strata around London," and the various experiments by Dr. Dalton and others to determine the yield of springs in proportion to the rainfall; and under this head is considered, in an extremely complete manner, the absorbent properties of various descriptions of soil and rocks. Following this is a geological treatise with reference to water-bearing strata, commencing with the alluvium of the valleys of the Humber and Mersey, and descending through the London clay, the chalk, greensand, upper, middle, and lower Oolite, the lias, new red sandstone, magnesian limestone, the carboniferous series, down to the primary rocks of Devon and Cornwall, giving the several principal towns in England situated on those different formations.

This has reference almost solely to Great Britain; but it is remarked, in concluding this interesting portion of the work, that the field traversed mostly in detail "is more varied, and has been the subject of more minute investigation, than that of any other equal area on the earth's surface. It presents in nearly continuous sequence almost all the rocks characteristic of the successive geological epochs; consequently, it has become, in a great measure, a type of the geology of the whole world."

From the physical peculiarities which regulate the supply to be obtained, we pass on to details of a practical character. We have formulæ respecting the flow of water, the discharge through orifices and over notches and weirs; the flow of water through uniform channels and pipes, not forgetting the elements of friction. All these

* The temperature in subways, is necessarily much more uniform than the external temperature. The experience in Nottingham is that in summer when the external air was 55° to 62°, the subway readings were 58° to 59°. In the winter, during a severe frost, the temperature in the open air was 20° to 29°; in the subway it was uniformly 43° to 43·76°. In London the difference between the temperatures internally and externally is about 17°.

* "A Comprehensive Treatise on the Water Supply of Cities and Towns." By William Humber, Assoc. Inst. C.E., Memb. Inst. M.E. London: Crosby, Lockwood, and Co., 1876.

subjects appear to have been examined *con amore* without elaborate verbiage, but with the single purpose of elucidating a subject on which the author has collected numerous facts, and which are here arranged and classified clearly and lucidly.

There is ample evidence in all these chapters that each division has had careful study, and can be read with satisfaction and profit.

THE ALKALI TRADE.*

What cotton fabrics are in our textile industries, that the manufacture of soda is among our chemical trades—viz., the chief and most important. There are, perhaps, few outside the trade, and those who study the statistics of our various industries, who can fully appreciate the vast importance of the alkali trade to this country. Our readers will, however, gather some idea of its extent when we mention that in 1874 no less than 459,756 tons of salt were decomposed, and we exported 5,010,616 cwts. of alkali, of the value of £2,618,034.

Although "kelp" is still made in Scotland, and we continue to import small quantities of "barilla" from Spain, and although two entirely novel processes are worked on a small scale, ninety-nine hundredths of the soda manufactured in this country is produced by the process devised by the unfortunate Le Blanc. The career of this great inventor, his struggles, privations, and eventual death by his own hand, forms a close parallel to that of his countryman and contemporary, Le Bon, the French inventor of gas lighting. "The world," it is said, "knows nothing of its greatest men;" and it is sad to remember that the founders of two of our most important and beneficent industries, which have produced for others incalculable wealth, should have lived in misery and committed suicide in despair.

Le Blanc's process for the conversion of salt (chloride of sodium) into carbonate of soda has three stages:—(1) the decomposition of common salt by means of sulphuric acid, with the evolution of hydrochloric acid; (2) the decomposition of the "salt cake," so formed, by chalk and carbon; and (3) the separation of the carbonated alkali by lixiviation and purification. A complete description of the alkali manufacture will therefore include an account of the manufactured materials employed, and the utilization of the bye-products. This Mr. Kingzett has given us in a masterly manner in the volume before us. After a short but very interesting and suggestive introduction, he begins with an account of sulphur, pyrites and the manufacture of sulphuric acid. He then proceeds to describe the mode of producing salt cake (sulphate of sodium), and its conversion into carbonated and caustic alkali. This part of the work is rendered especially valuable by descriptions of the most recent improvements in apparatus, illustrated by well-executed drawings. Then follow the modes of condensing the hydrochloric acid, evolved in the initial stage of Le Blanc's process, and the several ingenious methods of separating the chlorine to be used in another of our important chemical industries—the manufacture of bleaching powder.

Further on we have an excellent account of what is called "alkali waste," a material which has a strong family likeness to our "foul lime"—real "foul" lime, we mean, and not such as we have seen, from which every trace of sulphur had been removed by carbonic acid. What foul lime is to the gas maker that "waste" is in an intensified degree to the alkali manufacturer. It accumulates in the neighbourhood of large works at the rate of 500 or 600 tons per week, and poisons the air and pollutes the watercourses for miles around. As may be supposed, the difficulty of disposing of this enormous quantity of waste is very great; it is the Beckton difficulty exaggerated some hundreds of times. People at St. Helen's, Widnes, and other centres of the alkali industries, however, are not so squeamish as a few of the inhabitants of Belgravia and Fulham. They paint their houses of a sombre colour, which sulphuretted hydrogen does not affect, and finding that the gas does not poison them, breathe it contentedly, and perhaps, in time, enjoy it, as a Chinaman does the identical flavour in a rotten egg—a luxury in the Flowery Land. However that may be, chemists have not failed in the endeavour to convert the "waste" into an innoxious product, and extract the sulphur which, theoretically, ought to represent the exact quantity used in producing the sulphuric acid originally employed. So complete a success has not attended their efforts, but, at the present time, a large amount of sulphur is extracted from "waste." Unfortunately we do not see that any of the processes suggested or employed would suit the circumstances of gas companies for the treatment of their foul lime, and we may pass on to one of the novel methods of producing carbonate of soda from common salt, which possesses some interest to gas makers, inasmuch as it involves the use of ammonia. The details of this process are carried out with much secrecy, but the chemical reactions which take place are well known, and are of the simplest character. A saturated solution of salt is treated with ammonia, supersaturated with carbonic acid. The result is a double decomposition, by which chloride of ammonium and bicarbonate of soda are produced. The latter being insoluble in a strong solution of the former, falls as a fine powder, which is easily separated by filtration. Ammonia is, of course, recovered from the chloride by distillation with caustic lime. And here is the weak point of the process, bad for the soda maker, but good for the ammonia producer. About five per cent. of the ammonia is lost in each operation.

We have treated this book from our own special point of view, but a few historical notes may be of interest to our readers. When Le Blanc's process was first introduced into England, Pitt's salt

duty, with the proceeds of which we had fought Le Blanc's countrymen, was still imposed, and the process received a very limited application. When, however, this tax was removed in 1823, the alkali manufacture rapidly developed. The price of salt fell in London from £35 per ton to £2 10s. per ton. In 1814 soda crystals sold for £60 per ton; in 1861 they were sold for £4 10s. per ton, and are now cheaper. In 1861 there were in Great Britain 50 soda-works, employing over 10,000 workmen, in operation, and their number has since increased.

In concluding this notice, we are happy to be able to express a high opinion of the merits of the book. The author has spared no pains to acquire information, which he imparts in clear and graceful language. Any readers who desire information on the alkali manufacture and the allied industries may consult it with pleasure and profit. It has but one fault—it lacks an index. Chapter headings are all very well in their way, but a waste of time is involved in consulting them, and we hope that Mr. Kingzett will compile a full index for another edition, which we anticipate will soon be called for.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 4, 1877.

The Examiners reported that the further Standing Orders applicable to the Coatbridge Gas and Perth Water Bills have been complied with; that no further Standing Orders are applicable to the Ashton-under-Lyne Gas, Louth Gas, and West Surrey Water Bills; and that the further Standing Orders applicable to the Tudhoe and Sunderland Bridge Gas Bill have not been complied with.

The Gas and Water Orders Confirmation (Abingdon, &c.) Bill was committed.

The Bishop Auckland District Gas, Bristol United Gas, and Glasgow Corporation Water Bills, brought from the Commons, were read the first time, and referred to the Examiners.

The Gas and Water Orders Confirmation (Brotton, &c.) Bill was considered in committee of the whole House, and reported without amendment.

Petitions against the following Bills were presented:—Ashton-under-Lyne Gas Bill from Corporation of Ashton-under-Lyne; Bolton Improvement Bill from (1) Halliwell Local Board, (2) Justices of the Peace for the County Palatine of Lancaster, (3) Messrs. Taylor; Dukinfield and Denton Local Boards of Health Bill from London and North-Western Railway Company; Gas and Water Orders Confirmation (Abingdon, &c.) Bill—Ikinston Gas Order—from Ikinston Local Board; Heywood Water Bill from (1) Earl of Derby, (2) William Stott and Elizabeth Stott; Perth Water Bill from (1) North British Railway Company, (2) Perth Water Commissioners, (3) Inhabitants and ratepayers of Perth.

Petitions were also presented against alteration in the Bolton Improvement Bill from Richard Henry Ainsworth; against alteration in the Perth Water Bill from Perth General Station Committee and Caledonian Railway Company; for amendment of the Perth Water Bill from Magistrates and Council of Perth, as Commissioners of Police and Local Authority; and in favour of the Colne Gas Bill from Trawdon Local Board.

TUESDAY, JUNE 5.

The Alliance and Dublin Consumers Gas (Bray Supply) Bill was reported without amendment.

The Newport (Monmouthshire) Gas Bill was read a second time and committed.

The Stamford Water Bill was read the third time and passed.

The following Bills, brought from the Commons, were read the first time and referred to the Examiners:—Local Government (Gas) Provisional Orders (Penrith, &c.); Burslem Local Board; Carshalton Gas; Christchurch Gas; Newcastle-under-Lyme Borough Extension and Improvement; Southend Gas.

The Gas and Water Orders Confirmation (Brotton, &c.) Bill was read the third time and passed.

The Local Government Board's Provisional Orders Confirmation (Bishop Auckland, &c.) Bill—to confirm a Provisional Order of the Local Government Board, under the provisions of the Gas and Water-Works Facilities Act, 1870, and the Public Health Act, 1875, relating to the Local Government District of Bishop Auckland, and certain other Provisional Orders of the Local Government Board, under the Public Health Act, 1875, relating to the Local Government District of Hyde, the Boroughs of Plymouth and Ryde, and the Local Government District of West Houghton—was read the first time, and referred to the Examiners.

THURSDAY, JUNE 7.

The Examiners reported that the further Standing Orders applicable to the Dukinfield and Denton Local Boards of Health and the Epsom and Ewell Gas Bills have been complied with; that no further Standing Orders are applicable to the Leicester Gas, Ashton-under-Lyne Improvement, Wakefield Gas, Croydon Commercial Gas, Bolton Improvement, Heywood Water, and Ramsgate Local Board Bills; and that the further Standing Orders applicable to the Newcastle and Gateshead Water, Colne Gas, and Wakefield Improvement Bills have not been complied with.

The following Bills were read a second time and committed:—Ashton-under-Lyne Gas; Coatbridge Gas; Louth Gas; North Cheshire Water; Perth Water; West Surrey Water.

The Dundee Gas Bill was read the third time, with the amendments, and passed.

The Bridgwater Corporation Water Bill, brought from the Commons, was read the first time, and referred to the Examiners.

A petition against the Bishop Auckland District Gas Bill was presented from the Bishop Auckland District Local Board.

FRIDAY, JUNE 8.

The Examiners reported that the further Standing Orders applicable to the Sunningdale District Water Bill have been complied with; and that no further Standing Orders are applicable to the Bristol United Gas and Glasgow Corporation Water Bills.

The following report from the Standing Orders Committee was agreed to:—"That the Standing Orders not complied with in respect of the Tudhoe and Sunderland Bridge Gas Bill ought to be dispensed with, and the Bill allowed to proceed, provided that the name of the Hon. Francis Baring be struck out."

The Newport (Monmouthshire) Gas Bill was reported without amendment.

The Alliance and Dublin Consumers Gas (Bray Supply) Bill was read the third time, and passed.

* "The History, Products, and Processes of the Alkali Trade, including the most Recent Improvements." By Charles Thomas Kingzett, Consulting Chemist. With 23 Illustrations. London: Longmans and Co. 1877.

The Reservoirs Bill, brought from the Commons, was read the first time. The accounts of the Metropolitan Gas Companies for the year 1876 were presented.

HOUSE OF COMMONS.

MONDAY, JUNE 4, 1877.

The Lords amendments to the Maryport District and Harbour Gas Bill were agreed to.

The following Bills were read the third time and passed:—Local Government (Gas) Provisional Orders (Penrith, &c.); Burslem Local Board; Carshalton Gas; Christchurch Gas; Lowestoft Water, Gas, and Market (Lords); Newcastle-under-Lyme Borough Extension and Improvement; Southend Gas.

The Examiners reported that the Standing Orders not previously inquired into have been complied with in the case of the East Worcestershire Water Bill (Lords).

WOOLWICH, PLUMSTEAD, AND CHARLTON CONSUMERS GAS BILL.

Mr. RAIKES, on Friday, June 1, presented the following special report from the committee on this Bill:—

"The Bill empowers the company to raise £60,000 additional capital. The committee have divided the proposed additional capital into two parts, one of £30,000, or A shares, of £10 each; the other of £30,000 or B shares, also of £10 each. They have authorized the issue of A shares of the company without restriction, in consideration of the company having a capital of £60,000, of which only £12,000 is allowed 10 per cent., the remaining £48,000 being limited to 7½ per cent., and there being another company competing in the same district with a capital of £60,000, upon which they are allowed to pay 10 per cent., upon full amount, and by the present Bill the company are placed under all the modern restrictions as to pressure and illuminating power, to which the competing company are not subject. The B shares are to be sold by auction or tender in pursuance of the Standing Orders of the House, and they have inserted clauses to that effect."

TUESDAY, JUNE 5.

The Bridgwater Corporation Water Bill was read the third time and passed.

The Blackburn Borough Gas, Water, and Extension Bill (Lords) was read a second time and committed.

WEDNESDAY, JUNE 6.

The Woolwich, Plumstead, and Charlton Consumers Gas Bill, as amended, was considered.

The Londonderry Gas Bill (Lords) was read the first time, and referred to the Examiners.

The United General Gas Company (Limerick) Bill was reported.

The Gaslight and Coke Company Bill was reported, "Preamble not proved."

THURSDAY, JUNE 7.

The Waterford Gas Bill was reported.

The Reservoirs Bill was read the third time and passed.

FRIDAY, JUNE 8.

The United General Gas Company (Limerick) Bill, as amended, was considered.

The Gas and Water Orders Confirmation (Brotten, &c.) Bill (Lords) was read the first time and referred to the Examiners.

[For report of the proceeding in the House of Commons Committee on The Gaslight and Coke Company Bill, see Supplement to this week's JOURNAL.]

DRAINAGE OF OXFORD.—Mr. W. H. White, C.E., and engineer to the Oxford Local Board, in a paper recently read before the Ashmolean Society, gave the following particulars of this work:—The total length of new sewers and surface drains is 32½ miles. Of this length 7½ miles have been constructed of brick, and 25 miles of stoneware pipes. The temporary pumping power supplied consists of a portable double-cylinder engine of 14 nominal horse power, and a 12-inch centrifugal pump, driven by a belt from fly-wheel of engine. At a fair working speed of 90 revolutions of the engine, 2300 gallons of sewage are discharged per minute, and at present about 1½ million are dealt with daily. The water supply of Oxford is about 2 million gallons per day—that is, 60 gallons per head of the entire population, and in very wet weather the 100 acres contributing surface water to the sewers would yield about the same quantity. Therefore, if the present amount of water continued to be pumped into Oxford, the ultimate wet weather flow would be something like 4 million gallons per day. He concluded by stating that 370 acres of land had been purchased at Sandford for an irrigation farm, to connect which with the pumping-station a rising main of cast-iron pipes, 1½ mile long, had lately been commenced.—*Builder.*

GRAND JUNCTION WATER-WORKS COMPANY.—The following appeared in the *Daily News* of Saturday last:—"Sir,—In the accounts of the Grand Junction Water-Works Company, which have just been issued prior to the general meeting of shareholders on Wednesday next, my certificate as the professional auditor of the company, which was written on the accounts, has been suppressed in the printed copies issued, evidently because I would not certify the accounts to be correct, and pointed out wherein they were erroneous. As there is no other course open to me to put the very numerous proprietary in possession of the truth respecting these accounts before the annual meeting, you will do them and the public a real service by giving publicity to my certificate, a copy of which is subjoined. I am, &c., Robert A. McLean. *Copy Certificate.*—I have audited these accounts, and certify: 1. That the item 'Accounts in suspense for adjustment' is overstated by £555 18s. 1d., being the expenses of the committee of investigation, which were unanimously passed and ordered to be paid by the last general meeting of shareholders, and which have been paid. 2. That the balance of £24,765 13s. 5d., stated to be 'applicable to dividend' is incorrect. (a) Because it should be reduced by the aforesaid £555 18s. 1d. (b) Because it should be further reduced by the inevitable cost of collecting the half year's water-rents (£63,518 17s. 9d.), the gross amount of which is entered as revenue. The 'expenses of collection' charged in the accounts, pertain to the previous half year's rents. (c) Because even when reduced, it cannot be 'available for the payment of dividend' until converted into money—£40,281 10s. 2d. of it is still uncollected. A large sum must, therefore, be borrowed from the bankers to make up the amount necessary to pay the dividend. 3. That to the item 'Allowance to company's auditors,' should be affixed the words, 'Subject to arrangement by the general meeting,' which were inserted by the auditors, but have been struck out since the accounts left their hands. 4. That during the half year the collectors received £994 0s. 7d. of water-rents in advance, which they have retained in their own possession, but which should have been paid to the company, and shown in these accounts. 5. That with these exceptions the accounts are correct.—Robert A. McLean, Public Accountant, Auditor appointed by the Company, 8, Old Jewry, London, May 30."

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

SATURDAY, JUNE 9.

(Before the MASTER of the ROLLS, Lord Justice JAMES, and Sir RICHARD BAGGALLAY.)

In re THE EUFION GAS COMPANY.

APPEAL OF HENRY KELSALL ASPINALL.

This was an appeal from the order of Vice-Chancellor Malins, placing the appellant on the list of contributories in respect of 1000 shares not fully paid up. [Reported in the JOURNAL of GAS LIGHTING of March 20th.] The facts, shortly stated, were as follows:—Henry Kelsall Aspinall, in March, 1874, received from his brother Joseph a form of application for 1000 shares in the company, and a blank form of transfer for his signature, with a letter asking him to sign and return the documents, and that he (Joseph) would at once pay the full amount of capital due upon the shares, and that no personal liability or risk would be incurred by the appellant. Relying upon this statement, he signed and returned the documents, and the 1000 shares were duly allotted. Joseph paid the £1000 upon the shares, but it was alleged directly after withdrew the money, and the Vice-Chancellor held that that could not be considered as payment, and held that Henry, being the tool of Joseph, was liable to pay the calls made upon the shares.

Mr. HIGGINS, Q.C., and Mr. MILLAR appeared for the appellant, Henry Kelsall Aspinall; Mr. GLASSE, Q.C., and Mr. MONTAGUE COOKSON, Q.C. appeared for the official liquidator.

At the conclusion of the appellant's case,

The MASTER of the ROLLS, in giving judgment, said it appeared that Joseph Aspinall induced his brother, Henry Kelsall Aspinall to apply for shares, promising to pay for them, and telling him he would incur no liability by signing the application. He sent the application to Joseph Aspinall, for whose benefit it was made, leaving him to deal with the matter. The allotment was made and communicated to Joseph; the shares were registered, and two cheques of £500 each were paid into the bank by Joseph in respect of them. After the winding up commenced, it appeared that no money had been paid to the company; the whole thing was a sham, because the money paid was the company's own money. In his opinion the shares were not fully paid-up shares, and therefore the decision of the Vice-Chancellor would be affirmed.

Lord Justice JAMES and Sir RICHARD BAGGALLAY concurring, the appeal was dismissed with costs.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

FRIDAY, JUNE 8.

(Before Vice-Chancellor HALL.)

THE EDGWARE HIGHWAY BOARD v. THE COLNE VALLEY WATER COMPANY.

Mr. DICKINSON, Q.C., and Mr. YATE LEE appeared for the plaintiffs; Mr. COTTON, Q.C., Mr. GRAHAM HASTINGS, Q.C., and Mr. EVERITT for the defendants.

This was an action to restrain the defendants from opening or breaking up certain portions of five roads near Edgware, and from laying any pipes thereunder until they have informed the plaintiffs of the "plan" according to which they proposed to effect such opening and breaking up, and also from further proceeding with the breaking up, already commenced, of another road. The defendants had given to the plaintiffs, on the 30th of May, notice of their intention to break up these roads and lay down their pipes thereunder, and to commence work on the 4th of June; and the principal matter in dispute between the parties was whether, according to the construction of the Acts of Parliament under which the defendants were proceeding, they were bound, before commencing operations, to submit to the plaintiffs any and what plan of the mode in which they proposed to carry out their works. The defendants are a company incorporated by the Colne Valley Water Act, 1873 (36 Vict., cap. 80), for the purpose of better supplying with water Bushey, Pinner, Edgware, and other districts in the counties of Hertford and Middlesex; and as this special Act incorporated the provisions of the Water-Works Clauses Acts, 1847 (10 & 11 Vict., cap. 17), and 1863, which are of general application, the question was one of great interest and importance. By the 28th section of the general Act of 1847, "undertakers" by any special Act authorized to construct water-works are empowered, under the superintendence of the persons under whose control the roads may be, or of their officer, to open and break up the soil and pavements thereof; but before doing so they must, under the 30th section, give to such persons not less than three clear days notice of their intention; and by the 31st section, no road is to be opened or broken up except under such superintendence, "and according to such plan as shall be approved of by such persons or their officer, or in case of any difference respecting such plan, then according to such plan as shall be determined by two justices," a provision being contained in the section that in case the persons so entitled to superintend shall fail to attend at the time fixed for the opening of the road, or shall not propose any plan, the undertakers may proceed without their superintendence. Some information had been supplied by defendants, and they had indicated on a large Ordnance map the line in which they proposed to lay their pipes, but they had not, as the plaintiffs contended they were bound to do, submitted any plan of their own for the approval of the plaintiffs, nor had they so indicated the position of their pipes as to enable the plaintiffs to ascertain whether they would be laid to the centre of the road, in the water tables, under the footways, or under the greensward, not at what depths and with what gradients they would be laid. Without this information, the plaintiffs contended that they could not judge how often the pipes would have to cross the roads, nor to what extent they would interfere with the gas-pipes and sewerage, or even with the surface carriage and causeways. On the other hand, the defendants maintained that, being a body constituted for the public benefit, and bound, in executing their works, to do as little mischief as possible, they were not required to give even so much information as they had already done, and that until the actual commencement of their works they could not indicate the precise position their pipes would occupy. Moreover, that the word "plan" in the Act meant "method or manner," and not "map," and that it never was the practice for water-works companies to submit maps or detailed schemes of their proposed works before commencing operations, but for their surveyors, at the time and on the spot, to point out to the surveyors of the highway authorities how the pipe-laying was to be carried out.

For the plaintiffs it was contended that, as custodians of the roads in the interest of the public, at whose expense they were kept up, it was their duty to see that a proper plan, such as they could sanction, was adopted before the roads were broken up, and that it was most unreasonable to contend that an approval could be given at the moment of commencement of works, the details of which had not been considered.

The argument on behalf of the defendants was that, being a body constituted for the public benefit, and there being no suggestion that they were likely to act wantonly or *malà fide*, there were no other restrictions than those pointed out by the Act, with which, they maintained, they had, in fact, complied.

The VICE-CHANCELLOR, without calling for a reply, said that according

to the view of the defendants the word "plan" in the 31st section of the general Act was not to be construed in its ordinary sense, but as meaning merely an indication of the general mode or manner in which the breaking up or opening of the roads was to be effected, without rendering it necessary for the defendants to state such matters as the position and depth of their pipes. These were, however, matters which, in his lordship's judgment, should certainly form part of the "plan," and ought fairly and properly to be communicated to the highway authorities in such a manner, and to such an extent, as would enable them to judge whether what was proposed ought to be allowed to proceed, and was a plan which ought to be approved, or whether recourse should be had to the justices. The contention of the defendants, that they had merely to show a general line, without being bound to adhere to it with any particularity, was not correct, nor was the view taken by them of their obligations in accordance with the true construction of the Act. They had, no doubt, to some extent, supplied specifications, but even if what they had given had amounted to a "plan," it was one which had not been "approved." Either, therefore, no plan within the meaning of the Act had been submitted at all, or if any such had been submitted it was one with which the plaintiffs were not satisfied, and treating the case under the latter alternative, the defendants had not gone to the justices, as, in case of difference, the Act provided that the parties should do. Considering, therefore, that there had been no such proposal or plan submitted by the defendants as the Act of Parliament provided, his lordship granted the plaintiffs the injunctions they sought until further order, the chairman of the board giving the usual undertaking as to damages.

(Before Vice-Chancellor MALINS.)

SIMMONS v. THE VESTRY OF RICHMOND.

In this case the plaintiff sought by injunction to restrain the vestry from working a steam-engine and pumps in the Lower Road, Richmond, in such a manner as to create a nuisance to her. The matter was before his lordship on the 17th of May, as reported in the JOURNAL of the 22nd ult., page 781.

Mr. PEARSON said that the impression produced on his mind, and, no doubt, on that of his lordship, at the last hearing, was that there was only one pump being used.

The VICE-CHANCELLOR said that his impression was that there was only one engine, and that of very small power.

Mr. PEARSON replied that there were in reality three engines down the well, and, in addition to that, there was a large engine and a large boiler in a shed close to the plaintiff's house, and it was that of which she complained.

Mr. GLASSE said that the lease of the premises expired on the 30th of this month. The engine must then cease to work, and the artesian well would, no doubt, be brought into use.

Mr. PEARSON said there was nothing to prevent the vestry from getting the agreement renewed, if the artesian well proved a failure, and artesian wells were not always successful. In the meantime, this lady was being ruined.

The VICE-CHANCELLOR asked what depth had been reached with the artesian well.

Mr. SENIOR: Nearly 235 feet.

Mr. GLASSE said they had just got into the chalk, which contained an unlimited supply of water. The mistake made by the Messrs. Meux, in Tottenham Court Road, with their well was that they went through the chalk into the gault.

The VICE-CHANCELLOR: You intend to stay in the chalk?

Mr. GLASSE said they did. He contended this was a case for damages under the Act. The vestry were bound to supply the town with water, or a *mandamus* could be obtained against them. The 308th section of the Public Health Act provided that where any person sustained any damage by reason of the exercise of the powers of the Act, full compensation should be made to such person by the local authority exercising such powers, and any dispute as to the fact of damage or the amount of compensation should be settled by arbitration. There was, therefore, no necessity for the plaintiff coming to the High Court of Justice at all.

In the course of further discussion, the VICE-CHANCELLOR asked if they had any water in the artesian well.

Mr. SENIOR replied that it filled up 50 feet with water directly they touched the chalk.

After some further discussion,

The VICE-CHANCELLOR stated that he should adjourn the motion for three weeks, and suggested that the vestry had better let the damages be assessed in his chambers.

Mr. GLASSE said if there was any power for his lordship to assess damages it should be done. He was afraid his lordship had not the power. The plaintiff should have proceeded under another section.

The motion was then ordered to stand over till the first motion day after June 30.

ROLLS COURT.—FRIDAY, JUNE 8.

(Before the MASTER OF THE ROLLS.)

SOWDEN v. DRIFHLINGTON AND GIRDLESOME GASLIGHT COMPANY, LIMITED.

This was a motion to restrain the defendant company from injuring the property of the plaintiff, whose land adjoined theirs, by their operations in excavating for the erection of a new gasholder.

Mr. WALLER, Q.C., and Mr. WILLIAM KARSLAKE appeared for the plaintiff; Mr. CHITTY, Q.C., for the defendants.

Mr. WALLER said his lordship had granted an interim order on the 18th of May, which he now asked to have continued.

Mr. CHITTY said he was willing to admit that there had been some slight damage, to the extent of £15 at the outside; but he was willing to give an undertaking in damages, and submitted that on the balance of convenience the Court would not interfere to stop the defendants works, which were nearly completed. They only wanted to excavate the trench 2 feet deeper, and then the cone would be removed, and a retaining wall built, and any damage occasioned to the plaintiff would be made good.

The MASTER OF THE ROLLS said the defendants had no right to prosecute their works so as to cause a subsidence of the plaintiff's land. The principle of the balance of convenience only applied where there was a question as to the rights of the parties; but here there was no question at all. No one had a right to injure his neighbour. It was merely a question of expense. He was quite certain the work could be prosecuted without injuring the plaintiff, though it might cost a little more, but unless the parties could make an arrangement, the defendants must not carry out their work economically to the injury of the plaintiff.

Mr. CHITTY said the plaintiff bought his land at 1s. per yard, and was willing to sell it at 2s. 6d.; the company offered 2s., but this he declined.

The MASTER OF THE ROLLS repeated that he could not allow persons to take another man's property, or injure it, simply because it was convenient.

After some further discussion, his lordship granted an injunction restraining the defendants from doing, or permitting to be done, anything which might cause the plaintiff's land, or the buildings thereon, to subside or crack, or from carrying away the soil of the plaintiff.

QUEEN'S BENCH DIVISION.

SATURDAY, JUNE 2.

(Before Justices MELLOR and LUSH.)

SOUTHAMPTON GASLIGHT AND COKE COMPANY, Appellants, v. THE GUARDIANS OF THE POOR OF SOUTHAMPTON, Respondents.

Mr. M'INTYRE, Q.C., and Mr. LAWSON, appeared for the appellants; Mr. MEADOWS WHITE, Q.C., and Mr. BULLEN for the respondents.

In this case a rule had been obtained by the company to set aside an order made upon an appeal to the Court of Quarter Sessions for the borough of Southampton, whereby it was ordered that the award of Mr. Pownall, the arbitrator appointed under the Act of 12 & 13 Vict., cap. 45, sec. 13, on an appeal against the assessment of the company's works to the poor-rate, should be entered as the judgment of the Court, and the costs paid by the company to the respondents. In his award, dated the 10th of July, 1876, the arbitrator affirmed the rate, and directed that the costs of the appeal and reference, amounting to £563 7s. 4d., should be paid by the appellants. The award was served upon the appellants after the Quarter Sessions were over, and the costs were also taxed when it had ceased to be sitting. The appellants protested against this proceeding, and an amended order was subsequently prepared by the Clerk of the Peace, no further proceedings having been taken before the Court itself. The appellants did not object in Court to the taxation having taken place out of sessions. The rule to quash the order of sessions having been obtained, the respondents now appeared to show cause against the same, and it was submitted by them that it was the usual course to tax costs out of Court, and that the taxation having taken place by consent, it was not competent to the appellants to object to it having been done out of sessions. On the other hand, it was contended that the costs must be taxed during the sessions, except it was otherwise arranged by consent and agreement.

Justice MELLOR, in giving his decision, said he was of opinion that the rule ought to be discharged. It was clear to his mind that the object of the Act of Parliament was to obtain the opinion of a skilled person, in matters involving considerations of account and other difficult questions. The present was just the kind of case for the reference prescribed by the statute, and it was referred to Mr. Pownall, a gentleman thoroughly qualified to decide it. The arbitrator also had power, which he would not have had unless it had been given expressly by the reference, to award costs. This power he exercised in favour of the respondents. But it was now said that although the reference was had by consent of the parties, and by order of sessions, the respondents were not to have their costs because they were taxed when the sessions were not sitting. He (Justice Mellor) thought it was never in the contemplation of the parties that the costs should be taxed in sessions, but only that they should be taxed in proper form, which was done. The statute seemed to show that although the judgment must be entered as the judgment of the Court, it was not necessary that the Court should give any particular direction as to the taxation of costs. The appellants, therefore, were precluded from taking the objection. It was in evidence, moreover, that it was the practice to tax costs out of sessions; and although it was suggested on the other side that there was not enough business at these particular sessions on which to found a practice, he thought that was not sufficient.

Justice LUSH concurred, and said if the costs had been given under sec. 5 of the Act, and nothing had been done by the parties to avoid the effect of that section, no doubt the taxation would have been invalid. The present case, however, arose under sec. 13. It was one of the terms of the reference in this case that the costs were to be in the discretion of the arbitrator. In saying this the parties did not express all that they intended, but left something to be inferred. The order of reference must be read as if it had expressly provided that the costs were to be taxed in the ordinary way by the Clerk of the Peace, and all objections, if any, to this implied term of the reference ought to have been made at the sitting of the Court. The rule must, therefore, be discharged with costs.

ACCRINGTON COUNTY COURT.—FRIDAY, MAY 18.

(Before Mr. BLAIR.)

OSWALDTWISTLE LOCAL BOARD v. ACCRINGTON GAS AND WATER COMPANY.

This was an action brought by the Oswaldtwistle Local Board to recover £250 from the Accrington Gas and Water Works Company for water, according to contract.

Mr. RADCLIFFE, who appeared for the plaintiffs, in opening the case, stated that the gas and water company agreed to purchase from the local board 30 million gallons of water, at 6d. per 1000 gallons. According to the agreement, the water was to be taken at 10 million gallons a year, commencing in 1874. The water was duly supplied and taken during 1874 and 1875, and each year £250 was paid by the water company to the local board. The Accrington Water Company required the water in consequence of a scarcity in their supply. Their mains were connected with those of the local board, they having been previously supplied with water at the rate of 9d. per 1000 gallons. In 1876 they did not commence to take the water until the 22nd of July. They took water for 17 days to the extent of 3,150,000 gallons, and refused to take the remainder or pay for it.

Mr. JORDAN, who appeared for the defence, said it was on the ground that it stank, and was unfit for domestic consumption. The medical officer of the board in his report said it was.

Mr. RADCLIFFE continued his observations, showing the need of the Accrington Water Company for the water in the first instance; and that as there was considerable rainfall in 1876, the water company's reservoirs would be well supplied, so that they did not require the board's water. They offered to take the remaining 6,850,000 gallons of water during 1877, provided it was similar to what they had hitherto received. He should submit that the same influences which affected the water of the Oswaldtwistle Local Board must affect the water of the Accrington Water-Works Company, and that no quality of water was guaranteed. He considered that they had taken that course as a subterfuge to escape payment for the water. Some of the members of the Oswaldtwistle Local Board were shareholders and directors of the Accrington Water-Works Company.

Mr. JORDAN said that he had given the board notice to produce their medical officer's report, which was put in. Mr. Jordan then said he should apply for a nonsuit on the statement made. He was there merely as a lawyer to do the best for his clients, and as a lawyer he submitted that the local board could only contract under their seal. He quoted the 85th section of the Public Health Act (11 & 12 Vict., cap. 63), which provided that every contract, wherever the value exceeds £10, shall be in writing, and be sealed with the seal of the local board, and shall be signed by five members, &c. Cases on the point had been carried to the superior Courts, and the judges held that, where there was no seal, the contract with the local board was invalid, whether executory or executed. He also argued that as the Local Board of Oswaldtwistle had incorporated with their Act the Water-Works Clauses Act, 1847, section 35 of which provided that the local board were "bound to provide and keep in the pipes to be laid down a supply of pure and wholesome water," sufficient for the domestic use of the inhabitants resident within the board's district, this did away with his friend's contention that there were no conditions in reference to the quality of water. He should submit that it would be an im-

plied term in the contract that the water should be reasonably fit for use, as there was but one main for supplying water to manufactories and for domestic purposes.

Mr. RADCLIFFE, in reply, said the water company had entered into a contract, and were now attempting to get out of it in a most dishonourable way. He submitted that the section quoted was not relevant. It only referred to contracts to be paid out of the rates for work executed for the board.

Mr. JORDAN said that, at common law, any special contract must be under seal.

Other cases were quoted, and after a lengthy legal argument, Mr. BLAIR gave judgment. He could not help thinking, he said, that the parties should have agreed upon the facts, and submitted the legal points to a superior Court. There was a large sum of money at stake, and a question of principle was involved which it was important to local boards and water-works companies should be settled. Of course, the case was brought to that court by consent, with a reasonable desire to save expense. He decided, without any serious hesitation, that at common law, at all events, if not under the statute, all the plaintiffs contracts were bound to be under seal. Under statute, there was considerable doubt, but he did not think it was necessary to decide whether this contract fell under the quoted section of the Public Health Act, because he was fully convinced that, under common law, local board contracts must be under seal to be valid and binding. He should nonsuit the plaintiffs, with leave to move, as he thought it most desirable that the question of law should be decided by the superior Courts. Had it been a question of fact, he should have decided the case, but it being a question of law purely, he should certainly give the plaintiffs the opportunity of trying it in the higher Courts.

Mr. RADCLIFFE: We thought we were coming here to try the question of fact, and we are very much surprised that this question of law should have been raised.

ST. HELEN'S COUNTY COURT.—WEDNESDAY, JUNE 6.
(Before Mr. T. P. E. THOMPSON and a Jury.)

NOXIOUS VAPOURS PROSECUTION.

Dr. Angus Smith, Government Inspector of Alkali Works for the Western Division, brought an action against the St. Helen's Chemical Company for having emitted through their chimney a larger quantity of muriatic acid than was allowed by the Act of Parliament.

Mr. HOPKINSON, barrister, of Manchester, appeared for the plaintiff and Mr. SWIFT, St. Helen's, for the defendants.

Mr. Fletcher, district inspector, stated that on the 2nd of March he tested the smoke, and found it to contain 8-10ths of a grain of muriatic acid; and on the 14th of March he also tested, and found it then to contain 1-1 grain of the same acid. The Act of Parliament says that only 1-5th of a grain should be allowed to emit from the chimneys of chemical works.

For the defence it was contended that on the first occasion the manager had explained to Mr. Fletcher the cause of the escape of the acid. The second offence happened through the rim of the pan being faulty, an occurrence which was very rare in the trade. These explanations, they thought, had been considered satisfactory, as it was six weeks afterwards before they knew that any action had been taken in the matter.

The JURY gave a verdict against the company for £25 and costs.

DUMBARTON DEBTS RECOVERY COURT.

(Before Sheriff STEELE.)

THE MANAGER OF A SKATING RINK AND HIS GAS ACCOUNT.

Mr. R. D. Orr, banker, Helensburgh, as the treasurer of the Helensburgh Gaslight Company, sued Frederick C. Shepard, manager of the Helensburgh Skating Rink, for the sum of £16 3s. 9d., being amount of account due for gas supplied to the rink. Liability was denied by the defender, on the ground that he was simply manager of the rink, and was not in law liable for the debts of the company. The pursuers contended that they had supplied the gas on the presumption of the defender's responsibility; that he was the only person they knew in connexion with the rink; and that he had paid a previous account without objection.

The SHERIFF has since issued the following interlocutor:—The sheriff-substitute, having heard parties procurators, finds that in or about the month of September, 1876, a skating rink was constructed at Helensburgh, of which the defender was manager, and to which the public had access by tickets sold by the defender, and paid for to him; finds that various accounts incurred in the erection of the rink were charged by the tradesmen against the defender, and paid by him without any objection being stated by him of his thus being held liable for the amount; finds that for this establishment a supply of gas was furnished by the pursuers on the application of the superintending tradesman, and in this the defender fully concurred, and made use of the gas accordingly on all occasions when he required; finds that in November, 1876, the defender paid to the pursuers an account for gas supplied by them, amounting to £6 9s. 6d., and this he did without making any objection to the account as being charged against him; finds that the pursuers continued to supply gas to the defender in the same way, and on the same understanding of the defender's responsibility, and, indeed, he was the only person the pursuers knew in connexion with the rink against whom they considered themselves to have any claim; finds that the second account for gas furnished became due on the 7th of November, 1876, amounting to £12 15s. 6d., and to this account likewise the defender made no objection with reference to his liability, but simply complained that the price was excessive, and he accordingly wrote to the pursuers a letter, which is in process, in which he makes that objection, and asks the pursuers to send him an account with a reduced rate of charge; finds that this the pursuers declined to do, and, after a short period, during which a further supply of gas, amounting to £3 8s. 3d. had been furnished, they adopted the course of cutting off the supply, and resorted to the present action; finds in these circumstances that the pursuers are entitled to hold the defender as sole debtor of the account pursued for, and that the defender is not entitled to shift the burden of liability on any other party or parties hitherto unknown to the pursuers, and with whom they have never had any dealings; therefore repels the defences, and decerns against the defender in terms of the conclusions of the summons; finds the pursuer liable in expenses, which modifies to £4 12s. 5d., and decerns.

BURGESS HILL AND ST. JOHN'S COMMON GAS COMPANY, LIMITED.—The eleventh annual general meeting of shareholders was held on the 1st inst.—Mr. W. Wood in the chair. The report of the directors showed a satisfactory state of affairs, and the profits of the past year enabled them to recommend that a dividend at the rate of 7 per cent. per annum be paid. This, after placing 3 per cent. on gas-rental to renewal-fund, left a balance of £115 11s. to be carried forward to next year's account. The report and balance-sheet were unanimously adopted. The advisability of reducing the price of gas was discussed, the matter being referred to the directors for their consideration, it being understood that the price would be reduced from 6s. 8d. to 6s. 10d. per 1000 cubic feet, the reduction to come in force on July 1. The retiring directors and auditor were re-elected. A vote of thanks to the directors and to the chairman terminated the proceedings.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

Dr. Whitmore's report on the illuminating power, pressure, and quality of the coal gas consumed in the parish of Marylebone during May, supplied by The Gaslight and Coke Company:—

	Illuminating Power in Sperm Candles.			Mean Pressure in Tentshs of an Inch.		Mean Quantity of Sulphur in 100 Cu. Ft.	Mean Quantity of Ammonia in 100 Cu. Ft.	Sulphur-retted Hydrogen.
	*Mean of 21 Obser.	High-est.	Low-est.	High-est.	Low-est.	Grains.	Grains.	
Gas supplied from the Fulham works . . .	16.32	17.04	15.91	22.62	7.90	16.70	0.66	No trace
Gas supplied from the Beckton and Bow works . . .	16.44	17.06	15.81	36.40	16.22	11.84	0.56	No trace
Cannel gas supplied from the Pimlico works	20.37	21.40	19.71	20.05	13.74	16.06	0.46	No trace

Mean of daily readings of barometer 29.69
" " " thermometer 60.95

* Each observation consists of ten readings of the photometer, at intervals of one minute.

During the month the mean illuminating power of the gas supplied from Fulham was equal to 16.32 candles, that supplied from Beckton and Bow was equal to 16.44 candles, and that supplied from Pimlico (cannel gas) was equal to 20.37 candles; the range was from 15.81 to 17.06 candles in the common gas, and from 19.71 to 21.40 in the cannel gas. The mean amount of sulphur contained in 100 cubic feet of the Fulham gas was 16.70 grains, in the Beckton and Bow gas it was 11.84 grains, and in the Pimlico gas 16.06 grains. The quantity of ammonia in the three gases varied from 4-10ths to about 6-10ths of a grain in 100 feet. The pressure of all the gases was fair, and on no occasion was sulphuretted hydrogen detected in either of them by the ordinary tests.

METROPOLIS WATER SUPPLY.

Dr. Whitmore's report on the composition of the Thames companies and other waters supplied to Marylebone during May:—

	In Grains, per Gallon.		In Parts, per Million.		In Degrees.	
	Total Solid Matter.	Loss by Incineration.*	Chlorine.	Free Ammonia.	Albumenoid Ammonia.	Hardness after boiling Fifteen Minutes.
West Middlesex	20.32	0.72	1.06	0.00	0.07	13.7
Grand Junction	20.00	0.80	1.06	0.00	0.068	13.5

* The loss by incineration represents the amount of organic and other volatile matters contained in the Imperial gallon (70,000 grains) of water; the total solid matter, minus such loss, consisted principally of carbonate of lime, with small quantities of other equally harmless salts.

The water of both companies, as seen through a glass tube 2 feet in length, was clear, bright, and well filtered. The water of the river Thames at Hampton—the intake of both the above companies—was very much improved, as compared with its condition in the two previous months.

PUBLIC LIGHTING AT MAIDENHEAD.

At the Meeting of the Town Council of Maidenhead on the 1st inst.—the Mayor presiding,

The TOWN-CLERK reported that the deputation appointed at the previous meeting waited upon the gas company with the view to making an arrangement as to the future lighting of the borough, and that he subsequently received a note from the secretary to the company, asking that the proposition of the corporation should be given in writing. This request was complied with. The offer of the corporation was £3 10s. per lamp for a three years contract, under the same conditions as those last agreed upon; or, failing this, to burn by meter, at the rate of 5s. per 1000 feet, the Town Council to light and extinguish the lamps, provide the meters, and keep the lamps in repair. The gas company, in their reply, stated they were willing to accept the three years contract, at the rate of £3 10s. per lamp, the lamps being supplied with Sugg's 3½ feet regulators; secondly, that the company were also willing, as an alternative, to supply the lamps by meter at 5s. per 1000 feet, subject to the following conditions:—1. The price to be paid shall be 6s. per 1000 cubic feet of gas. 2. A meter to be provided for every 10 lamps, or fraction of the same. 3. The lamps to be supplied under the provision of this agreement shall, for securing uniformity of consumption between metered and unmetered lamps, be provided with proper self-acting pressure regulators and burners, to the satisfaction of the company. 4. The meters shall be such as are approved by the company, and be provided and fixed by them, and not interfered with by any other person, the cost of which, with expenses of fixing, is to be paid by the corporation. 5. The whole of the present and future public lighting plant to be kept in good repair by the corporation. 6. The lamps to be cleaned, lighted, and extinguished by the corporation. 7. Interest to be paid by the corporation at the rate of 10 per cent. on existing lamp-posts, lamps, burners, &c., each lamp being estimated at £3. 8. The gas-meters shall be examined by the company as often as required, and if any meter shall, upon examination, be found defective, the company shall have power to remove the same for the purpose of repairs, upon giving notice to the town-clerk. 9. The average amount of the indication of all the meters attached to the public lamps under the control of the local authority shall, except as hereinafter provided, be deemed to be the amount consumed by each such lamp. 10. Should it be ascertained that either of the test-meter lamps is extinguished when some or either of the remaining are burning, it shall be assumed that the quantity consumed by such meter shall be the same as that indicated by the other meters, or such meter shall be rejected from the calculation. 11. The gas supplied to any such public lamps shall be permitted to pass unrestricted to and from such self-acting regulator for the whole of the period during which any such public lamp shall be lighted. 12. The gas consumed, as ascertained by the test-meters quarterly, shall be paid for within two calendar months of the termination of each quarter. 13. If either the company or the local authority shall dispute the accuracy of the registration of any meter used for measuring the gas supplied to the public lamps, then such meter shall be tested in the manner provided, and if found to register erroneously, or in case any such meter shall be shown to have at any time ceased to register, notwithstanding gas may have passed through it to the burners, and notwithstanding such meter shall, on being subjected to the test then act correctly, it shall not be deemed to be one of the meters from

which the average aforesaid shall be determined. 14. Any difference which may arise under any of the provisions hereinbefore contained with respect to the local authority between the company and such local authority shall be, from time to time, settled by arbitration, in manner provided by the Lands Clauses Consolidation Act, 1845, with respect to the settlement of disputes by arbitration."

The Mayor said the committee had had these conditions under their consideration that afternoon, and had made two or three amendments in them, subject to which they recommended the council to burn their gas by meter. He read the amendments, which were to the following effect:—In paragraph 3, "to the satisfaction of the company" was altered "to the mutual satisfaction of the company and the corporation." Paragraph 4 was made to read, "The meters shall be such as are approved by the company, and be provided by the corporation, and fixed by the company, and provided with two locks, one key to be held by either party," &c. Paragraph 5 was amended thus: "The corporation to keep in repair the lamp-posts, lamps, and meters." In paragraph 7, "interest to be paid by the corporation at the rate of ten per cent." was altered to "five per cent." Paragraph 8 was altered as follows:—"The gas-meters shall be examined by the company and the corporation as often as required; and if any meter shall upon examination be found defective, it shall be immediately repaired at the expense of the corporation." The only other amendment was in paragraph 12 as to the time of payment, which was altered from "within two calendar months of the termination of the quarter" to "within two calendar months of the delivery of the account."

Mr. LOVERING said the offer made by the deputation to the gas company of £3 10s. per lamp was not subject to the condition that the burner should be a 3½ feet one. Since their interview with the company he had thought the matter over, and come to the conclusion that it was most desirable to burn by meter, and not by contract. The great mistake made by the gas company was this—they assumed that the public lamps had been burning twelve hours for 300 nights; whilst the fact was they had not burnt nine hours, as could be clearly proved. He was satisfied that if they burnt for 300 nights, even at 4 feet, the company, at £3 10s. per lamp, would be making a good profit. Still, on the whole, he considered it more satisfactory that they should take their supply by meter, as was done at Nottingham, Paddington, St. Pancras, and at another place not far away—Uxbridge. Here the price charged per 1000 cubic feet was the same as had been offered here—namely, 5s. per 1000 feet, and it had been found that the cost yearly per public lamp was £2 17s. Here was a great saving, and one which they ought to see if they could not effect in Maidenhead. Apart from that, it was always more satisfactory for those who consumed any commodity to pay only for what they consumed. He proposed, therefore, that the committee's recommendation be adopted.

Mr. FULLER seconded the motion. Whether they burned more or less, he said, he thought the system of lighting by meter would be much more satisfactory.

Mr. COLMAN said he should rather have gone on pleasantly with the company, if they had accepted £3 10s. per lamp, because it must be evident that the lighting by meter would impose extra labour upon the council. Still he should support the proposition of Mr. Lovering, because he thought it was a proper principle to go upon that they should only pay for what they consumed.

After some further conversation, the recommendation was adopted, and the Town-Clerk was directed to send to the gas company a copy of the conditions amended by the committee, and approved, as amended, by the council.

NICTHEROY (BRAZIL) GAS COMPANY, LIMITED.

The Ninth Annual General Meeting of Shareholders was held on Wednesday, the 6th inst., at the Offices, 5, Great Winchester Street Buildings, London—Mr. H. L. MICHELLS in the chair.

The SECRETARY (Mr. W. W. Wright) read the advertisement convening the meeting; and the report of the directors was taken as read. It was as follows:—

The directors have the pleasure to report that the working of the company for the past year has been fairly satisfactory. The revenue has been increased by £1200; the increased outlay for working expenses, exclusive of coal, has been only £300, while the reduction in the cost of coal has been about £600, with an increase of nearly 6 per cent. in the quantity consumed.

The directors regret to announce the death of Mr. Pennell, our late chairman, who from the commencement of the company gave the most devoted attention to its interests. They have elected Mr. H. L. Micholls to take his place.

The vacancy thus caused in the board has been filled by the election of Mr. Neate as a director, he tendering his resignation as consulting engineer. In this manner a saving will be effected of £100 per annum without practical change in the administration of the company's affairs. A further reduction of expense has also been secured by Messrs. J. Moore and Co., the agents in Rio, having, rather than relinquish their connexion with the company, consented to accept £600 per annum in place of £750, the commission previously paid. This change took place from October last.

The accounts show that after setting aside a sum of £2000 for the reserve-fund, providing for doubtful debts, and deducting the 2 per cent. interim dividend paid in October last, there remains the sum of £3853, from which the directors recommend a dividend of 3 per cent. for the half year, which will absorb £2567 2s. 5d., and leave £1295 17s. 7d. to be carried forward.

Mr. Martineau is the retiring director, and, being eligible, offers himself for re-election. The auditors, Messrs. Price, Waterhouse, and Co., retire, and offer themselves for re-election.

Dr.	Revenue Account,	Dec. 31, 1876.	Cr.		
Coals carbonized.	£5,925	6 2	Gas supplied to street-		
Purifying materials.	46	13 7	lamps	£10,786	10 6
Carbonizing wages	723	4 5	Less fines	96	10 3
Yardmen and labourers	530	4 9			
Lamplighters and inspectors	975	3 1		£10,690	0 3
Salaries and commissions	920	1 11	Public buildings.	464	2 6
Agency in Brazil	712	10 0	Private consumers	4,020	5 11
Honorarium to concessionaire,			Residual products	3,032	0 11
pursuant to arbitration award.	250	0 0	Fittings	247	6 0
Maintenance	550	0 0			
Insurance of works	90	0 0			
Brazilian taxes	46	1 4			
Directors remuneration	500	0 0			
Office expenses in London and					
Brazil, including secretary	454	11 6			
General expenses in London and					
Brazil, including postage and					
receipt stamps, and telegrams	204	17 4			
Reserve for doubtful debts	350	0 0			
Auditors	21	0 0			
Interest on debentures	264	17 0			
Discount	22	2 11			
Income-tax	27	7 9			
Law expenses	22	16 10			
Loss on exchange	260	13 10			
Amount carried to reserve to cover					
depreciation and cost of con-					
cession	2,000	0 0			
Balance, being profit for the year	3,556	3 2			
	£18,453	15 7		£18,453	15 7

The CHAIRMAN said he had only to propose the acceptance of the report as it was given to the shareholders. He regretted having to be in the position

he then occupied, in consequence of the loss they had sustained in the death of their late chairman, Mr. Pennell, who, he could assure them, always had the interests of the company at heart. The directors had elected him (Mr. Micholls) to fill Mr. Pennell's position, and so far as he was concerned, he would do his best to carry on the working of the company successfully. It was satisfactory to him to take the post at the present time, for he thought they had "turned the corner," and that their affairs were looking somewhat better than in previous years. The report was fairly satisfactory, for though it announced nothing exceedingly wonderful, still it showed progress. The revenue for the past year had been increased by something like £1200, and the extra expenditure had been only about £300. That was not unsatisfactory. The increase, so far as the working of the company went, was not unsatisfactory either. They had had 48 more public lights added to their consumption, which was fair, and there were a few more which they hoped to get shortly—some 15 or 20 probably. The receipts for private lighting had increased from £3100 in 1875 to £3900 in 1876, which was not very large, but still it showed that people were more inclined to take gas. The increase in the quantity of gas made was fairly good also. On the whole he thought the company were progressing, and eventually would be a very good undertaking; but the shareholders had to look forward to a conclusion of their contract, and he hoped to see their reserve-fund, during the time that he was chairman—and he trusted he should be supported by the proprietors in his view—reach a considerable amount, the shareholders being contented with moderate dividends in order to secure themselves against any future circumstances. The appointment they had made—which was referred to in the report—of Mr. Neate as a director would result in a saving of £100 a year to the company. Mr. Neate was in the position of consulting engineer, always there, and gave his serious attention to matters, and he was willing, in the hope of reducing expenditure, to accept a position as a member of the board, and his co-directors thought that in electing him they were only doing what was just in this matter. The reduction made with Messrs. J. Moore and Co. was effected with some difficulty, and to some extent it was a compromise. They trusted that those gentlemen would do their duty fairly in the matter, and the directors would continue to give every attention to the business of the company, and perhaps next year their report to the shareholders would be more satisfactory than that now presented. With these remarks he moved—"That the report and accounts now submitted for the year 1876 be adopted."

Mr. GORTO seconded the motion. It would, he said, be more satisfactory to the directors to see a larger attendance of shareholders, but they were thankful to those gentlemen who did come. He thought it would be agreeable to all the shareholders to see that they were able this year to put by so large a sum as £2000 towards their reserve-fund. The shareholders knew the duration of the concession was not a long one, and it behoved them, out of their profits, to provide for the end of the concession. The position the company would be in at the conclusion of their period would be something like this—that the Government would either take the works off the company's hands at a valuation, or they would renew the concession. They ought, therefore, to be provided with a reserve-fund, to make up for depreciation of their property, because, possibly, they might not be able to get back, by a valuation, the whole amount of the money spent on the property. It was very satisfactory to know that there now stood to the credit of the reserve-fund so large a sum as £3400 altogether, with the £400 of the company's debentures. This money would accumulate at interest, and, with the additions they trusted they would be able to make every year, would place them in a very satisfactory position at the end of the concession.

In reply to a SHAREHOLDER,

The CHAIRMAN said the concession had between 12 and 13 years to run, at the end of which time he would like to see that a reserve-fund of between £30,000 and £40,000 had accumulated, although he did not think it likely there would be that depreciation of the property. The concession was for 21 years, at the end of which the Brazilian Government had a right to purchase their works at a valuation. Knowing what valuations were, and even assuming that the valuers might value their property at its full cost, it would only be right for them to have such a reserve-fund that they might take it at something like two-thirds.

A SHAREHOLDER: Who is the valuation to be made by?

The CHAIRMAN: There is regular provision made for that, and we think it is exceedingly fair.

Mr. MARTINEAU said the valuation provided for would, in all probability, leave the company with a considerable sum. He had no doubt, when the time came, they would receive a fair sum for their property.

The CHAIRMAN: At the expiration of the privilege, should the contract not be renewed—but, of course, they hoped it would—the province would pay for the materials at a valuation. There would be four valuers—two named by the Provincial Government, and two by the concessionaires; and in the event of their not agreeing, a fifth would be named by the four, or would be appointed by the Minister of Public Works.

Mr. GORTO: In either of the two events they would be in this position: If the Government purchased the property, the company would have a reserve-fund to cover the depreciation; while if the concession were renewed, they would start their new era with a splendid reserve capital at their disposal. This, he thought, was a proper basis to place their affairs on.

The CHAIRMAN: And if the concession is renewed, we might give the reserve to the shareholders as a bonus.

A SHAREHOLDER: Or extend the works with it.

The CHAIRMAN: Yes, or extend the works; but this we have been doing. The resolution was carried unanimously.

The CHAIRMAN said the next resolution referred to the declaration of the dividend. By the accounts they would see that they were able to pay a dividend of 3 per cent. for the half year; and with the sanction of the meeting he would propose that that amount be paid as soon as they could get the warrants out, which they would set about immediately after the proposition was carried.

Mr. MARTINEAU seconded the resolution, which was carried unanimously.

The CHAIRMAN: The next resolution I have to propose is that my friend, Mr. William Martineau, who retires by rotation, but who is eligible for re-election, should be re-elected a director of this company. In proposing his re-election I have very great satisfaction. I have now been on the board with Mr. Martineau for some years, and we have agreed in almost everything that has come before us, and a more earnest or better director it would be impossible to have.

Mr. NEATE seconded the resolution, which was carried unanimously.

Mr. MARTINEAU, in reply, thanked the meeting for re-electing him. His attention would always be given, in the most earnest manner, to the interests of the company. He was always close at hand, and able to attend to the company's affairs at any moment.

The CHAIRMAN then moved the re-election of Messrs. Price, Waterhouse, and Co., as auditors, with a remuneration of 20 guineas, the usual rate. These gentlemen had always done their duty most ably.

Mr. MARTINEAU seconded the resolution, which was carried unanimously.

The CHAIRMAN, in closing the business, said he regretted with Mr. Gorto

that meeting had not been more fully attended; for, speaking moderately, he believed the company were doing a very good business.

On the motion of Mr. BOWLMAN, a hearty vote of thanks to the chairman was passed, and the proceedings then terminated.

MONTE VIDEO GAS COMPANY, LIMITED.

The Fifth Ordinary General Meeting of Shareholders was held at the Cannon Street Hotel, London, on Monday, the 28th ult.—J. BRAMLEY MOORE, Esq., in the chair.

The SECRETARY (Mr. Denniston) read the notice convening the meeting, and the following report and statements of account were presented:—

The directors have to lay before the shareholders the accompanying statement of accounts, and to report upon the general working of the company for the year 1876.

The net profit for the year amounts to £52,241 1s. 5d., and adding the balance brought from 1875, gives a sum to the credit of profit and loss account of £52,861 0s. 1d. Deducting the interim dividend of 4 per cent. paid by the board on the 9th of December last, and the sum of £9000—which is this year passed to contingency-fund—there remains a balance of £22,184 4s. 1d., sufficient for a further dividend of 4 per cent., making 8 per cent. for the year, and leaving the sum of £507 8s. 1d. to be carried forward to the next account.

The remittances from Monte Video have up to the present been insufficient to enable the directors to recommend the immediate distribution of the dividend; they propose, therefore, with the sanction of the shareholders, as soon as sufficient funds are in hand, to call a formal general meeting at which the dividend can be declared; in the meantime, every endeavour is being made in Monte Video to hasten the collections.

The directors who retire by rotation are Bartlett James, Esq., and J. L. C. De Salles, Esq., who, being eligible, offer themselves for re-election.

The auditors, Messrs. Price, Waterhouse and Co., and John Cater, Esq., retire, and offer themselves for re-election.

Dr.	Balance-Sheet, Dec. 31, 1876.	Cr.	
Capital subscribed . . .	£541,920 0 0	Capital expenditure, Dec. 31, 1875 . . .	£529,924 9 4
Contingency-fund . . .	25,000 0 0	Add expenditure during 1876, as follows:—	
Dividends unclaimed . . .	980 8 0	New services . . .	639 0 0
Bills payable . . .	5,190 18 4	Do. station and gasholder . . .	257 8 0
Sundry creditors, London and Monte Video . . .	12,232 8 6	Do. mains . . .	256 14 9
Profit and loss account—		Do. extensions at gas-works . . .	1,524 11 4
Balance, Dec. 31, 1875 . . .	£33,135 2 8	Do. dock, building pier, and other works . . .	3,974 7 5
Dividend paid June 14, 1876 . . .	32,515 4 0	Total capital expenditure to date . . .	£536,576 11 0
Balance . . .	£619 18 8	Stock of coals at cost . . .	10,273 16 11
Profit for 1876, as per revenue account . . .	52,241 1 5	Do. gas-fittings . . .	8,835 4 4
	£52,861 0 1	Do. meters in store and at rental . . .	5,443 17 4
Deduct interim dividend paid Dec. 9, 1876 . . .	21,676 16 0	Do. residuary products . . .	1,404 3 10
	£31,184 4 1	Do. materials in store for use . . .	3,121 11 1
Less carried to contingency-fund . . .	9,000 0 0	Do. ditto sale . . .	640 14 6
Balance available for dividend . . .	22,184 4 1	Sundry debtors, being gas consumers in Monte Video . . .	26,396 15 6
	£607,507 18 11	Bills receivable in Monte Video . . .	3,342 12 0
		Bills receivable in transit . . .	3,000 0 0
		Cash in Monte Video . . .	1,022 3 5
		Ditto London . . .	3,725 2 3
		Furniture in London and Monte Video . . .	957 0 6
		Shipments afloat . . .	2,709 5 8
		General average on (Moorhill) . . .	59 0 7
			£607,507 18 11

Revenue Account.

Cost of manufacture and expenses in Monte Video after making provision for bad and doubtful debts . . .	£48,987 8 11	Sales of gas, residuary products, meter-rent, and sales of fittings . . .	£99,822 9 8
Directors fees, salaries, and London expenses . . .	2,506 0 2	Revenue from dock and sale of materials . . .	4,545 0 5
Income-tax . . .	372 13 8	Interest account—balance . . .	1,019 2 1
Renewal of 70-feet holder . . .	1,528 15 9	Transfer fees . . .	34 2 6
Balance, being profit for the year . . .	52,241 1 5	Iron lighter . . .	215 5 3
	£105,635 19 11		£105,635 19 11

The CHAIRMAN: Gentlemen, we meet you to-day with pleasure mingled with some little disappointment. At the same time I think that, upon the whole, I may congratulate you upon the statement of accounts we have to lay before you, and the general report upon the company's affairs. The chief features in the accounts to which I beg to call your attention are these: The net profits for the year 1876, as you will see, were £52,241, and although this is a somewhat smaller gross income than we had in the previous year, yet we are enabled to pay you an equal dividend—viz., at the rate of 8 per cent., which was the amount held out originally on the formation of the company. The consumption of gas by private consumers has diminished, and as they pay more to us per 1000 cubic feet for what they consume than the Government do, this will easily account to you for the difference in our income. But there is not the slightest doubt that as things get restored to order and their normal state in Monte Video, this source of our revenue will increase again, and prove more remunerative than it is at present. You are very well aware of the dreadful state of things they have had to encounter in that country. Commerce has been paralyzed, and the crops have been injured by drought, and all these circumstances operate injuriously, not only upon the means of individuals, but they affect the sale of every article of commerce, whether gas or other necessities, throughout the whole community. Well, gentlemen, with reference to our profits of the past year, you will see that after deducting the interim dividend of 4 per cent. paid by the board on the 9th of December last, and the sum of £9000, which has been passed to the contingency-fund, there remains a balance of £22,184, sufficient for a further dividend of 4 per cent., making 8 per cent. for the year, and leaving £507 to be carried forward to the next account. Now, the disagreeable part that I have to announce to you is that which I last year had to communicate—the necessity for a delay in the payment of the dividend. This arises, as you are aware, from the accounts, because of the sums of money owing to us, which is something like £27,000. The money has been fairly and truthfully earned, but the payment of it is in arrear, and therefore we can only hold out to you the same expectation that we did last year, and we have no doubt that, with little delay, we shall be in a position to pay the dividend as before. With that object in view, we shall ask you to authorize us, as you did on a former occasion, to hold a *pro forma* meeting to enable us to declare the dividend when we find ourselves in funds, which, I hope, will not be very long hence. I ought to tell you that of the sum which is owing, about one-half, or £14,000, is due from the Government, or was due from them at the end of last year, and having this large sum outstanding, it leaves us, as I said, without money to pay your dividends. The fact is that, for the business we have to do, and the stock we have to keep, we have not sufficient working capital to enable us to secure regularity in the payment of dividends; but we hope that, as the contingent-fund increases, we shall by-and-by get over our difficulty in this respect. You will see by the accounts that

we have locked up, in coals, fittings, meters, materials in store, and residuals, the sum of £29,719, and I think that will explain to you at once why we have no ready money in hand at the present time; but I hope, as I say, by-and-by, that we shall get over this difficulty. The undertaking is going on as prosperously as can be expected, and as regards the general management of the directors, I am fully justified in stating that they have taken every opportunity of redeeming the promises they made to you to look most carefully into the expenditure. You will find that in the past year there has been a reduction in the wages to a very large amount—something like, in round numbers, £8000; there has been a reduction in the general charges of £1545; and a reduction also in the London expenses of £195 or £200. I think these things cannot but be very satisfactory to the shareholders. I need hardly tell you that, in order to the accomplishment of these reductions, great vigilance has been exercised, and I need hardly assure you that such vigilance will continue to be exercised by us in the future, so that as far as reductions, consistent with the maintenance of real efficiency, can be effected, you may rely upon it they will be carried out as far as possible. The sales of gas, as I have explained, were 2½ million cubic feet less last year than in 1875, otherwise we should have had a much better profit. On the other hand, there having been a reduction in the cost of coal of £4253, and in the other items I have mentioned, we are enabled to present the accounts which are now before you, and which, upon the whole, I hope will be considered satisfactory. There is one thing I have yet to bring before your notice, which, however, for the present, is not very satisfactory, and that is the question of the dock. I may say the dock has been a disappointment to us, but this statement you must accept with some caution, because it is hardly fair to take the value of the dock to the company hitherto in estimating what it may be in future. And for this reason, that the ordinary trade of the country which would give occupation to that dock, has been almost annihilated. Shipping at Monte Video has been so completely paralyzed, that the business of the dock can scarcely be said to have had any existence at all. But there can be no doubt as things come round, and as trade recovers itself, the dock will be more in demand. I must also remind you that a rival dock has been established there, which will compete with us, although, perhaps, it does not possess the same advantages and facilities that ours does. Still, for the reasons I have given you, I do not see why we should not look forward with a hopeful feeling as to the future, even with reference to the dock. I have now to move—"That the report be approved and adopted."

Mr. BARTLETT JAMES seconded the motion.

Mr. LOWE asked whether the chairman could give the meeting any idea of the income from the dock, apart from the gas-works. The reason he asked the question was because the chairman, in the course of his speech, stated that the directors were short of funds. The two accounts evidently ought to be kept distinct, otherwise they could not tell whether the dock was not sinking a good deal of the profits of the gas. In the last two years, as far as he could make out, the dock had made about £10,700, and the cost of keeping up the dock amounted to £9600. With reference to the sum of £26,396, due from sundry debtors, it appeared to him to be a very large item, and he hoped it did not arise from giving undue facilities to customers who did not pay. Having made these inquiries, he was bound to say that he regarded the state of the company's affairs as extremely satisfactory. There had been, during the past year, considerable reductions in establishment and manufacturing expenses, as compared with previous years, and he thought the shareholders had to record their thanks to the directors for the improvements thus effected. He would be glad to learn from the chairman whether, in case of accident to a ship in the dock, the company would be liable for damages. He knew an instance of a very heavy loss having been involved in this way.

A SHAREHOLDER agreed with the last speaker as to the propriety of separating the dock and gas accounts. He suggested that the number of meters in use from time to time should be stated in the report, and some indication as to the increase or reduction in the consumption of gas furnished.

The CHAIRMAN said that any details and particulars desired with regard to the consumption of gas, which it would be impossible for them to follow if he read them to the meeting, were quite at the disposal of the shareholders at the office. As to the dock, he thought Mr. Lowe was quite right in making the inquiry, and it was his (the chairman's) duty to answer it. There was no specific account showing the first cost of the dock, but the revenue accounts were separate, and he could tell everything expended on it, and also the income and cost of working it. In giving those particulars, however, it would not be fair for them to judge of the value of the dock to the company in the future. Even though at present it should be worked at some loss practically, still that would be more than compensated by its general utility to the company hereafter. There had been expended in connexion with the dock a sum equal to about £10,000. The gross income for the past year was £4545, and the expenditure was £1353, leaving a profit of £3192. In the previous year the gross income was £6274, and that might be taken as some indication of what they might look forward to in future as business resumed its normal state in the country. Every one present knew, and no one better than Mr. Lowe, the dreadful state of things that had existed there. But in Monte Video, as he (the chairman) could state, from observation, if misfortunes came upon people like a flood, as they often did, prosperity very frequently returned in a most marvellous manner. Mr. Lowe asked about the liability of the company if an accident happened to a ship in the dock. The directors did not consider themselves liable so long as the accident was not brought about by carelessness or mismanagement on the part of their servants.

Mr. CLEMENTS said there was a special contract with every ship using the dock, and there was a clause of indemnity printed on the back of each contract.

Mr. JAMES, referring to the inquiry respecting outstanding debts, said he had much pleasure in stating that at Monte Video the accounts were looked after very sharply—quite as well, if not better, than in Rio Janeiro. The consumers paid up very promptly, and he thought it was much to their credit that they did so. With regard to the Government, he could not say quite so much; they required a little more patience. He might remark that the engineer of the company had done his work well. He was a young man, and a very deserving one. The manager also had done his best, and he considered that the company were well served by their staff in Monte Video. Looking at the affairs of the company, and considering the peculiar circumstances of the country, he thought they had done as well as could be expected in the past year.

The motion was put, and carried unanimously.

The retiring directors and auditors were re-elected, and, on the suggestion of the SOLICITOR, a resolution was adopted authorizing the board to call a *pro forma* meeting for the declaration of the dividend.

On the motion of Mr. LOWE, a cordial vote of thanks was given to the directors for their attention to the business of the company.

The CHAIRMAN acknowledged the vote for himself and colleagues. He said they were much indebted to the shareholders for the indulgence with which they had received the board, for when directors came before their constituents without funds to pay a dividend, the announcement of the fact was not a very welcome one. He could, however, state that the board

had submitted the best accounts in their power, and they hoped to make up their deficiency soon. He could assure the shareholders that their affairs had great attention at the hands of the board; there were some most useful and able men upon it, and he might particularly allude to the assistance and help obtained from his old friend on his right (Mr. James). The shareholders might look to the directors to do the best for the company in the future.

The proceedings then terminated.

ROCHDALE CORPORATION GAS SUPPLY.

A Meeting of the Rochdale Town Council was held on Thursday last, the Mayor (Alderman Heape) in the chair.

The Gas Committee presented the following report on their department for the year ending March 31, 1877:—

Gas made this year (estimated), 253,963,000 cubic feet; last year, 241,315,000. Increase, 12,648,000.

Gas sold and used this year, 221,391,000 cubic feet; last year, 212,662,000. Increase, 8,729,000.

Value of gas sold, after deducting discounts, this year, £47,435 4s. 3½d.; last year, £44,112 8s. Increase, £3322 16s. 3½d.

The profits this year amount to £6903 1s. 6½d.; last year, £5497 1s. 6½d. Increase, £1406.

The present number of consumers, 18,550; last year, 18,037. Increase, 513. New lamp services laid this year, 76; making total new services laid this year, 589.

3990 yards of new and additional main-pipes have been laid during the past year in various roads and streets, at a cost of £2200 3s. 8½d.; the services referred to above cost £386 6s. 10d.; extensions on works during year, £16,033 9s. 3d. Making total amount chargeable to capital, £18,619 19s. 9½d.

In referring to the surplus profits for the year, your committee are sorry the amount has not reached the sum that many expected, but this deficit is accounted for in one or two items. The advantages from cheap contracts in coal and canal have only partly affected the profits this year, as a very large quantity of coal and canal was in stock last March at the higher prices, together with canal and coal contracts amounting to 5500 tons unexpired. The advantage expected to be derived from the introduction of hydraulic stoking machinery over hand labour has not been realized this winter, owing to the winter season being far advanced before the men were capable of working them to advantage. The coke receipts are less this year than last, although over 1000 tons more have been sold. This deficit has been caused by the unusually mild winter, and the reduction in the price of coal, making this residual quite a drag in the market.

A large outlay has been made in the erection of a new gasholder and tank (which is working satisfactorily), and will give ample storage for some years to come.

The amount of money to be borrowed from the Finance Committee during the year ending March 31, 1878, will be distributed over the works as follows, viz.:—

Extension of retort-house	£5,500	0	0
Front buildings, including governor-house	2,550	0	0
Governors	600	0	0
Extension of street-mains	2,500	0	0

Total £11,150 0 0

Alderman SIMPSON moved—"That this committee recommend the council to order that the price of gas be reduced 5d. per 1000 feet, both inside and outside the borough, such reduction to commence as and from the 31st of March last, and that the discount allowed to consumers within the borough remain as at the present time."* He stated that the profits of the gas-works for the year ending the 31st of March last were, in round numbers, £7000, and there would have been £2000 more than that but for one circumstance which he would explain. At the commencement of the last financial year the Gas Committee made contracts for the supply of coal and canal at a considerably lower rate than those previously running; but the old contracts had not expired, and during last year they used up as much material at the old prices as would have made a difference of £2000 if all the material had been at the lower rate. This year they would not be under these circumstances. The stock they had in hand would, of course, cost them no more than the cheapest used last year; and the new contracts entered into, though not much less, were not much more than the prices paid last year. Therefore, if the consumption was only the same this year as it was last, they could with safety reckon on a profit of £2000 more, making £9000. They proposed to reduce the price 5d. per 1000 feet, which, with the present consumption, would represent a reduced income of £4000. The effect of this would be that, assuming the consumption to be the same as last year, they would have at the end of the year a profit of £5000. It might be said that in many places they were selling gas at a cheaper rate than in Rochdale. From a list he held in his hand, it appeared that in some towns the price was more, and in some less than in Rochdale, but he would not trouble the council with the details, because they must deal with facts as they found them. The Gas Committee in Rochdale, unlike those in some other towns, had handed over the whole of their profits to the town, representing a sum of nearly £100,000 since the concern first came into the hands of the corporation. That fact placed them at a disadvantage with other towns where the profits had been devoted to the reduction of the capital, but still the price, when reduced, would be something like the average of other towns similarly situated to Rochdale. It was a pity the price could not be still further reduced, and yet them make a profit; but with the gas at the reduced figure and at a profit of at least £5000 at the end of the year, the council had no reason to be otherwise than satisfied.

Alderman SHAWCROSS asked Mr. Simpson to give them the price in Littleborough, Milnrow, and Whitworth.

Alderman SIMPSON said he had not the scale of prices in those places at command, but the comparison would hardly be fair on account of the smallness of production in those districts. He believed, however, the price at Littleborough was 6s. net.

Mr. JOHNSON asked for the prices at Blackburn, Bolton, Manchester, Oldham, and Ashton. He thought the council ought to closely examine the accounts, and then they would find that there were other things that had to do with the price of gas besides the cost of coal and canal. The council some time ago sanctioned an expenditure of about £5000 on two hydraulic stokers at the gas-works, being told at the time that the saving of these machines would be great in the matter of labour, and that the committee would be independent of anything like a turn-out amongst the men. Taking the past year's accounts, and comparing them with those of the year before, he found that the wages paid to the stokers, without the machines, were £3316; whereas last year, with the stokers that had cost such an enormous sum, the wages were actually more by £500. In the yard labour they found also a large increase—namely, from £494 to £640. This increase in labour was not due to any rise in the labour market, and he thought they ought to have some explanation of it. In the report the committee had issued they stated that the increase in the amount of gas made this year as compared with last was 12 million feet, but the increase in the amount sold was only 8 million feet, so that absolutely a third of all the extra gas made was unaccounted for. As to whether the price they were asked to pay was a fair price, he would direct their attention to what the price was in a few neighbouring towns. In Blackburn the price was 4s. 3d., or with the discount 4s.; in Birmingham, 3s. 1d. and 2s. 7½d.; in Bolton, 3s. 9d. and 3s. 7d.; in Burnley, 3s.; in Huddersfield, 3s. 7d.

Alderman SIMPSON said these were the prices charged to the largest consumers, and after all deductions were made. Moreover, the quality of the gas in these places was not stated.

Mr. JOHNSON said in Manchester the price was 3s. 6d. and 3s. 5d.; in Oldham, 3s. 8d.; in Stockport, 4s.; in Salford, 4s. He had taken towns fairly near to Rochdale, and which ought to be some guide to them. Then again, in Rochdale, the capital account of the works was rapidly increasing, and the committee expected to spend £11,000 this year, all of which, within about £2000, was to be spent at the works. He thought the matter was a most important one, and the council ought to be put in possession of certain information as to whether the £11,000 in question was to be spent in trying Alderman Tweedale's scheme at the old works. He could only suppose that this was the case, and that the committee had abandoned—he had almost said their foolish proposal to erect new gas-works. In conclusion, he said that, looking at the price of gas in surrounding towns, where he saw no special advantages which should enable them to make gas cheaper than at Rochdale, he thought the rate should be lower than it actually was. He also thought an explanation was due for the great increase of wages, and the extraordinary amount of gas that appeared to have been wasted. He did not know that it was any use moving an amendment, because the corporation must have a profit from somewhere, and if they could not get it by charging a legitimate price like other towns, they must get it by an extra tax, in the shape of a gas-tax, instead of paying it directly.

Alderman LITTLEWOOD asked the chairman whether, taking the price of gas in the surrounding towns, and also the quality, Rochdale on the average occupied a favourable position in the price they proposed to charge. Another question was this—what per centage would the contemplated profit of £5000 bear to the whole of the capital employed at the works?

Alderman SIMPSON said he could only answer the first question generally by saying that Rochdale did hold a favourable position. The first towns that Mr. Johnson referred to were those of Bolton and Blackburn. He would take these two first. In Bolton the quality of the gas, according to their own statement, was 17 candles, while in Rochdale during last year the average quality was 18½ candles. When the quality was over 15 candles of illuminating power, it was usual to reckon each candle as equal to 3d. per 1000 feet, so that in the quality alone they had, in the case of the two towns, a difference equal to 4½d. per 1000. In Bolton the invoice price was 4s., and 4s. 6d. beyond a certain distance. There was a sliding scale of discounts, amounting, in the case of the very largest consumers, to 25 per cent. Taking the illuminating quality into account, the prices compared in this way: In Bolton the price to the largest consumers was 3s. 4½d.; in Rochdale, 3s. 6d. To the smallest consumers the price in Bolton was 4s. 4½d.; in Rochdale, 3s. 9d. In Blackburn the price was 3s. 9d. and 4s., and there did not appear to be any discount, or if there was, there was none recorded in the information received from their gas engineer. The illuminating quality was 17 candles, so that Rochdale gas was much cheaper than that at Blackburn. In Lancaster the price was 4s., 4s. 6d., and 4s. 9d., less 8 per cent. discount if paid within 28 days. In Oldham the price was 4s. 6d., less 10d. within and 6d. without the corporation boundary. The average selling price, according to their figures, was 3s. 9½d., and the quality was 17½ candles, or one less than in Rochdale. At Wigan they sold the gas at 3s. 10d., with 10 per cent. off to large consumers. Of course in Wigan they possessed superior advantages in being near the coal-fields, but when they took into account that fact, and also that the quality was half a candle less, Rochdale did not compare at all unfavourably with them. In Burnley the price was 3s. per 1000, with no deductions, and charged to all consumers alike, and the illuminating quality was put down as 18 candles. An explanation was required here, however. In Burnley, instead of handing over all their profits for the benefit of the town, they had steadily applied a large portion to the extinction of their debt, so that virtually their property was almost freehold, and not chargeable with interest for depreciation. Mr. JOHNSON had referred to the mechanical stokers, which had been expected to produce such beneficial results. He admitted that the case demanded an explanation, and that explanation could be given. Of course, if there had been no stokers they would naturally have expected the wages to have been more this year than last, because of the increased amount of material that had to be manipulated. But, unfortunately, when the stokers were introduced they were so incommode by the stock of coal and canal in the retort-house, that they could not make arrangements for the free working of the stokers. Besides they had to get their men into the use of them, and it was only at the end of the season that they became at all proficient. In these matters they only found themselves in the same position as other places where the stokers had been first tried. Ultimately, however, he hoped to be able to congratulate them upon a saving equal to that in Manchester, where they had just ordered another complete set of these stokers. In referring to the disparity between the increase of gas made and the increase of gas sold, he remarked that both this year and last they had had to depend to a great extent upon estimates as regarded the quantity made. The quantity sold was discovered by the rent-book; but, owing to one of their meters being out of order, the quantity made had not been accurately measured. The result was that last year's amount had been placed at too high a figure, and this year's was perhaps rather understated. As to the contemplated extensions, it would be time enough to discuss them when the estimates were brought before the council. In conclusion, he remarked that a profit of £5000 represented only about 4 per cent. on the whole of the capital employed, but this was after the interest had been paid, and a 75th part of the debt.

The resolution was then put, and carried *nem. con.*

FATAL BALLOON ACCIDENT AT HULL.

A fearful accident occurred at Hull on Whit Monday, the 21st ult., by which a large number of persons were seriously injured, one of whom, a girl named Lucy Ann Hanson, has since died.

It appears that for several years a gala has been held every Whit Monday, in a large field in the Beverley Road, and this year one of the attractions advertised was the ascent of a balloon. Arrangements were made with the British Gas Company for a supply of gas, it being estimated that the balloon would require for its inflation about 18,000 cubic feet. There being a strong wind at the time it was filled, the balloon, although securely fixed to the ground with ropes, swayed vigorously from side to side. We learn from the local papers that close to the ring in which the filling took place there was a "striking machine," against which, just as the ascent was about to take place, the balloon was driven, and a long slit was made in the silk, through which the gas began to escape rapidly. Close to the striking machine which had caused so much damage there was a stall for the sale of hot peas, a kind of refreshment greatly in demand at entertainments of this kind. Very shortly before the balloon drove upon this stall a naphtha lamp had been suspended thereon, and the escaping stream of gas coming in contact with this naked light, a fearful explosion followed.

Spectators of the scene state that what they saw was a vivid flash, as of lightning, followed by a dense white smoke, this in turn being followed by a blaze which lasted so long as there was any of the varnished silk of which the balloon was composed remaining to be consumed. From the midst of this mass of smoke and flame there arose a mighty cry of anguish, and the excitement amongst the spectators was most intense. The policemen on duty at the gala, with many others who were not too much excited

* The present invoice price is 4s. 4d. per 1000, the discounts varying from 2d. to 5d. per 1000 feet, according to the quantity used.

to act, at once rushed to the rescue, and soon one and another were hauled out from amongst the burning mass. When the balloon collapsed, owing to the escape and ignition of the gas, it fell upon quite a crowd of persons, who were completely covered by the silk and the netting in which it was enclosed, and these people, mostly young men and women, and children, were rendered powerless to help themselves. Their position was, besides, rendered the more awful by the fact that the varnish with which the silk composing the balloon was covered, when it became heated, caused the burning material to stick to the hands and faces of the sufferers, and in numberless instances the skin was torn away from hands and faces as the unconsumed material was removed.

Amongst the injured was the little girl, Lucy Ann Hanson, who was so frightfully burned that she expired the next day. An inquest was opened on the body by Mr. J. J. THORNLEY, the borough coroner, on the 24th ult., when evidence was taken identifying the deceased, and an adjournment was then made to the 7th inst. It is not necessary for us to report more of the evidence than that which shows the arrangements for inflating the balloon, and the circumstances immediately connected with its destruction.

John Robert Warren said he was the inspector of the outdoor department for the British Gaslight Company at Hull. At the latter end of April, Mr. Wood, the manager of the gala, called upon witness, and told him he was going to have a balloon ascent, and asked him if he could provide a 4-inch main. Witness told him they could lay up to a 7-inch main, and Mr. Wood agreed to have this size. The main was laid into the ring, and had a valve at the end. From the end of the pipe to the balloon was a canvas pipe provided by Mr. Metcalfe, the aéronaut. Witness had superintended the filling of two balloons before this, and had been present at the filling of several others. About a quarter or twenty minutes to four they opened the valve. As the balloon filled with gas no portion was left free to flap about. It was a very good balloon. The only hole in it, which was stopped with a solution of india-rubber, had been caused by a hook. The inflation went on successfully, and was completed by a few minutes past seven. The crowd were unruly. They threw sticks and stones at the balloon. There were three or four policemen in the ring, but the crowd outside was great. When the balloon was filled he closed the valve in the ring, and sent a man to close another valve in the street. The car was attached half an hour before the gas was shut off. The top of the balloon, when filled, would be 50 or 60 feet from the ground, when the car was attached. When filled, the balloon swayed over the ring, and above the crowd, but occasionally it came down so that they could touch it. Some of them jumped up and broke the netting in a dozen places. They also broke the ropes several times, and the police had to thrash the people back with sticks on several occasions. Ultimately Mr. Whittaker and Mr. Metcalfe got into the car. There was nothing in the direction of the wind to prevent them making the ascent. The balloon was let go, and it rose a little and cleared the ropes. As soon as it got out of the ring the crowd clutched all round the car, and, in witness's opinion, prevented the ascent. There was tremendous shouting and hooting. Anticipating that he would get a crushing, witness cleared to windward. The ring was large enough, in witness's estimation, for the balloon to go off. The car drifted southward, but as the crowd was so very great between himself and the balloon, he saw very little more. The balloon appeared to surge, and there was then a slight explosion or flash. The gas took fire in the balloon, and the flame spread over a very large surface, and seemed to float in a sheet. It was wavy. There were great cries, and witness went to look for Metcalfe and Whittaker, and found them all right. The fabric of the balloon burned for some time, but the gas was gone instantly. Immediately the fire was over, the crowd seemed to get hold of the burning material and run about with it. Did not see any one on fire. The gas was in precisely the same state as if sent into a house. A dull red heat might not have fired it, but a spark or bright red heat would. A red-hot poker, unless of a bright red, would not have fired it. Witness examined the pea-stall at which the balloon was fired. It was between 30 and 40 yards from the ring, and had a "boggy" fire, which consisted of a square basket filled with burning coke, which would fire the gas. If the balloon was ruptured the wind would carry the gas to the fire. There was a slit in the neck of the balloon, which was made in disconnecting the valve from the balloon. In witness's belief the balloon was ruptured in some way, and the gas fired from the pea-stall. He could not see how it was rent. If the crowd had not laid hold of the balloon it would have gone up safe.

Benjamin Metcalfe, of Leeds, said he was an aéronaut. He signed an agreement with Mr. Wood to make an ascent, and originally was to bring a balloon to Hull, capable of holding 36,000 feet of gas. He intended to make a second ascent at Grimsby on the Tuesday, according to his agreement with Mr. Wood, but as the Grimsby Gas Company could not inflate such a large machine, he brought the smaller one to Hull, which was quite new, and with which he had made 13 ascents. It was made of silk, with a coating of india-rubber and oil, and was very inflammable. The wind went down when they commenced to inflate it, but got up again when the balloon was filled. Witness, however, did not consider it unsafe to make the ascent. He attached the car with the help of the men Mr. Wood had provided. Witness had not noticed the pea-stalls with fires. If he had known of them he would have ordered them off at once. He was very particular about fires, and ordered several people out of the ring who were smoking. After he had attached the car he got into it, followed by Mr. Whittaker. Witness tried if the balloon would lift Mr. Whittaker. It would not, and he told him to get out, and he got out. Witness tested the lifting power by means of sand-bags. When Mr. Whittaker got out, a lot of men in the crowd seized the car and took possession of it. They refused to let go, and the wind blew the balloon over, and a lot of boys seized the netting and kept the balloon from rising. Could not tell how the balloon was perforated, but while witness was watching it and directing those who had hold of the car to pull it back into the ring, which they refused to do, the balloon blazed up in the middle. Witness threw himself out, and the gasman got hold of his shoulders and dragged him out of the way. The gas was out in a moment, but the balloon material was on fire for a little time, and the people seized hold of it and made it worse. The accident to the balloon was owing entirely to the misbehaviour of the crowd. Everything was in good order and ready for a start, and he would have been away in three minutes.

After hearing other evidence,

The CORONER summed up, and, in the course of his remarks, said the main point was whether any person was to blame, and, if so, whom? People dealing with a substance like gas were bound to exercise great care in using it. They had heard how Mr. Wood and Mr. Metcalfe dealt with it. Mr. Wood said he was not aware of the vicinity of the fire, and Mr. Metcalfe, upon whom the responsibility, so far as his own life was concerned, seemed to rest, more fully stated that he did not notice fires there, as, if he had, he would have taken steps to remove them before the ascent was attempted. He (the coroner) thought it was his duty to see there were no fires in close proximity to the balloon. At the same time, it was only fair that they must not lose sight of the fact that had the balloon not come in contact with the striking machine and been ruptured the accident would not have happened. He referred to the contradictory character of

some of the evidence, and pointed out that Mr. Metcalfe's men said that the crowd took possession of the balloon and pulled it over, whilst others asserted that it was blown over. It was also a question whether proper provision was made for keeping the ring clear. As a similar ring had been used on previous occasions, it was fair to conclude that it was of sufficient diameter. There was a miscarriage somewhere, and the difficulty was to lay it upon the right shoulders, but they would find it difficult to obtain sufficient evidence to bring in a verdict of manslaughter against any man. If any one was to blame, it was between the three men who were in charge of the balloon—viz., the gas inspector, Mr. Metcalfe, and Mr. Wood. But there was another party—viz., the crowd, who were said to have taken possession. They must also consider whether it had not been a miscarriage of a general character, arising from a combination of causes, and one of those things which they felt justified in describing by the name of accident, because they could not fix the responsibility upon the proper person.

The jury then retired, and on their return into court returned a verdict of "Accidental death." But while not attributing criminal negligence to any person, they thought that greater care ought to have been exercised by the persons in charge of the ground and balloon, and strongly recommended that in future no gas balloons be allowed to ascend unless proper precautionary measures to prevent danger to the public were taken by the manager.

PROFESSOR TYNDALL ON GERMS.

[From *The Times*.]

The Friday evening discourse at the Royal Institution (the last for this season) was given by Professor Tyndall, F.R.S., the subject being in continuation of the discourse with which the session was opened.

Professor TYNDALL began by illustrating the change from sweet and transparent animal and vegetable infusions to putrefying and turbid ones. The turbidity, he said, was due to swarms of infusoria, the lowest forms of which, called bacteria, were the known agents of putrefaction. He referred to the two rival views regarding the origin of these organisms—the one deriving them from seeds, eggs, or germs, the other from spontaneous generation. Contrasting the power of a luminous beam with that of our best microscopes, he showed, by referring to the recent observations of Dallinger, that the beam can reveal the existence of germinal particles which baffle a magnifying power of 15,000 diameters. Exposing, a year ago, both animal and vegetable infusions, boiled for five minutes, but eminently putrescible, to air proved by the beam to be free from floating matter, they were never found to putrify, or show the slightest inherent power to develop bacterial or fungoid life. The evidence furnished by hundreds of experiments bearing upon this point, and executed with the utmost physical precision, was complete. Last autumn, however, the organic liquids previously experimented on, and which five minutes boiling reduced infallibly to barrenness, were found capable of withstanding 15 minutes boiling, filling themselves afterwards with putrefactive organisms. There is no correction of error here; the two portions of the inquiry are perfectly correct. Either, therefore, the Professor reasoned, in 1876 the infusions had become endowed with an inherent generative energy not possessed by them in 1875, or some new putrefactive contagium external to the infusions, and of a far more obstinate character than that of 1875, had been brought to bear upon them at the later date. By experiments long continued Professor Tyndall convinced himself that in his later inquiries the laboratory of the Royal Institution had become filled with a virulently infective atmosphere. He therefore removed his apparatus to the Jodrell laboratory, in Kew Gardens, and exposed his infusions to its less infective air. The result was that liquids which, in Albemarle Street resisted three hours boiling, filling themselves afterwards with putrefactive organisms, were completely sterilized by five minutes boiling at Kew. Either, then, the infusions had lost in Kew Gardens a generative energy which they possessed in the laboratory of the Royal Institution, or their department in the laboratory must be referred to the contagion of its air. With a view of making nearer home experiments similar to those made at Kew, a shed was erected on the roof on the Royal Institution. Chambers were prepared in the shed, and charged with infusions which had never been permitted to come near the laboratory. The first experiments failed utterly, the air of the shed proving sensibly as infective as that of the laboratory itself. The cause of this was not far to seek. Professor Tyndall's assistants had passed from the laboratory to the shed and from the shed to the laboratory, unconscious carriers of infection, like those cowherds who, *The Times* informs us, unsuspectingly spread abroad the germs of foot-and-mouth disease. The shed was subsequently disinfected, and uninfected cloths were employed for the preparation and exposure of the infusions. The result was that they remained pellucid, and without any trace of bacterial life. Now a rod 30 feet long would stretch from the infusions in the shed to those in the laboratory. At one end of this rod, five minutes boiling rendered the infusions barren; at the other end the same infusions resisted 180 minutes boiling. Shall we, then, infer that at one end the infusions possess the power of spontaneous generation, and at the other do not? Or that at one end we have obstinately infective, and at the other end comparatively uninfected air? It is needless to dwell upon the absolute similarity of the spread of putrefaction, as here illustrated, to that of infectious disease. There is not a phenomenon of the one which does not find its parallel among the phenomena of the other. Where, then, are we to seek the contagium which so copiously produced the organisms of putrefaction, after the ordeal to which the infusions in the laboratory had been exposed? Professor Tyndall rendered it visible. Placing a small truss of old and desiccated hay, obtained from Heathfield, in Sussex, under a horizontal beam of light sent through the darkened theatre of the Royal Institution, on beating the hay, clouds of fine dust rose into the beam. That was the contagium. Mingled with that dust were the desiccated germs which had spread a plague among the infusions, asserting their vitality after exposure for hours to a boiling heat. Washing these germs from the hay, we obtain an infective virus which, if communicated in the most minute quantity to a perfectly sterilized infusion of any kind, causes it in 20 hours to swarm with putrefactive organisms. It may be, for aught the Professor knew, the contagium of hay fever. Certain it is that in the nostrils of persons affected by this catarrh, *vibrios*, similar to those developed from the hay germs, are found in swarms when the fever is high. How would these obstinate germs act in the wards of a hospital? They cause both animal and vegetable infusions to putrefy. How would they affect the wounds and sores of living men? Would they succumb to ordinary disinfectants? These are questions of the gravest import, which the enlightened student of the antiseptic system will know how to answer for himself. Or, suppose a bunch of this hay shaken in the air of an establishment devoted to the preserving of meats and vegetables, is it not probable that the ordinary process of boiling, by which such preserves are sterilized, would be thereby rendered nugatory, serious commercial loss being the result? It may be added that a wiry hay from Guildford, which did not appear to be old, proved almost as refractory as that from Heathfield. Boiled continuously for four hours, these desiccated germs maintained their vitality unimpaired, while specially resistant germs defied five, six, and, in one instance, eight hours boiling. We now turn to another aspect of the question.

Following the plain indications of the germ theory of putrefaction, we sterilize in five minutes the very infusions which a moment ago were described as resisting five hours boiling. The germs are indurate and resistant, the adult organisms which spring from them are plastic and sensitive in the extreme. The gravest error ever committed by biological writers on this question consists in the confounding of the germ and its offspring. The active bacteria developed from those obstinate germs are destroyed at a temperature of 140° Fahr. Let us reflect upon these facts. For all known germs there exists a period of incubation, during which they prepare themselves for emergence as the finished organisms, which have been proved so sensitive to heat. If, during this period, and well within it, the infusion be boiled for the fraction of a minute, even before the boiling point is reached at all, the softened germs which are then approaching their phase of final development will be destroyed. Repeating the process of heating, every ten or twelve hours, each successive heating will destroy the germs then softened, until, after a sufficient number of heatings, the last living germ will disappear. If properly followed out, the method of sterilization here described is infallible; a temperature, moreover, far below the boiling point suffices for sterilization. Professor Tyndall showed infusions of mutton and turnip competent to resist five hours continuous boiling, but which had been reduced to utter barrenness by the proper application of a temperature of 160° Fahr. Numberless observations indicated that oxygen was necessary to the life of the organisms here under review. A thick scum would often collect upon the top of an infusion, which scum, greedy of oxygen, and appropriating it, permitted no trace of the gas to reach the infusion underneath, which remained on this account as pellucid as distilled water. Hence the idea of sterilizing the infusions by depriving them of air. This was done with perfect success. Subjecting an infusion for four or five hours to the action of the Sprengel pump, and subjecting it afterwards to one minute's boiling, with a view to extinguish its already expiring life, in the great majority of cases germs were destroyed. A minute thus accomplished what 300 minutes, in the presence of air, failed to accomplish. Here, as in all other cases, old and desiccated hay infusion proved most intractable. Nor is the effect here mentioned to be ascribed to a mere suspension of the life of the germs; they are deprived of life by being deprived of air, for when, after a sufficient time, germless air is restored to the infusions, it fails to revive them. It is obvious that these remarks also apply to infusions purged of air by boiling. There is a singular similarity between the vital actions of these lowest organisms and those of the highest. Privation of oxygen stifles both low and high, and excess of oxygen poisons both. Professor Tyndall exhibited infusions of beef and mutton which had been subjected for many weeks to a pressure of ten atmospheres of oxygen, which were sweet, transparent, and without a trace of life. In connexion with this subject, the Professor referred to the beautiful experiments of M. Paul Bert, and concluded his discourse with these words:—"I hardly think it necessary to summarize what has been here brought before you. In fact, the whole discourse is but a summing up of eight months of incessant labour. From the beginning to the end of the inquiry there is not, as you have seen, a shadow of evidence in favour of the doctrine of spontaneous generation. There is, on the contrary, overwhelming evidence against it; but do not carry away with you the notion sometimes erroneously ascribed to me, that I deem spontaneous generation 'impossible,' or that I wish to limit the power of matter in relation to life. My views on this subject ought to be well known. But possibility is one thing and proof is another, and when in our day I seek for experimental evidence of the transformation of the non-living into the living, I am led inexorably to the conclusion that no such evidence exists, and that in the lowest, as in the highest of organized creatures, the method of nature is that life shall be the issue of antecedent life."

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

Taken as an entity, the iron trade of this neighbourhood appears to be rather more encouragingly employed just at present, although it still cannot be said to be by any means brisk. A few of the larger concerns, such as Butterley, Staveley, and Thorncliffe, which have their own ironstone and fuel, are fairly well engaged, these facilities giving them advantages over their competitors, which enable them to underrate all the smaller firms, or those not so favourably circumstanced.

In pig iron prices have remained nominally at the same figures as those given in my last week's report, although there have been actual reductions of small per centages, in order to get transactions out of hand. At the same time it is felt that the weakness of the Scotch iron market may have a further similar effect here, unless the strikes in Lancashire and Northumberland have a natural tendency to make local producers inclined to be firm in their quotations where they can. Manufactured iron remains very quiet throughout Derbyshire, as well as in South and West Yorkshire, few of the works devoted to those branches being more than half employed.

In the brass trade generally there is no pressure of business, although some of the large establishments are still producing a steady output of taps, hydrants, and other articles required by water companies.

Steam coal is in better request at about the same prices, but the colliers strikes elsewhere are causing so many inquiries to come hereabouts that the local coalowners will, doubtless, soon alter their figures in an upward direction.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The strike in West Lancashire has now fairly commenced, but as the termination of the notices happened to coincide with the commencement of the Newton Races, which are always made a holiday time in this district, it is at present difficult to say how matters really stand. Nearly the whole of the men ceased work on Thursday and Friday, but whether the whole of them will remain out is doubtful, some of them having left their tools in the pits, evidently in the anticipation of an early return to work. So far as the masters are concerned, some of them have withdrawn their notices, but in the Wigan district the colliery proprietors appear to be tolerably unanimous, and unless more than two-thirds of their men at once return to work, many of them have determined to close their pits entirely, even taking out the ponies, which would indicate that they are preparing themselves for a protracted struggle. At present the notices affect upwards of 20,000 men, but not one-half of these are members of the union.

So far as trade is concerned, the market is naturally a good deal unsettled, but prices are not at present materially affected, and generally continue very low. Several gas coal contracts have recently been given out, and consumers have been able to place them at extremely low rates, colliery proprietors, as a rule, being unable to get more than 8s. per ton for good screened qualities at the pit mouth. In other classes of fuel pit quotations remain without material change, good Arley at the pit mouth being quoted at 9s. to 10s. per ton; Pemberton four-feet, 8s. 6d.; common coal, 6s. 6d. to 7s.; burg, 5s. 6d. to 5s. 9d.; and slack, 4s. to 5s. per ton.

The iron trade continues in a very depressed condition; there is little or nothing in the shape of legitimate business; what few purchases that are being made being mostly of small job lots, which are offered at very low prices. Local makers of pig, finding that they are altogether unable to compete with north country smelters in the common brands, are now turning their attention more to the production of hematites. The finished iron trade shows no improvement, most of the works being very badly off for orders, and prices continue low, Middlesbrough and Lancashire bars delivered into the Manchester district being still quoted at £6 12s. 6d. to £6 15s. per ton, and Staffordshire ditto at £6 15s. to £6 17s. 6d. per ton.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

Down to Saturday night the strike of the Northumberland miners continued, but there are hopes that affairs will be arranged this week; of course, the entire coal trade of Northumberland is stopped. The Durham collieries are very busy. The steam collieries of that county have received a large accession of trade. Turns range from a fortnight to three weeks. A good deal of what is called house coal has been turned into steam in this county since the strike. Prices for best sorts have advanced from 11s. 6d. to 12s. 6d. per ton. The price of gas coal is firmer, in consequence of the stoppage of the Northumberland trade, and the withdrawal of second-class Northumberland coals from the market, especially for local consumption; the second-class and inferior Durham coals in the colliery districts bordering upon the Tyne have advanced in price. The strike of the Northumberland miners is causing any amount of inconvenience to trade, and as the Newcastle Races will come round in a fortnight, it is pretty certain that the coal trade of the North of England will remain in a very disorganized condition during the whole of June.

Coasting freights are unsettled. There is a range of about 1s. per ton according to the demand and supply of tonnage. Through the close of the Northumberland coal trade ships have gone elsewhere than the Tyne, and business is more lively at Sunderland, Seaham, and Hartlepool than ordinarily. Generally speaking there is more life in the Durham coal trade than has been noted for the past two years.

The general manufacturing trade of the North has recovered a little. Chemicals were in better demand last week, and quotations were a little higher. The market has a tendency to stiffen. A fair amount of iron is being shipped. Prices are no higher, but any downward tendency is checked for the time. A fair amount of pig iron is sent abroad, and there seems more inquiry for certain sorts of manufactured iron. There is a moderate inquiry for fire-clay goods. The best shipments seem to be to France.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual general meeting of the Melrose Gas Company was held on Monday, the 4th inst.—Mr. Curle presiding. The accounts for the past year were submitted and read, and the usual dividend was declared on the £2800 stock of the company.

On Friday week the annual meeting of the directors of the Comrie Gas Company was held. Mr. McKenzie, secretary, gave in his report for the past year, from which it was shown that the affairs of the company were in a flourishing condition. There had been an increase in the consumption of gas during the year, which was believed to be owing to the reduction in price made last year. Notwithstanding the increase in the consumption, there had been a decrease in the expenditure for coal. The directors declared a dividend similar to that of last year—namely, 1s. per original share. It was reported that the works of the company were in good order, and that there was every reason to be satisfied with the manner in which the manager performed the duties of his department.

The following is a report of the quality of the gas supplied at Greenock during the month of May:—Number of experiments, 26; durability in minutes, 4-inch flame—minimum, 62; maximum, 72; average, 67.42. Photometer experiments, 26; minimum, 25.50 candles; maximum, 29.65 candles; average, 27.35 candles. Temperature of gas during testing, 59.15°. The gas was free from sulphur and all other impurities.

A meeting of the Finance Committee of the Dundee Gas Commission was held on Monday, the 4th inst., when the estimates of revenue and expenditure for the current year were submitted, and considered at some length. From the accounts it appeared that during the year ending on the 30th of April last, the revenue was £57,380 6s. 8d., while the expenditure had been £55,853 5s. 8d., leaving a balance on the right side amounting to £19,624 2s. 2d. It was resolved to recommend that the price of gas should be reduced from 4s. 5d. per 1000 cubic feet to 4s. 2d., with the usual discount of 5 per cent. for cash within 28 days. Gas has never, hitherto, been sold in Dundee at such a low price as that now recommended.

The Edinburgh City Analyst's usual report upon the gas supply was submitted to the meeting of the Town Council of Edinburgh, held last Tuesday. It stated the average illuminating power of gas supplied by the Edinburgh Gas Company, on the 30th of May, was equal to 27.60 standard candles, and that of the Leith Company to 26.50 candles.

Dr. Wallace's report on the condition of the Glasgow gas, for the week ending the 2nd of June, shows that in one instance the illuminating power was down as low as 25.35 candles, and that the maximum at the West Street station was 30.11 candles.

The subject of the Glasgow gas supply was under consideration at the monthly meeting of the Town Council, held last Thursday. Bailie Walls, in moving the adoption of the minutes of the Gas Committee, said he was glad to state that they had bought a considerable quantity of the first-class coals necessary at very reasonable prices, considering that attempts had recently been made to advance the price. They had bought about 25,000 tons at prices ranging from 6d. to 1s. per ton higher than they had paid last year, and they had the prospect of soon considerably increasing that amount at the same price. A good deal of talk took place on the question of testing the gas, but the Lord Provost said that the magistrates would see that the Gas Committee gave a supply of gas of the proper quality to the city. Dr. Wallace has recently furnished to the Gas Committee a report upon a series of tests made upon six of the fifty rheometers, which it was resolved to get some months ago for trial in some of the street-lamps.

Before leaving the subject of gas supply, it may be worthy of mention that the "Forfar Slander Case" is again in the Court of Session. On Thursday last the pursuer, Bailie Lowson, convener of the Forfar Corporation Gas Committee, gave notice of motion for a new trial. His advocate, Mr. Scott, asked the Court on the following day for an order to have the evidence printed, and he said that what the pursuer complained of was a verdict contrary to the evidence. He (Mr. Scott) held it to be proved that other people who saw the publication in which the slander occurred put the same meaning upon it as the pursuer did. The Court refused the order for printing, and the motion for new trial was put to the debate roll for an early hearing.

The inhabitants of Newport (Dundee) have taken steps to secure a full supply of wholesome water. The Water Commissioners, at their meeting on Thursday last, thought that a supply should be given at the north end of the bridge, charging a water-rate to be afterwards arranged. The

engineer of the Dundee Water-Works has, at the request of the Water Commissioners, prepared a report on an alternative scheme—the water in one case being delivered at the north end of Tay Bridge; and in the other, being carried across the bridge, and a reservoir formed at Wormit Hill. The cost of the scheme, it was reported, would be about £8278.

At the last meeting of the Police Commissioners of Forfar, a correspondence with the law agents for the Board of Supervision was read as to the closing of the action against the commissioners, with the outline of an interlocutor, agreeing to accept of the commissioners undertaking to carry out the scheme of Mr. Bateman's report on the water supply, under reservation of the board's right to apply again to the Court of Session should that scheme prove insufficient.

New water and drainage works for the burgh of Innerleithen were begun a few days ago, the first sod of the undertaking being cut by the Hon. H. M. Stuart, of Traquair, who has given the free right of the water of the Bold Burn to the inhabitants. Several speeches were delivered and toasts proposed. The works will be finished in about seven months, at a cost of about £6000. There will be laid some 3½ miles of iron piping.

The pig iron market has been somewhat steady during the past week. Business was done on Friday afternoon at 54s. 1½d. one month, closing buyers at 54s. cash, and sellers 54s. 1½d.

There is a very quiet condition of things in the coal market, and some descriptions of coal are very difficult to sell. Prices seem to be getting weaker, but there is no material change.

LUTTERWORTH GAS COMPANY.—The annual meeting was held on the 4th inst.—Mr. J. Fox in the chair. From the statement of accounts presented it appears that the amount received for gas during the past year was £766 14s. 10d.; for meter-rent, £39 13s. 3d.; for coke, gas tar, &c., £151 1s. 7d. The balance available for dividend was £199 10s. 11d. A dividend at the rate of 7½ per cent. was declared.

KIBWORTH GAS COMPANY.—The annual meeting was held on the 4th inst.—Mr. W. Grant in the chair. The report showed a slight falling off in the consumption of gas during the past year. The total income, including a balance brought forward, was £1390 5s. 3d., and the expenditure was £940 4s. 10d., leaving a balance in favour of the company of £450 0s. 5d. A dividend of 6 per cent. on the shares was declared, leaving in hand £210 0s. 5d.

THE RECENT EXPLOSION OF GAS AT BRIGHTON.—At the meeting of the Brighton Town Council on Wednesday last, the Town-Clerk reported that he had been served with notices of six actions against the corporation, by owners of property and others, claiming compensation for damage done to their premises by the explosion of gas at the south end of Market Street, on the 14th of March last, and which is alleged to have been caused by the corporation steam roller fracturing the main of the gas company.

SALES OF PROVINCIAL GAS SHARES.—At a recent sale by auction, at the "King's Arms," Folkestone, twenty-three £10 shares in the Folkestone Gas Company were offered. Thirteen of them realized £20 10s. each, three £20 12s. 6d. each, six £21 each, and one (of the new issue) £14 10s. At a sale by auction, at the "White Horse," Ipswich, last month, nineteen original £10 shares in the Ipswich Gaslight Company were offered. The first five were sold at £22 10s. each, the second lot at £22 2s. 6d., and the third for £22. The remaining four realized £22 each. Thirty-two new shares were then put up, and brought 15 guineas each.

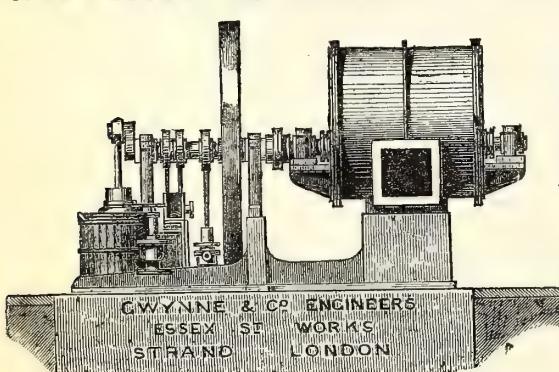
BURY GAS SUPPLY.—At the meeting of the Bury Town Council on Thursday last, a discussion took place with regard to the proposed reduction in the price of gas, the profits on the year just closed available for distribution between the corporation (in the reduction of rates) and the consumers (in the reduction of the price of gas) being stated at £8226. A resolution had been passed in committee, by the casting vote of the chairman, that the initial price of gas for the next twelve months should be 4s. 2d. per 1000 feet, 1s. per 1000 feet to be allowed for the consumers share of profits, and 2d. per 1000 for prompt payment. After an animated discussion, in which a strong opinion was expressed in favour of a still further reduction, the whole question was referred back for further consideration.

OPENING OF THE CLACKTON-ON-SEA GAS-WORKS.—On Tuesday, the 5th of June, the directors of the Clackton Gas and Water Company met for the purpose of receiving the engineers's report as to the completion of the new gas-works, after which they accompanied him over them, and witnessed the retorts charged and the gas lighted up with great success. These works are situated on the outskirts of the town, and are a model of their kind, being carefully designed so as to comply with present wants, and also to meet all future requirements. They have been constructed from the designs, and under the superintendence, of Mr. Jabez Church, C.E., of 17B, Great George Street, Westminster. This company have powers to manufacture and supply gas, and likewise to supply water, under a Provisional Order, granted by the Board of Trade. Messrs. Hanna, Donald, and Wilson, of Paisley, were the contractors for the ironwork, and Messrs. Saunders and Sons, of Dedham, Essex, for the brickwork. The engineer is preparing plans for the water scheme, which is to be shortly carried out.

DIRECT-ACTING HYDRAULIC MACHINES.—At a meeting of the Society of Engineers, held on Monday evening, June 4—Mr. Thomas Cargill, C.E., President, in the chair—a paper was read by Mr. Ralph H. Tweddell on this subject. The author first described the cases in which gearing by shafting, wheels, and belts was used for driving machinery. He then alluded to the advantages of that mode of transmission, especially in large workshops, where the machines were placed far apart. After considering the transmission of power by steam for driving small engines on each machine, he proceeded to describe his application of hydraulic pressure to the transmission of the power, and also to working the tools themselves. To illustrate this part of the subject, he described the differential accumulator, by the special construction of which the effect of a blow is obtained, as well as a steady pressure; and referred to the success which has attended the adoption of his hydraulic rivetters to this combination. After giving some data as to the working of the portable rivetter, one of which can close 5000 ½-inch rivets in 9½ hours, he described the hydraulic plant at the Toulon Dockyard, where the principal machine shop, 380 feet by 170 feet, is fitted up entirely on his system. Confining his advocacy of hydraulic power to special applications, he claimed that, for certain stated purposes, as compared with gearing, it was cheaper, because it effected a saving in the cost of buildings; safer, in that there was no shifting of belts; more economical, because pipes never got out of order, while shafting always required attention; more efficient, because the friction, &c., in shafting increased the wear and tear; and also because with shafting, to work the smallest machine in a shop it was necessary to drive all the shafting, whereas with water it was not so. Comparing hydraulic with steam power, he showed that, owing to the limited pressure obtainable by the latter, it could never compete with water at 1500 or 2000 lbs. per square inch, even for fixed tools, and that for portable machines it was totally inapplicable.

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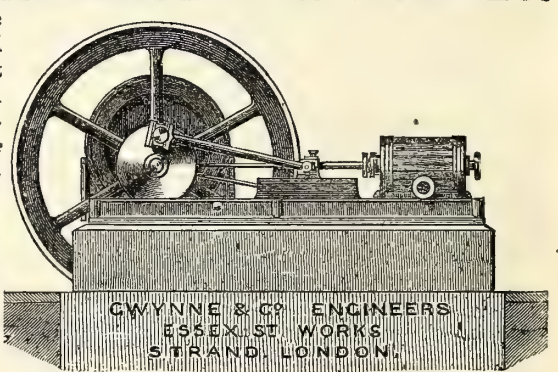
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SUPPLEMENT

TO THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

Vol. XXIX.

LONDON, JUNE 12, 1877.

No. 735.

Parliamentary Intelligence.

HOUSE OF COMMONS COMMITTEE.

WEDNESDAY, MAY 9.

(Before Mr. D. R. PLUNKET, Chairman; Mr. FOLJAMBE, Mr. STARKEY, and Mr. COURTNEY.)

THE GASLIGHT AND COKE COMPANY BILL.

(Continued from p. 912.)

Mr. Lewis Angell, examined by Mr. MICHAEL.

I am a member of the Institution of Civil Engineers, and also engineer to the West Ham Local Board of Health. I reside in Stratford. The Bromley works of The Gaslight and Coke Company are situated in Canning Town, in the parish of West Ham. The nuisance is one of the most intolerable I have ever experienced. The West Ham Local Board have had complaints from residents a mile and a half to two miles from the works. There is a population of 100,000 people in West Ham, besides the surrounding populations of the adjoining districts. Those complaints have been received from all classes, from the highest to the lowest. We have also had memorials from the Metropolis on the other side of Bromley and Bow. We have had private letters sent to us, and also the officials of the populous district have communicated with us, in order to put the law in force. We have been complained of very seriously because we have not put the law in force, it being alleged that the board have not taken sufficiently energetic means to suppress the nuisance. We have had an influential memorial from residents in the metropolitan district, signed by the Vicar of Bow, Sir Edmund Hay Currie, and people of that class. I have traced the nuisance to the gas-works. Proceedings are pending at the present time, by the local board, against the gas company in the superior courts. The West Ham Gas-Works, also within our district, do not create any nuisance whatever. I have heard no complaint, nor have I at any time traced anything to them. I believe they are not under any obligation to reduce the quantity of sulphur to 15 or 20 grains. They use the oxide of iron process. They used lime some few years ago, and then there were occasional complaints; but since they have given up lime there have been no complaints. I have not heard any complaints that their gas is more impure than the gas supplied by The Gaslight and Coke Company. I burn the West Ham Company's gas, and have not found any bad consequence resulting either to property or health. I have not seen any evidence of the West Ham gas producing those results which are said to arise from having a larger quantity than 20 grains of sulphur. My gilt frames are the same as average gilt frames, and not in any way darker than those in other districts. There is no injury to property which I have traced to sulphur in gas. If that injury had arisen from sulphuric acid, it would hardly have occurred without my noticing it.

Cross-examined by Mr. O'HARA: I live at the Grove, Stratford, which is about a mile and a quarter, I should think, from the gas-works. I have been woke up in the early morning by the smell; it is so conspicuous and intolerable that there is no mistaking it.

Mr. O'HARA: As to these proceedings in the superior courts, do you know who advised them? How did you begin them?

Witness: In consequence of the complaints which were made. It is one of the standing discussions at our board; there is scarcely a meeting at which this matter is not mooted. Our clerk is the solicitor to the board, and he was instructed to take proceedings against the company, and the board certainly entertain the hope that those proceedings will be successful. Of course, we shall be quite satisfied if the stink is abated.

By Mr. ROUND: The company's officials have told me that they have adopted the very best practical process for purification—namely, the process prescribed by the Referees—and that they can do no more. They admit the nuisance, but they say that they can do no more than they are doing to abate it. I have been over the works repeatedly, and have been shown what they were doing, although I am not sufficiently a gas engineer to be able to form any judgment about it; but I considered they were doing all they could.

By the COMMITTEE: The West Ham parish is a very extensive one. I am living about half a mile from the West Ham works, and therefore very much nearer those works than The Gaslight and Coke Company's works. The West Ham works are in the midst of our population. There is a very great difference in the relative size of the works. The West Ham Gas-Works would perhaps be about one-fourth of the size of the Chartered Company's works. They supply a large district out by Woodford and Loughton. We suffer no inconvenience whatever from the West Ham Gas-Works.

Mr. Richard Henn Collins, examined by Mr. MICHAEL.

I am a barrister-at-law, and have resided at 32, Redcliffe Gardens since July, 1873. I was absent from London on circuit during the greater part of the summer of that year, and then went away for the long vacation. After my return I perceived a most offensive smell. I cannot say that I traced where it proceeded from, but I was told. I observed the smell particularly in the mornings, often about five o'clock. I have been awakened by it. I have gone from one side of the house to the other to see whether it was on both sides of the house. I found it came in through the windows on one side, and then I went to the other side of the house, and found it came in through the windows on the other side. It was about as unpleasant a smell as one can possibly imagine. In the summer of 1874 the smell was so very bad that I seriously thought of leaving my house. I frequently spoke to the builder who owns most of the houses in the place, and told him I must try to get some joint action taken by the householders in the place to indict the

company, or to get the vestry to remove it, otherwise I said that I, and no doubt others, would find it necessary to give up our houses.

Cross-examined by Mr. O'HARA: I went to see Mr. M'Clymont, and told him that what we wanted was joint action, to put down this nuisance by indictment.

Mr. O'HARA: Have you ever looked into the Gas Act?

Witness: No, I cannot say that I have.

Why would they not take joint action?—I understood they were taking joint action, or that the vestry were going to take it, and I am not sure that they did not begin.

Supposing they were by indictment to put an end to this nuisance, would that satisfy you?—I would not be particular as to how it is put an end to.

You are not particular whether it is done here or in Westminster Hall?—No; on the contrary.

By the COMMITTEE: I have repeatedly tried to stir the inhabitants up, but always in the hope that some action would be taken by the landlord particularly, because he owns an immense tract of new building land all about there, and I thought he would be a very likely man to set the thing going.

The COMMITTEE: Have you any idea why he discontinued the proceedings which he began?

Witness: I should state that I am not quite clear whether the proceedings ever got so far as being actually commenced. He told me that the gas company were themselves trying to get rid of the obligation to make this stench, and that is the last thing I heard about it.

The CHAIRMAN (addressing Mr. Michael) said: Perhaps you will be kind enough to answer this question. How would it be supposing the local authority indict for a nuisance—will their statute protect the company? Is the indictment to be tried first, and then, in the event of its succeeding, and not until then, the Referees are to alter the limit?

Mr. MICHAEL: That would not, with great deference, touch the Referees at all.

The CHAIRMAN: I want to know whether it requires it to be such a nuisance as would be proved by a successful indictment?

Mr. MICHAEL: I shall be glad to have an opportunity of putting you in possession of what course must have been in the minds of the gas company when they consented to such a clause as that—perhaps it was forced upon them—or what would be the logical sequence of such a clause. Supposing gentlemen were appointed as Referees who were all practically acquainted with the manufacture of gas, then, in other words, this clause says: You shall impose such a limit, judged of by your practical experience in gas-making, as will allow the gas company to manufacture gas without creating a nuisance. There is nothing provided that will enforce the Referees (it is a matter for their private opinion) to say, "We think you can, if you so will, reduce the quantity of sulphur to 5 grains." There is no appeal given.

The CHAIRMAN: Perhaps it is my own fault that I have not made clear what I was in doubt about. Do you consider that it is entirely in the discretion of the Referees to say what is and what is not a nuisance? For instance, suppose Mr. Collins had himself applied to the Referees, or suppose Sir Edmund Currie had gone on behalf of 50,000 people whom he spoke of, would the Referees then, do you think, have it in their discretion to say whether it amounted to such a nuisance as was contemplated by this section without further proof?

Mr. MICHAEL: The view I take of it (it matters nothing what another tribunal may say) is that it leaves this matter entirely untouched. It does not say that a nuisance shall be created, but it says that the gas shall be purified in such and such a way. The only restriction is that they shall not impose such a limit as that it cannot be done without creating a nuisance, which is another point entirely. That you may prove before a tribunal that a nuisance is created, does not at all touch the discretion of the Referees. There is no obligation on them to say, "You shall conduct it by such and such a process;" so that, although you may have one thousand injunctions, it does not touch the discretion of the Referees at all. They will say, "It is simply for you to decide which plan you will adopt."

The CHAIRMAN: I think you hardly see my point. What we want to arrive at is whether it is not possible for the Referees to be informed of these things, and as soon as possible then to alter and remedy them if they think fit. Suppose there was a successful indictment, and the Referees were aware of that, and they went to the gas company and ascertained that all due precaution had been taken, would you consider that they would be obliged to alter the limit of restriction?

Mr. MICHAEL said the indictment did not alter the state of things at all, seeing that they must have known that there was a nuisance at that time in the locality, and yet they had insisted on some kind of process which would inevitably produce a nuisance. There was no power of appeal from the Referees. Supposing there were an indictment for a nuisance; then there would be an injunction by the Court of Chancery, after indictment, to prevent the company carrying on purification by lime, because it was quite clear that the High Court of Chancery had nothing whatever to do with the defence, which merely raised the point that it was impossible to do it in any other way. All the decisions of the Courts came to one thing. It was nothing to the Court that it could not be done in any other way. In the case of injunctions with reference to the pollution of rivers by sewage and other matters, where the local authorities had said, "You cannot prevent us pouring sewage into the river, because there is no other course open to us, and, therefore, you will cause a destruction of health to the whole of the inhabitants, by preventing us carrying out the only available plan," the Court had said, "It is nothing to us; all we

can do is to restrain you from committing a nuisance." Following that out in the present case, the Court would most likely say, "Before we grant an injunction you must proceed at law, and prove that there is a nuisance." Supposing that the nuisance was proved to the satisfaction of the Court, it would be in the discretion of the Court to act in accordance with all their decisions, and to say, "You shall not use lime." But what was the result to the Referees? If the Referees were to continue the restrictions, as far as the present state of knowledge was concerned, as lime was the only mode—if the evidence was to be believed—by which the gas could be purified at all, there were no means of enforcing it on the Referees, because the nuisance had been created by the mode which had been adopted. They would say, "There is nothing in any way imposed upon us, by the Act of Parliament, to dictate to you the means to be adopted to prevent a nuisance. All we have to do is simply this. The Act says this: 'You shall not put more than 20 grains of sulphur in your gas;' but you may use whatever means you like. We believe it can be done without creating a nuisance, and there is an injunction against this mode; an indictment does not touch it at all, and we believe you can do it without creating a nuisance."

The CHAIRMAN: Do you mean by an alternative process?

Mr. MICHAEL said by any process. It was not for the Referees to dictate what the process should be. If there were anything to say that the Gas Referees were obliged to show the gas company how their restrictions could be carried out, and that only that process should be used, then there would be relief to the gas company; but now they had an arbitrary power, and it was entirely within their discretion to say what it should be. If they had ever indicated that there was another process which might be adopted instead of the lime, in order to avoid that nuisance, then the company's case would be very much weakened. But they had never indicated any other way of doing it.

The CHAIRMAN: I think, Mr. Michael, that you hardly see my difficulty. One would think the obvious way of remedying this, if there be a nuisance, is that the people so affected, as so many preliminary steps are required for the construction of this Act, should go to the Referees, and say, "We have a grievance," and that then the Referees, among whom there happens to be an experienced gas engineer—

Mr. MICHAEL: No, sir; pardon me, there is not.

The CHAIRMAN: That is another question. At any rate, they must be supposed to be competent and impartial persons. One would suppose that the next step would be that they should inquire at the gas-works whether there is a nuisance, the cause of which can be cured by an improved system; but if they find that all the precautions they can suggest are being taken, and that still the company are under the danger of a prosecution at any time, or an indictment, is it conceivable that they would act so unreasonably as to give the company no alternative?

Mr. MICHAEL: It is not only conceivable, but we shall prove to you that it is absolutely the fact. We have placed everything at the disposal of these gentlemen; we have spent thousands of pounds to carry out their suggestions. They have never said to us, "Use the A, B, C, or D process," or any process, that we have not adopted. We do not find them coming here and saying, "If you will only modify this process you will prevent a nuisance." That is exactly our position.

The CHAIRMAN: You say you do not consider the word "nuisance" in this section is a technical term. You do not mean to say such a nuisance as would have to be proved by indictment, but you consider it to be used in the ordinary and popular sense.

Mr. MICHAEL: I am quite willing to take it either way; but I believe it is the legal sense of a nuisance. I do not know whether you had in your mind the definition of a nuisance which has been held under the Public Health Act, namely, that of injurious to health.

The CHAIRMAN: Yes.

Mr. MICHAEL: I do not think it was intended to be confined to that.

The CHAIRMAN: I am thinking of a common ordinary nuisance for which you may indict at common law.

Mr. MICHAEL: There has been rather a strict definition given to "nuisance" under the Public Health Act. I think it is wider than that.

The CHAIRMAN: It would hardly apply unless there was an interpretation clause.

Mr. COURTNEY: Your situation may be analogous to that of a Board of Health who are the owners of a piece of ground between two mills; they are not allowed to turn their sewage into the stream because of injuring the stream; they are obliged to get rid of it somehow or other. But in this case you are under the orders of the Gas Referees, who, by clause 36 of your Act, are instructed to prescribe and certify the maximum amount of impurity in the gas, subject to the condition that their orders shall not require you to make a supply of gas continuously, so as to occasion a nuisance. That is a statutory restriction upon their order. Has it occurred to you that you might possibly go to the Court of Chancery and apply for an injunction to restrain them issuing a certificate which imposed upon you a duty which could not be fulfilled without creating a nuisance?

Mr. MICHAEL: It has occurred to other parties, although it has not occurred to us, because, as I venture to say, there is an entire loophole in the whole matter. It all comes to this: What is the process? Are you tied up absolutely to that process or not? It involves an entirely different matter.

Mr. COURTNEY: That will be a question of evidence.

Mr. MICHAEL: It does not say that they shall prescribe a process which absolutely and indispensably will not create a nuisance.

Mr. COURTNEY: That is quite true, so you might be under the difficulty of having to prove a negative before the Court of Chancery, supposing you went there.

Mr. MICHAEL: We should have a double onus thrown upon us of proving a positive and a negative. I think in the Tunbridge Wells case, and other analogous cases, it has been held that the Court of Chancery has nothing whatever to do with the process, and that all they have to do with is to lay down fixedly the law, "You shall not create a nuisance." It is no defence whatever to say that you do not know of any process by which this can be done without creating a nuisance.

Mr. COURTNEY: That is quite a different point. My question is whether you could not yourself institute some process to restrain the action of the Referees.

Mr. O'HARA: To relieve you from committing a nuisance.

Mr. MICHAEL: What can be the difference between our proving it to the Court of Chancery and our proving it to the committee? If this involves a hardship upon us, and involves the necessity of the same proof that we should have to give to the Court of Chancery, is it not right that we should come to you, and ask you to legislate for us, and give us that relief which you say we ought to be permitted to obtain from the Court of Chancery? It is by the action of the Legislature that the difficulty has arisen; therefore, is it not better for us to come to you and ask you so to deal with the law, with better knowledge, so as to relieve us from being between the two stones under the action of which we are being ground to powder?

Mr. O'HARA: The 30th section prescribes the duty which the Referees have to perform, coupled with certain conditions. The moment the Referees perform that duty, and forget the conditions, they are acting

ultra vires. Let the company refuse to obey the order of the Referees when that order is *ultra vires*, and then who will enforce the penalty? That is the way to test it. In one case you propose to relieve the company from being obliged to obey; in the other case I say let the company defy those who are doing what is illegal and *ultra vires*.

Mr. MICHAEL: That is a very nice state of things. Here you are representing the Metropolitan Board of Works, who have passed a law, and they recommend the gas company to place the law at defiance. They have got a pecuniary interest, because they get the penalties of our breaking the law. They advise us to break the law in order to avail themselves of the penalties.

Mr. O'HARA: We say that the Referees act thoroughly within the law, and that there is no breach of the law, and you dare not defy them.

The CHAIRMAN: May I ask by which side the Referees will be called, because it seems to me that this Act of Parliament contemplated that the Referees might carry out its provisions according to the intention of the Act?

Mr. MICHAEL said the course which had usually been adopted was that neither side should call the gentlemen exercising such functions, but that the committee should themselves call them.

Mr. ROUND said he was instructed to appear by the Board of Trade, who had no opinion whatever upon the merits of this Bill, as to whether it was proper that the restriction which was placed last year upon the company should be repealed now or continued. All they felt was that, so long as their officers, to whom certain duties had been entrusted, exercised those duties to the best of their ability, and in the discharge of them had not laid themselves open to any imputation of *mala fides* or corruption in any way, it was a matter of indifference to them. He did not himself propose to put the Referees into the box, as he did not conceive it was at all necessary for the purpose of defending what they had done. They were simply discharging their duty, according to what seemed to them to be the mode defined by the Act of Parliament, and they had nothing whatever to do with what the results might be. Of course, if the committee thought that the Referees could give any information, they, in the exercise of their discretion, would take what steps they thought right.

The CHAIRMAN: What do you suggest is the check upon the Referees in the discharge of their duty? I suppose they would not be re-appointed next year if there were complaints made to the Board of Trade. Is that the remedy, or what is it?

Mr. ROUND said the Referees might be bound, in the exercise of their discretion, to see whether or not, in their judgment, everything had been done that could be done. It did not devolve upon them either to suggest or to dictate to the company any particular process by which the purification could be carried out. The Referees might be entitled to say, "There is not uniformity in your system; you adopt one process at one branch, and another process at another branch. We have formed the opinion that at A, where you have adopted a certain process, there have been no complaints of a nuisance; but at B, where you have adopted the same process, or have adopted a different one, there are complaints." The Referees might say there was want of uniformity.

Mr. MICHAEL: Do you say that that is the case?

Mr. ROUND: I am merely putting that as an illustration.

Mr. MICHAEL: If so, I suppose the Referees will be called to prove it.

Mr. ROUND said the Referees were no partisans in any way whatever: they were simply discharging a public duty. The Board of Trade thought it was incumbent upon them, if the conduct of the Referees was inquired into, to see that they should not be unprotected; but their view was that they had nothing to do with the question raised by the Bill or otherwise. They had appointed good men, as they thought, and until their conduct was impugned in any way, it was not proposed to call them.

The CHAIRMAN: We do not in the least impute any misconduct to them, but the phase which the case seems to take now is this: On the one hand the gas company say, "It is impossible for us to conform to your requirements without creating a nuisance," and, on the other hand, the public say, "It is impossible for us to endure this smell." The Act of Parliament says, "You are not to inflict such a limit of impurity as will create a nuisance," and what we want is to have an explanation from these public officers.

Mr. ROUND said the duty imposed upon the Referees was to reconcile two things—viz., a certain maximum amount of purity of gas coupled with no nuisance.

Mr. MICHAEL hoped that it would not be thought that he imputed any kind of misconduct on the part of the Referees, as he begged to disclaim that most entirely.

The CHAIRMAN requested the Referees to be in attendance on the following day.

Mr. ROUND said he ventured to think that the whole case should be concluded on the part of the promoters, and that then any explanation which the Referees could give should be given. If the Referees were called at that stage, it would be practically giving the company an opportunity of shaping their case so as to be a reply upon the Referees.

Mr. MICHAEL: If there is anything presented by the Referees against us, ought we not to be able to answer any allegation they may make? Is it not your wish that the committee should hear the whole case, and know the whole truth of the matter?

The CHAIRMAN said the present application was made on behalf of a company who were asking for an alteration in the Act of Parliament under which they were working. It turned out in the course of the inquiry there was a state of affairs apparently existing which had not been explained, and the committee thought that the people who could best explain it were the Referees themselves, the question being as to the exercise of their discretion as public servants. The Referees were the servants of the Board of Trade, and, therefore, they did not come as partisans for one side or the other, but only to explain their conduct. There was no imputation of *malfaisance* upon them; but there was a state of affairs which the committee did not quite understand, and which required clearing up.

THURSDAY, MAY 10.

Lord Charles Thynne, examined by Mr. MICHAEL.

I have resided at Redcliffe Gardens since the year 1870. When I first lived there I remarked that the neighbourhood was so singularly free from any bad smell that I determined to purchase the house. After my return from Ireland in 1873 we were very much annoyed by a most disagreeable smell, that pervaded the whole house when all the doors and windows were closed. In consequence I wrote to the Metropolitan Board of Works, and complained to them upon the subject. A rigid examination was instituted in the sewers and drains, and it was found that no bad smell arose from that source. It was subsequently traced to the works at Fulham of the late Imperial Gas Company. I inquired there as to the source of the nuisance, and I was told it was the result of a process of purifying the gas, which had been changed in 1873. Up to the present time I have found that the nuisance has been of an unfailing and unendurable character; of course, it depends upon the quarter of the wind. When the wind is in the south or south south-east, which is in the direction of the Fulham station, I suffer from it very considerably, but not when it is in other quarters.

Cross-examined by Mr. O'HARA: I made a representation to the resident engineer of the gas company a few months ago. I took no further steps beyond calling upon the Metropolitan Board, because it seemed hopeless. They told me at the gas-works that it was due to a new process of purification.

Mr. John William Mellor, Q.C., examined by Mr. MICHAEL.

I have resided in St. George's Square since the end of 1866, and my house has been subject to bad smells at intervals ever since. I think recently the smell is rather worse. I usually perceive it when the wind is in the east. My house is on the west side of the square, and the smell comes straight across from the gas-works. I think I can remember about half a dozen instances in which the smell has been very bad in the night. I have been awakened, I think, three times myself by the force of the smell. I generally walk from my house to Westminster in the morning. I walk along the Grosvenor Road, and as soon as I get near the gas-works the smell is perceptible every day. The very bad smell of which I complain has only been perceptible in the night on about half a dozen occasions. It produces a suffocating feeling, but I cannot say that I have been sick, although it has made some of my children feel sick. I feel it chiefly with a moist atmosphere, undoubtedly. I have been to the gas-works to make inquiries, and ever since 1866 I have received assurances from the persons to whom I complained that the works would probably before long be taken out of London, and I, sincerely trusting that that might be the case, took no further steps until the letter was written which was read to the committee yesterday. I should like to say that the gas is manufactured in a low building, which, so far as I can see from passing, has open windows with wooden bars across. It occurs to me that the place in which these works are situated is a very bad one for the neighbourhood; and that is, I believe, the general feeling of the inhabitants of St. George's Square. Upon the night before that letter was written—it was written on the 23rd of November—I had suffered very much from this smell. There are 124 houses in St. George's Square, and I went to No. 124, the office of the trustees, to complain. As I was going there I met a friend, General Anstel, and I found he was going for the same purpose as I was. We compared notes, and I suggested that a strong remonstrance should be sent to the gas company. I saw Mr. Sclater-Booth, and afterwards we agreed to send the letter. At that time we were not aware that any Bill was about to be promoted by the gas company. I think very probably, if we had been aware of it, we should have had a meeting, and endeavoured to be represented upon the occasion, because this matter has been a serious nuisance to many of the inhabitants.

The COMMITTEE: Do you mean to say you would have supported the Bill?

Witness: That I cannot say. I am not sufficient chemist to know whether it is the fault of the gas company or not; but when the letter was written my strong impression was that it was owing to the negligent way in which the gas was purified. I am told by the gas company that I am wrong in that, but I thought it desirable the committee should know my view.

Mr. ROUND said that in conformity with the wish expressed by the committee, two of the Referees, Mr. Vernon Harcourt and Dr. Pole, were present, and were prepared to give the fullest information upon any subject on which it was desired.

The CHAIRMAN: As you were present yesterday when the idea arose of asking those gentlemen to attend, if you will be good enough to commence the examination, then we can ask them whatever we think necessary.

Mr. Augustus George Vernon Harcourt called.

The CHAIRMAN (to witness): I wish to say that we have not asked you to come here as a witness either in support of the Bill or against it; but we have thought that perhaps it would shorten the inquiry, and be the most convenient process, if you would throw some light upon the practical operations by which you execute your office under the clause of the Act.

Witness (in examination by Mr. ROUND): I was appointed one of the Gas Referees in 1862, in connexion with Dr. Pole and Professor Tyndall. The first step we took with regard to the carrying out of section 30 in The Gaslight and Coke Company's Act of 1876 was to put ourselves in communication with the engineers of that company. We visited the different gas-works, to observe what modes of purification were in use. With the exception of the small Silvertown works, which we had not to do with, we visited all the works shown on the map. The first notification we made as to how many grains of sulphur might be allowed, consistently with the non-creation of a nuisance, was in September, 1872. The maximum amount that we thought justifiable in prescribing was 20 grains for the suburban works of Bow and Beckton.

Mr. ROUND: How far may that be said to have been done with the assent, or, at least, without the dissent of the gas company?

Witness: We endeavoured, as far as we were able, to obtain the assent of the gas company.

May I say that you succeeded? Can you fairly say that they were parties to that maximum of 20 grains?—I do not know how far; I can say that their assent was not required, but we endeavoured to obtain it.

Was there any direct opposition on their part?—I believe it was understood that we were required to fix a maximum, and, as far as my memory serves me, the maximum prescribed by us was considered reasonable. The following are our certificates since 1872:—

Half-yearly Periods.	Suburban Works. Grains.	Urban Works. Grains.
Winter half year, 1872-3	20	—
March to June, 1873	20	—
June to September, 1873	20	25
Winter half year, 1873-4	20	30
Summer half year, 1874	20	25
Winter half year, 1874-5	20	25
Summer half year, 1875	15	20
Winter half year, 1875-6	20	25
Summer half year, 1876	15	20
Winter half year, 1876-7	20	25

For the urban works the amount of sulphur was only recorded for 1872 and 1873; a portion of it was not fixed, but from June to September, 1873, we prescribed the actual amount for both suburban and urban works. In prescribing the various amounts of purity we thought we were acting conscientiously and in the discharge of our duty, and that we were prescribing an amount that was reasonable and practicable to obtain. During the first four years—from 1872 to 1876—complaints about the nuisance were comparatively few and unimportant; there have been more complaints within the last six or nine months than during all the preceding period since we have been Referees. Shoreditch, Pimlico, Fulham, and Bromley are the four stations from which we have complaints.

Mr. ROUND: As to each and all of them, you have been asked by the Board of Trade to inquire into and make special reports, have you not?

Witness: We have visited them all.

Mr. MICHAEL: Would you kindly answer the question?

Witness: I believe it was not for the Board of Trade that we were

asked to visit them in all cases. The reason I so limited my answer was, that I believe, in the case of the Pimlico works, it was a letter which was forwarded to us addressed by the solicitor, I think, of the gas company to us. It was not the Board of Trade who set us in motion in that case.

Mr. ROUND said he would confine the matter in the first instance to the Shoreditch case, and would read a letter, dated the 18th of October, 1876. It appeared that Mr. Walker, the vestry-clerk, addressed a letter to the Secretary of the Board of Trade, to the following effect:—

I am directed by this vestry to call the attention of the Board of Trade to the fact that a great and unbearable nuisance is caused by the operations carried on at the works of The Gaslight and Coke Company in Haggerston, which, it is alleged, arises from the mode of purifying the gas from lime, rendered necessary by the Gas Referees having prescribed a standard of purity which cannot be obtained without causing the nuisance complained of. The particulars are more fully set forth in the report (copy enclosed). I am to ask whether the Board of Trade are prepared to advise that the orders of the Referees may be so relaxed as to permit the nuisance complained of being discontinued, otherwise this vestry will have no alternative but to apply to the Court of Chancery to restrain the company from pursuing its operations.

[The report which appeared in the JOURNAL of Oct. 24, 1876, page 597, was read.]* That letter was signed Henry G. Sutton, Medical Officer, and E. Walker, Vestry-Clerk, and was sent to the Board of Trade, who addressed the following letter to the Referees, dated Oct. 20:—

Gentlemen,—I am instructed to transmit to you herewith a letter which has been received from the vestry of St. Leonard, Shoreditch, complaining of a nuisance caused by the works of The Gaslight and Coke Company at Haggerston, and to request that you will favour the Board of Trade with your observations thereupon.

To that letter, the following reply was received, signed by Mr. Vernon Harcourt, and addressed to the Board of Trade:—

I beg leave to acknowledge the receipt of your letter of the 20th inst. It shall have the attention of the Gas Referees, and we will send our observations thereon to the Board of Trade shortly. The Vestry-Clerk of St. Leonard, Shoreditch, having furnished us with copies of their letter to the Board of Trade, and its enclosure, I return the originals herewith.

On the 22nd of November, 1876, the following reply, signed by Mr. Vernon Harcourt and Dr. Pole, was sent to the Board of Trade. [See JOURNAL, Jan 2, 1877, page 17.]

Examination resumed: I formed my opinion from statements made to me at an interview at our office, at which the secretary of the company and the superintendent from those works were present; and from the account they gave of the nature of the nuisance, and from the statements that the smell which they considered had been objectionable was the smell of heated naphthaline. I also arrived at the conclusion, which was formed from inquiries upon the spot, that the nuisance arose from accidental miscarriage of the process of ventilating the purifiers, which had resulted in producing the high temperature in the oxide purifier, through which the air which is passed through the lime purifier is sent. The wooden sieves, I understood, had been burnt, and, as far as I could judge, the nuisance had been occasioned by that exceptional cause.

Mr. ROUND: I think prior to that the company had asked you to come and meet them upon the spot. This is a letter by Mr. Phillips, addressed to you, dated the 11th of October, 1876:—

Dear Sir,—Our engineers are experiencing difficulty in dealing with their foul lime, and notwithstanding all the pains they take, they are threatened with legal proceedings on the ground of nuisance. In the hope of being able to obtain some amelioration of your notification, the directors are very anxious that I should see you and your colleagues.

Then there was a meeting held, and you acceded to their request and went, did you not?

Witness: We visited Haggerston, as appears from this letter.

Mr. MICHAEL: You answered that letter on Oct. 17, 1876:—

I can meet you in town on any Monday, Wednesday, or Friday, that may be convenient to you. Shall it be next Monday, at our office, at eleven o'clock? I will write to my colleagues to endeavour to make an appointment for that day. I have written to our clerk to direct him to send you the six copies of our last notification, for which Mr. Bush has asked."

Witness: It was in consequence of that letter that the interview took place, at which Mr. Phillips, Mr. Clark, and, I think, also Mr. Evans, were present, and it was from the statements made at that meeting that I first formed the opinion that the nuisance was due to the miscarriage of the ventilating process.

Mr. ROUND: You told me what your opinion was. I only wanted to show how it was that you formed this opinion. Then, on the 24th, they write you this letter, signed by Mr. Phillips:—

While we were with you yesterday, the parish authorities of Shoreditch were at our works there, and, I am told, came to the determination to apply for an injunction to restrain us from the use of lime. I do not like to appear unduly pressing, but I cannot help thinking that your decision admits of no delay. A suspension of your order would allow us to use oxide of iron for the moment, and give you time to reconsider the whole question.

On the following day you answer that letter, writing to Mr. Phillips, and say:

We will reconsider the question of the difficulty of lime purification in London as soon as possible. I believe Dr. Pole will be in London before the end of the week. I wish to see the process of purification at Shoreditch, which is the subject of complaint. Friday, the 27th, would suit me, but if Mr. Clark has to attend your board meeting, I would postpone coming till Monday, the 30th; meantime I think it likely that the remedy lies in your own hands. Both from the account of the nuisance given by Mr. Evans and Mr. Clark, and from the fact that lime purification has been carried on for between two and three years without this outcry arising, I incline to think that the aëration of the purifiers is the cause of the nuisance. If the gas is thoroughly purged from ammonia before it enters the purifiers, and if the foul lime is got quickly into barges and sent away, I believe after much watching of the process that nuisance may be avoided.

Mr. MICHAEL: You have not visited the works then; it was a visit to your office that Mr. Phillips made?

Witness: It was an appointment to meet at our office in the first place.

Mr. MICHAEL: All this took place before the visit to the works?

Mr. ROUND: It is, nevertheless, the fact that you went there and witnessed the opening of one of those purifiers?

Witness: Yes; the interview you have referred to took place prior to the letter that you read.

You went there and saw one of these purifiers emptied?—Yes.

You had better explain what was the conclusion you arrived at when you saw it opened?—It was the conclusion stated in the letter—that the nuisance was due to a temporary cause, and then at the time of our visit the nuisance was very slight, and we found by inquiries among those who lived round the works that some had observed no nuisance, and that those who had observed the nuisance referred it very constantly to the period at which this over-heating of the purifiers had taken place.

Mr. ROUND: I think that explains Shoreditch, as far as I am able to deal with it.

Mr. MICHAEL said there were two letters which he thought ought to be read, of Nov. 6 and Nov. 9.

Mr. ROUND said he would read the letter from Mr. Vernon Harcourt to Mr. Clark, dated Nov. 6:—

The Gas Referees are desirous of witnessing the operation of opening and emptying a

* It is intended to reprint, in a pamphlet, the whole of the proceedings on this Bill and that of the Crystal Palace District Gas Company. This report, together with such portions of the correspondence as has recently appeared in the columns of the JOURNAL, will then be inserted in *extenso*.

lime purifier, as conducted at your works. The rate at which the purifiers become exhausted is probably known to you sufficiently to enable you to name one or two days between which we may choose. Friday next would be convenient to me, or the Monday following. Please address your answers to the Gas Referees at this office.

The letter of the 9th was written by Mr. Vernon Harcourt to Mr. Clark:—

I am obliged by your letters of the 7th and 8th. To-morrow (Friday) would have suited me; but I hear from Dr. Pole that he will be engaged, and I do not know whether Dr. Tyndall would be able to come. I think, therefore, it will be best to fix a day, if possible, sufficiently beforehand for us all to come. I understand that you have to change about three purifiers a fortnight, and think, therefore, that next Thursday or Friday (16th or 17th) another may be ready to be emptied. Please let me know as soon as you can whether you will be emptying a purifier on either of those days, and I will arrange with my colleagues. We should like to be present when the lid is raised. I think the difference between the upper and the lower part of each layer of lime depends on the accumulation of moisture in the upper part. Drier lime has more affinity for carbonic acid, wetter lime for sulphuretted hydrogen. If you can easily do so, I wish you would try the experiment of placing, on the second tier of sieves from the top, lumps of quick lime (from the size of a nut to that of a tennis ball) so that the sieves may be covered to an average depth of $\frac{1}{2}$ inch. I believe this layer will be thoroughly first hydrated and then carbonated before the purifier comes out, and if so it may be possible to have every other layer at least thus charged with dry lime and inoffensive when the purifier is emptied. Of course there will be holes in a layer thus formed. But I believe holes do no harm if they occur pretty evenly over the whole surface.

Witness: The object of that experiment was not to reduce the sulphur further—that was not the letter to which mine was an answer, but I suppose that Mr. Clark represented that the lime came out in an inconveniently wet condition, and my suggestion was to sacrifice one of the purifiers to some extent, so far as its service for purifying gas was concerned, by putting upon it layers of quick lime, which would serve to dry the gas passing through it, so as to cause a less deposition of moisture in the layers above.

Mr. Round: In point of fact, the suggestion referred to in this letter did not apply to the particular matter now under the consideration of the committee. It was no question whether it should be 20 or 25 grains?

Witness: Not at all. I may say that I have had a great deal of correspondence at many times with the managers of these works, and I have always taken the liberty, when I have been writing, to make any suggestions which it has occurred to me might be of service to them.

Mr. Michael: Did the engineer carry out your suggestion?

Witness: My recollection is that when I saw him he offered to do so, but I believe he was no longer finding the same difficulty. Some change had been made, I think, in the condensers, so that the lime no longer came out as wet as it had come out before, and, therefore, the object for which I made the suggestion no longer needed to be attained.

Mr. Round said he had exhausted the case of Shoreditch, and proposed to go to the Pimlico complaint, with reference to which the following letter had been addressed to the Board of Trade, dated Jan. 4, 1877. [See JOURNAL, April 10, 1877, page 541, No. 4.] In this letter you find no fault with the process as far as the purifier is concerned, but what you do find fault with is the way they deal with it afterwards, in getting it into the barges?

Witness: Yes, the nuisance being not in the purifying process, but in removing the lime from the purifying-box, and discharging it from carts into barges, lying at the river quay. It was unprotected as it fell from the carts into the barges, and on windy days it would be blown about and carried for a distance. I think the arrangements in use at the Fulham works might with advantage have been adopted.

I see you speak approvingly of arrangements at Fulham, and suggest that if they were carried out at Pimlico, the cause of nuisance would not exist?—I do not mention that as my own knowledge, but it has been mentioned by a witness, that the lime is now thrown through a shoot into the barge, which, I think, is a very ingenious and excellent method.

Mr. Round: Bromley comes next. On the 11th of January last you wrote to Mr. Phillips the following letter. [See JOURNAL, April 10, 1877, page 541, No. 5.] I rather gather from that, that the cause of the nuisance was similar to what it had been at Pimlico—viz., getting the lime away. You say in this letter, "We found that the refuse lime was emptied by manual labour into open trucks." That was very much what you found before, I think?

Witness: No, it was not quite the same. In the case of the Pimlico works, the purifiers are under cover, and very well sheltered from the wind, so that the lime does not get blown about when it comes out in a dusty state during the operation of emptying the purifiers. At Bromley the purifiers are not so protected, and when lime is dusty, no doubt it is blown out, and may be carried to a very considerable distance.

Can you offer any good reason why they should not be covered in both cases? Do you think it is right that they should be covered?—I think the principal reason is the expense. It is an additional expense to erect sheds over the purifiers. I know of no other reason.

At all events, you think it is desirable that it should be done?—That, I believe, would be one mode of diminishing the risk of nuisance.

Mr. Round: That brings me to Fulham. Two days afterwards, you wrote a letter dated the 13th of January, to Messrs. Leigh and Pemberton, the solicitors for the Chelsea Vestry. [See JOURNAL, Jan 30, 1877, page 159.] It appears your attention was drawn to certain cases, and you suggested a remedy. The company adopted that remedy, and since then you have thrice visited the works, and believe that if that mode of working is carefully adhered to, no further nuisance will be occasioned. Has there been brought under your notice any instance of complaint, upon the ground of nuisance, since that date at those works?

Witness: I have not heard anything about it since. I might say that on these occasions I spent several hours in the works, and walked round and round, and stayed for a long time to leeward of the purifiers that were being emptied, so as to form the best observations I could of the amount of effluvia escaping from the lime, and, on those occasions, I have satisfied myself that when those precautions were being taken, even in the immediate neighbourhood of the purifiers, there was nothing offensive.

The Committee: Seeing the evidence we have had to-day from Lord Charles Thynne, of his having experienced a nuisance up to the present time very badly, your explanation would be that they have discontinued the precaution?

Witness: Or that the nuisance was due to some cause other than lime purification. I am strongly of opinion that gas-works are bad neighbours apart from lime purification.

Mr. Round said he had exhausted the matter as far as he thought necessary with regard to those particular cases. With regard to the general question, he would begin with a letter dated the 11th of December, which the Board of Trade addressed to the Referees, and which was as follows. [See JOURNAL, April 10, 1877, page 540, No. 1.] That was an important letter, because the Board of Trade had thrown it upon the Referees to report to them whether the company could restrict its impurity to the amount required without creating a nuisance.

Mr. Michael: Now we have come to the general question, would you have any objection, in order to shorten the matter, to go back to the letter of the 11th of November, 1876, written by Mr. Phillips to Mr. Vernon Harcourt?

Mr. Round said he had not read the letter, because there was a request at the end to treat it as a private communication; but the witness stating

he had no objection to its being made public, it was read, and was as follows:—

I trust you will pardon my troubling you unofficially on the subject of the lime purification, your determination as to which is the subject of much anxiety to the directors. I am privately informed that the Shoreditch and the Fulham parish authorities are resolved to indict us if the annoyance to which they were recently subjected, and which our engineers say they cannot prevent is repeated. The directors feel that they would place themselves in the wrong were they to disregard your instructions, but they are seriously contemplating an application to Parliament for a Bill of Indemnity against the consequences, and I yesterday received instructions to prepare a notice for such a Bill. I earnestly trust that between this and next Friday you and your colleagues may have seen your way to a definite answer to my application for a 40-grain maximum, and that it may be such as to relieve us from all the great trouble and cost of another parliamentary fight. Do me the favour to consider this a private communication.

(To witness:) You did answer that letter, I think? Do you recollect telling them that you could not accede to this application for a 40-grain maximum?

Mr. Michael: I do not think Mr. Vernon Harcourt did that. He sent a letter on the 11th of November, signed by himself and Dr. Pole, which seems to be the answer.

Witness: I do not remember whether I sent any other.

Mr. Round: We will take it as a fact that you received that application from the company.

Witness: I should think I sent Mr. Phillips an answer.

Mr. Round: Here is your answer, apparently written on the same day. This is the letter written by you to Mr. Phillips:—

As a strong opinion has been expressed to us by yourself and Mr. Evans that the sense of the public is changed with regard to the sulphur impurity in the London gas, and that they no longer care to have the maximum kept low, we think it right to send, for your and Mr. Evans's consideration, a copy of a memorial dated the 4th of November, which has been presented by the Corporation of London to the Board of Trade, and forwarded by the Board of Trade to us.

Mr. Michael: Those letters crossed—that is not the answer. You did write on the same day, but your absolute answer was written from Oxford on the 13th; and signed by Dr. Pole and yourself?

Witness: Probably.

Mr. Round said the memorial mentioned was sent to the Referees by the Corporation of London, expressing great anxiety that they should adhere to what they had already prescribed; but he did not know that it was necessary for him to read it. It was a fact that pressure was put upon the Referees.

The Chairman: Read that part which gives the grounds of objection, whatever they may be.

Mr. Round said the memorial was signed by the town-clerk, and was as follows:—

The Gas and Water Committee of the Corporation of London have received a notification from the Gas Referees as to the amount of sulphur impurity, other than sulphuretted hydrogen, to be allowed in 100 cubic feet of gas, and raising the maximum from 15 and 20 grains for the winter half year 1876-7. The 43rd section of The Gaslight and Coke Company's Act, 1876, provides "that if on any day the gas supplied by the company is of less purity than it ought to be under the Act, the average of all the testings under the Act on the preceding and on the following day shall be deemed to represent the purity on that day," and the committee therefore think that, considering the results of the testings during the last year, and the taking of the average for testing upon three days, in case of excess of sulphur, instead of the testing of one day, it is very undesirable and unnecessary that the maximum for sulphur should have been increased even during the winter months. I have therefore, been directed to request you to bring this matter under the notice of the Board of Trade, in order that the attention of the Gas Referees may be called thereto.

It appeared that the Referees had increased the maximum of sulphur, and had allowed 25 grains in the winter, and the corporation said they thought it very undesirable and unnecessary that the maximum for sulphur should have been increased during the winter months; therefore, it was putting pressure upon the Referees to say: "Do not by any means accede to the application made by the company."

Mr. Michael: I now want the letter dated Nov. 13, and sent from Oxford.

Mr. Round: This is it:—

I have been once to the Shoreditch works since I saw you, and am going again next Thursday. I hope then that my colleagues and I will be able to witness the operation of the opening of a purifier from the beginning, and to judge, to the best of my ability, whether it is productive of nuisance, and whether it is managed as well as possible. I am sorry to hear that at Fulham, also, you have been threatened with an indictment for nuisance. I have often visited those works, and have thought that, though purification was carried on under great difficulties, owing to the very small size of the purifiers, the management of the refuse material was satisfactory.

Mr. H. Clark spoke to me of his desire to adopt a process of Hills, which is in use at the South Metropolitan works, by which gas is purified from carbonic acid, and sulphuretted hydrogen by washing with ammonia obtained from gas liquor. The process is excellent in principle, and I hear that it answers well. Either this process, or that which Mr. Patterson claims, of using a distinct set of lime purifiers to stop carbonic acid, would effect the important object of reducing the quantity of foul lime necessary to keep down the sulphur in gas to small proportions. I believe the quantity of lime which is produced on the system Mr. Clark now follows is eight or ten times as great as is required for reducing the sulphur. If the heating process which was the subject of my experiment at Horseferry Road were carried out, the production of foul lime would be dispensed with altogether.

Personally I look upon the process of lime purification as commonly conducted as very unsatisfactory. It is difficult to conduct it without causing nuisance. The refuse material seems of little or no value, and it must become continually harder to get rid of it. Better processes have been suggested, and I think that gas engineers ought to be able to bring some better process into use. Certainly the conclusion which you urge, that the attempt to keep the sulphur down to a low point should be given up altogether, is one which those who have taken the question up on the part of the consumers are not likely to acquiesce in.

Mr. Michael: Now we come to the letter of the 5th of March, 1877.

Mr. Round read the letter, as follows. [See JOURNAL, April 10, 1877, page 540, No. 2.] (To witness:) I see that you attach considerable importance to the fact that at each of the works you have to deal with a different engineer, and you suggest that if there was one chief engineer who would prescribe what was to be done at all the different works, the business would be much facilitated in this matter?

Witness: We found that the same problem, which is the removal of this foul lime without the creation of a nuisance, was treated differently at different works; and we thought that at some works one part of the process was well managed, and at other works another part, and in some cases scarcely any precautions were considered were taken; and we thought that if the precautions which were used for the different parts of the operation at the different works were combined and generally applied, the nuisance would be avoided.

FRIDAY, MAY 11.

Mr. Harcourt recalled.

Mr. Pope said his learned friend had asked him, though he was on the other side, to read some letters which it was desirable should be before the committee. The first was dated Jan. 16, 1877, and was from Mr. Phillips to the Gas Referees. [See JOURNAL, April 10, 1877, page 541, No. 7.] The reply to that was on the 23rd of January. [See JOURNAL, April 10, 1877, page 541, No. 8.] That letter was signed by the Gas Referees. The next was dated March 23, 1877, and was from Mr. Phillips to the Referees:—

The directors of this company met specially to-day to receive from the deputation of their number who waited upon you on Monday last, the 19th inst., a report of their

proceedings, and they hoped also to be favoured with your reply to the proposition then submitted, for such an exercise of your statutory powers as could admit of the avoidance of a most costly parliamentary inquiry. They are disappointed at having as yet received no answer from you, and I am instructed to request that any communication you may be pleased now to make to them on the subject may be in my hands prior to Thursday next, the 29th inst., on which day they will hold another special meeting to determine the course of action which they will adopt on the re-assembling of Parliament after the Easter recess.

To that the Referees replied on March 26, 1877:—

Dear Sir,—We are surprised to learn from your letter of the 23rd inst. that your directors expected from us a letter in reply to the conversation which passed when your chairman, deputy-chairman, Mr. Evans, and yourself, were good enough to come here last Monday. We are unable to send a reply, for the reason that no definite proposal was laid before us. Mr. Richards spoke of a desire to bring about some compromise, and Mr. Evans named 30 and 35 grains of sulphur per 100 cubic feet of gas as maxima with which the company might be content. Mr. Browne was of opinion that no maximum lower than 40 grains would effect what he desired, and we referred to a former request for that maximum, and appeared to share Mr. Browne's opinion.

Our letter to the Board of Trade in reply to the question, "Whether, in our opinion, the maximum amount as at present fixed of sulphur impurity with which gas supplied by the company shall be allowed to be charged, can be maintained without causing a nuisance," was read, not having been seen before by your directors, and you stated more than once that what you thought best was that your deputation should retire and consider that letter. The letter does, in effect, contain our answer; but if you have any further proposal to make to us, and will place it before us in a definite form, we will consider it at once and send you a definite reply.

We desire to add that we sincerely regret the expense to which your company may be put in endeavouring to free itself from the existing regulations respecting the purification of gas from sulphur. But we must remark, first, that we have not altered the standard prescribed by us since March, 1875, or that we are not responsible for the need of amending your Act of 1876; and, secondly, that we should be altogether exceeding our proper executive functions if we were in effect to annul these sections of your Act which you have now proposed to Parliament to cancel by fixing a maximum of sulphur impurity so high as to be inoperative.

That was signed by Mr. Vernon Harcourt and Professor Tyndall. The reply was dated the 26th of March, and was from the secretary of the company to the Gas Referees:—

I am instructed by the directors to acknowledge the receipt of your letter of the 26th inst. They regret that the proposition submitted to you at their interview was not made so clear to you as they thought it had been. The proposal made, and to which they looked forward for an answer, was that you should exercise the power vested in you, and extend the maximum of sulphur to 40 grains. Mr. Evans, it is true, did mention that he, in his experience, thought that possibly we might be safe from penalties with a 35-grain maximum, and that even at 30 grains it would be worth while to make the experiment. But the proposal to which the directors hoped to have an answer was, that you should extend the limit to 40 grains, and the result of the interview was that they anticipated that you would either accede to that maximum, or propose to extend the limit to 35 grains positively, or that you would suggest a temporary maximum of 30 grains by way of experiment.

Then on the 4th of April came a letter signed by Mr. Vernon Harcourt and Professor Tyndall:—

In reply to your letter of the 29th ult. we regret to have to state that we do not think ourselves justified in prescribing for the summer half year, upon which we have just entered, a higher maximum of sulphur, with which gas supplied by the company shall be allowed to be charged, than has been in force during the corresponding period of the two previous years.

That obviously closed that part of the correspondence, and then came the letter of the 7th of April from Mr. Phillips to the Secretary of the Board of Trade. [See JOURNAL, April 10, 1877, page 541.]

Witness: We did not attempt to write a reply to that document; but there was one point in it which we thought might need explanation, and we endeavoured to explain it.

The CHAIRMAN: I should say that last letter was not a judicious way of asking a favour of the Referees.

Mr. RICHARDS: You will remember, sir, the letter to which it was a reply.

Mr. POPE read the explanatory letter from the Referees to the Secretary of the Board of Trade, which was dated April 20, 1877. [See JOURNAL, May 1, 1877, page 666.] That letter was signed by Mr. Vernon Harcourt and Professor Tyndall, and the following, dated May 5, 1877, was subsequently written to the JOURNAL OF GAS LIGHTING by Dr. Pole. [See JOURNAL, May 8, 1877, page 699.]

By Mr. ROUND: We are all agreed that oxide of iron will not produce the degree of purity which is attainable and ought to be attained. It is also agreed that by lime a greater perfection can be obtained. In fact, in the present state of science, it is the only known means in use. That being so, the next question is how the foul lime is to be disposed of.

Mr. ROUND: Upon that, I understand that Mr. Evans says the ventilation of the foul lime is not new to him; that he adopted it at the Berlin works, I think, 38 years since; and that it would probably entirely get rid of the nuisance from the foul lime.

Witness: That appears to me to be an important statement, coming as it does from Mr. Evans, the former engineer, and now one of the directors of the company.

By the CHAIRMAN: I do not know that any process for removing sulphur compounds out of gas, except the ordinary lime process of which we have heard, has been successfully brought into use.

Mr. ROUND: I think that is admitted on both sides.

Mr. MICHAEL: That is a part of our case, certainly.

The COMMITTEE: You contemplate other methods; you say that other methods have been suggested?

Witness: That is a matter which rests with the gas companies to bring into use. There are others which, I believe, might succeed.

Mr. ROUND: What is the particular method which you think might be adopted?

Mr. POPE: I know what it is now—that is, what is in operation at Fulham, because the witness speaks of the overheating during that process, and the consequent generation of stench by naphthaline.

Mr. ROUND: That is the practice at Fulham. It seems that you and Mr. Evans are at one as to the efficacy of the system at Fulham?

Witness: I wish to say absolutely that I quite agree with the views which Mr. Evans holds as to this process, and I share his belief in its efficacy. I have seen the system in operation at the Fulham works, and I believe that its introduction is a most material contribution to the means in use for getting rid of the foul lime without creating a nuisance.

By the COMMITTEE: The peculiar system which I say is an improvement, as worked at Fulham, consists in drawing the air downwards through the lime before it is removed from the purifiers; and the advantages gained by it are—first, that the foul gas, as it is called—the crude gas with which the purifier is charged—is drawn out of the purifier by that means. Then the air which passes in carries away also the sulphuretted hydrogen dissolved in the water when the lime is damp, and by the oxidation of the lime which goes on to some extent, the material is rendered less offensive than it is when removed directly. I do not know any reason why that plan should not be adopted in the other works of the company. My opinion is that it ought to be adopted everywhere.

Examination resumed: The system adopted at Fulham is in use at some of the other works, but I can hardly say which; it has only been brought in quite recently.

Mr. ROUND: Do you know what processes there are, other than this, that are in use at the other works?

Witness: Some evidence was given recently upon that point by Dr. Frankland. There is the process which is pointed at in the letter of Mr. Phillips, which was read to the committee—the process that was tried at my suggestion at the Horseferry Road station of the company. It is impossible to say, until the process is actually in successful use, that it can be used successfully; and the committee well understand the difficulty which there is in this matter. We believe that, if the company would do their best with the object of reducing the amount of sulphur in the gas, they might develop other processes besides the one of purification by lime; but we cannot say positively, because, from the nature of the case, the matter is wholly in the hands of the company. A considerable sum, though less than that named in Mr. Phillips's letter, was expended by the company on a trial of the process which I recommended. Dr. William Siemens devised the apparatus which was employed, and I was responsible for the chemical part of it. That process consisted in bringing the gas, already purified from sulphuretted hydrogen, into contact with heated surfaces. I had ascertained, and others had observed before me, that the effect of this was to convert the bisulphide of carbon in the gas, which cannot be removed by any agent except the sulphide of calcium, into sulphuretted hydrogen, which is removable by oxide of iron. I had found also, by many experiments, that this could be effected without injury to the illuminating power of the gas. What remained was rather an engineering than a chemical question. To accomplish this on a large scale, and to construct an apparatus by which a large volume of gas could then be treated, Dr. Siemens arranged an apparatus, as far as I can form a judgment, very ingeniously contrived for this purpose, and that apparatus was in use for some months. As commonly happens in experimental works, the apparatus was not perfect; in particular, the plates which should have held in the gas which was generated cracked, and a large quantity of it escaped. The burning gas passed through the tubes of the apparatus, by means of which the heat was applied to the remainder of the gas; the temperature became unmanageable; the materials with which the heating apparatus was charged became coated with a deposit of carbon from the gas, and their purifying effect was thus impaired. For some time (on two occasions, for ten days or a fortnight together, a volume varying between 10,000 and 20,000 cubic feet per hour was purified by the apparatus; but the leaks increased, and went, as Mr. Phillips's letter says, from bad to worse, and the experiment was ultimately terminated, not, I consider, because the process failed, but because of the accident that had happened to the apparatus. The apparatus was not set up in order continuously to purify the gas that was being manufactured; it was only an experiment, and aimed at the discovery of practically purifying gas without injury to its illuminating power, and that, I believe, the experiment did demonstrate. I have since continued laboratory experiments of the same kind, and I have gained further knowledge upon the subject. My belief is, that if the company were willing to make a trial of this process, it would be practicable to overcome the engineering difficulty, but more than I have done in the matter I cannot do; it must rest with the company to try it or not. I tried every experiment myself during many years; and these large experiments were made at the expense of the company, at the Horseferry Road station, during the autumn of 1874 and the spring of 1875.

Mr. ROUND: Having shown certain good results, do you wish to convey to the committee that the company ought to have tried the experiment on a larger scale, and to have continued it?

Witness: I should be glad if they were willing to do so, as I think it offers them an alternative to the use of lime.

By the COMMITTEE: The mechanical nature of the arrangement consisted in a regenerative furnace, in which the regenerative principle was applied by passing heated gas to pass down through a chequer work of pebbles and brick, to which it gave up its heat before leaving the apparatus, and then by means of a valve reversing the current of gas entering the apparatus, the gas passed through the same brick chequer work, took up the heat given out by the former portion of gas, and so, by reversing the valve, each portion of gas was heated without the heat being carried out of the apparatus, and undoubtedly with a very great economy of heat. The quantity of fuel employed in working the apparatus was insignificant.

Mr. ROUND: From all the observations that you have been able to make, and the experience which you have acquired during your term of office, and the frequent visits that you have paid to the works, and so on, are you satisfied that even if they adopt carefully the present mode of purifying with foul lime, it could be done without creating additional nuisance?

Witness: Personally, I feel no doubt upon the matter.

Examination resumed: I have a model made here illustrating the mode adopted at Fulham. That [pointing] represents the exhauster, which is used for pumping air through the lime after one purifier has been shut off from the rest of the purifiers, and is no longer used for the purification of gas. There are some taps on the top of the apparatus which are opened, and then the exhauster is set to work. The air carries down with it a portion of the gas, which the purifier still contains when shut off. The air is then driven through this arrangement, which is a brick trough, also having perforated sieves on which are placed layers of oxide of iron. The sulphuretted hydrogen which the crude gas contains, and which, of course, is carried off from the lime in the purifier, passes up through this oxide of iron, and there the sulphuretted hydrogen is removed, while the air in the gas, which is quite inoffensive, escapes. By the continuance of this process for some time the lime becomes comparatively inoffensive. There were one or two suggestions which I ventured to make to the superintendent of the works on visiting him and seeing this process. One was, that as far as possible the surface of the lime exposed at any one time should be reduced. One of the complaints of which the committee have heard is, that the difficulty is far greater on a large scale, because, with the large purifiers that are used, a large surface is exposed, and it seemed to me, though I am only an amateur in such matters, that this large surface might be reduced by having the arrangement here represented, by which one portion of the lime could be covered over when the lid was raised, so that when they were shovelling the lime into their bags no offensive smell would escape from the part covered with the sacking.

The COMMITTEE: Do you mean that this does not entirely purify the lime before it is removed, but that it only contributes to the purifying of it?

Witness: It only contributes to it; the air might have passed for many hours, and the lime would even then be in some degree offensive when taken out. Something depends upon the condition of the lime—how far it is damp or dry. If the lime were damp, I feel no doubt that drawing the air down to dry it takes out the sulphuretted hydrogen. I believe that two or three hours passage of air through the lime would generally make a considerable difference in the degree of offensiveness of the lime. I also suggested that this down current of air through the lime should be continued during the operation of discharging the purifier. That, I think, is important, especially when a part of the surface is covered up—it produces a distinct down draught through the substance, and makes it much less likely that any effluvia or fine particles should be blown away from

the surface. When this operation has been going on, I have made observations round about. I mounted here [pointing to the model], and stood there for some time, and observed as carefully as I was able the degree of smell which came from it; and my conviction is, that when the process, with Mr. Evans's improvements, is rigidly carried out, nothing can escape that is offensive to the neighbourhood.

The COMMITTEE: What does this represent [pointing to the model]?

Witness: I might explain this also, as it is a very important part of it. The lime, when it is dug up from the layers, is shovelled into bags, which are carried on men's backs up a plank laid at the side; then it is tilted over and falls through a trap into a waggon, which runs on a tram. As soon as the waggon is full, it is covered over and runs to another point, where a second hood is let down over it, and then, by levers which stand out at the side of each of the waggons, the bottom of it is allowed to fall out, and the lime drops, still protected, into a barge, and there it is covered over. This is an arrangement which, I believe, was contrived by Mr. Kirkham, and it appears to me to be very well designed for avoiding any nuisance in that operation.

Mr. ROUND: How far has the sulphur been removed from the lime by this process?

Witness: I should think very little sulphur is removed in the process; the effect of the action of the air upon sulphide of lime is not to remove the sulphur, but to oxidize it, and as far as it is oxidized it is inoffensive.

At all events it removes the sulphuretted hydrogen?—It does rather more than remove the sulphuretted hydrogen which hangs to damp lime; it oxidizes the lime sufficiently, converting the sulphide of calcium into sulphate of calcium, and so renders the lime less liable to give sulphuretted hydrogen off when exposed to the moisture of the carbonic acid of the air.

Examination continued: The principal defect which there seemed to be in actual working at Fulham was that there is one of the exhausters only in use, and that is in connexion with three distinct sets of purifiers, two of which are emptied simultaneously. Now, since the same pump is used to pump air downwards through each, the two being simultaneously entered, and since the rate of discharge of layer after layer will not proceed simultaneously *pari passu*, it must frequently happen that the down draught is only operating in the case of one of the two purifiers, and in that case the other is without the protection which it furnishes. I think it would be necessary that there should be a pump to each, which there would be no difficulty in having, as they are not very expensive.

Mr. POPE (in cross-examination): The words, "A practical knowledge and experience in the manufacture and supply" point to somebody who has been engaged in that manufacture and supply. Which of your number satisfies that requirement?

Witness: I think it may be taken that my colleague, Dr. Pole, has a much larger experience than I have had. At the same time, I have been occupied on practical matters connected with the manufacture and supply of gas for some seven or eight years, and though one is unwilling to claim for one's self any particular knowledge, I believe I am not without that knowledge, although I have not been actually engaged in the manufacture and supply of gas. A great part of the correspondence has been undertaken by me, and I have had special work in connexion with the purification which the Board of Trade asked me to undertake. I have visited all the stations of The Gaslight and Coke Company, with reference to the complaints of nuisance which have arisen—Haggerston, Pimlico, Bromley, and Fulham especially. The reason we made a variation in our requirements for winter and summer was because the same amount of purifying material will effect a greater purification when the volume of gas passed through it is less, and the volume of gas passed through is less in summer than in winter.

Mr. POPE: I may take it that, in your judgment, the quantity produced in relation to the purifying apparatus ought to modify the requirements of purity?

Witness: Or else the amount of purifying plant, as it is termed, should be increased. If the make of gas is to be spoken of as indefinite, the amount of lime used should be indefinite also; in other words, if it be an inevitable nuisance, it will be an increasing nuisance.

Supposing the lime process not to be used, but a return to be made to the oxide of iron process, what amount of sulphur impurity would be left, or should you expect, in gas, supposing the oxide of iron process to be perfectly and carefully carried out?—I think it would average about 33 grains in 100 cubic feet.

Then the lime process is rendered necessary in order to get rid of 13 grains in 100 cubic feet, according to that calculation?—More than that.

No; you prescribe 20, and if there was no lime used 33 grains would be the result; the lime process is therefore rendered necessary to get rid of those 13 grains?—I spoke, not of the maximum, but of the average; you are comparing the maximum with the average. I think what the company have named—40 grains—is the right maximum.

We may take it that it is to get rid of from 15 to 20 grains, according as it is winter or summer, that the lime process becomes necessary?—Yes.

Do you still think that "much is to be said in favour of the view that the presence in gas of the small amount which lime purification removes is of no great consequence to the consumer"?—I certainly think so. I have heard a great deal said upon that subject within the last two weeks.

I do not want to commit you to an absolute statement; but, taking the whole matter—the information you gain from what you have heard and read, and what other chemists are doing and saying, and so on—what do you say now as to the inclination of your opinion that it is of no great consequence to the consumer to get rid of the small amount of sulphur which lime purification removes?—I would say of no great consequence.

It comes, therefore, does it not, to be a question whether you should relax your requisition of 20 grains, supposing the carrying out of the lime purification, or some other process, creates a nuisance?—Yes; I think that unless we believe that by some means gas could be purified without the creation of a nuisance at the maxima that we have named, it would be our duty to fix a higher maximum—such as 40 grains.

You would not, I suppose, insist upon your maximum simply because hereafter some means may be discovered?—No.

It would be quite time enough to fix your maximum when it is?—Certainly.

I have read with great interest what you have done with regard to the heating process you speak of, but you would hardly say that that, at all events, should be taken into account to-day as a process of purification?—I think only as illustrating the likelihood that, besides the process actually in use, if the obligation is continued upon the gas company to purify their gas beyond the removal of sulphuretted hydrogen, other processes besides the lime process may come into use.

Cross-examination continued: We have not maintained our maximum at its present figure in order to stimulate the company. We fixed the maximum simply because we believed it was a maximum which was practical, without the infliction of injury upon the neighbourhood. When I first visited Fulham the whole arrangement for the removal of lime from the purifiers was already in operation. The other point I have named—

that is to say, the covering over of a part of the lime when it was exposed, and the continuance of the down draught after the raising of the lid; and another point, which I have not mentioned yet—namely, damping the lime when it was found, on lifting the lid of the purifier, that it was in a dusty condition—those matters were adopted at my suggestion. My last visit to the Fulham works was towards the end of January.

Mr. POPE: Did you at that time carry with you any test, such, for instance, as a bit of blotting-paper in your hat, which was saturated, with a view to ascertain whether there was sulphuretted hydrogen given off, notwithstanding all these precautions?

Witness: I placed nothing in my hat, but I am very familiar with the smell of sulphuretted hydrogen, and could detect a very little at once. I do not think that the bad smell of the refuse lime is merely the smell of sulphuretted hydrogen, but I do not know what it is. It has never produced any bad effect upon myself except the dust, which is certainly unpleasant to the eyes when it is blown from the purifiers; and I have also found that the smell of the refuse lime is extremely persistent when one's clothes have been covered with this dust. I think that dust would travel half a mile on a windy day. On a wet, soft, muggy day it would not travel so far.

Mr. POPE: How do you account, if it be the dust, for the fact that everybody complains of it more at a distance in wet muggy weather than they do when the weather is windy, or the atmosphere clear?

Witness: I think what they complain of is the smell of the gas-works. I do not think most of them can distinguish between the portion of the bad smell due to refuse lime and other smells.

What is your opinion with regard to the smell of the gas-works? Is it better or worse during foggy days?—I think it is worse immediately in the neighbourhood of the purifiers, but probably the smell would not be carried so far.

I do not say there may not be a nuisance from the dust; but assume that it is proved that the nuisance is worse at a distance, under atmospheric conditions less favourable to dust travelling, would you, as a scientific man, then abandon the dust as the cause of the nuisance, and look for something else?—I think it more likely, if it were found that the nuisance at a distance was greater on still days than on windy days, that it would be due to some gaseous emanation, and less likely to be due to the dust.

You say you doubt its being sulphuretted hydrogen; what other gaseous emanations would you suggest?—Smells which have never been analyzed; I think I may say that positively. It is not known what substances produce the impressions of smell which you receive in the neighbourhood of gas-works, but there can be no doubt that they are very various.

Have you any experience with regard to this process of ventilating, as you call it—drawing air through a chamber for the purpose of purifying lime?—Yes; I have seen it done occasionally.

What special danger attends the use of that process?—The heating of the material, which I believe has been found to reach such a point that the sulphur in the mixture of the gas and air might inflame and explode.

Explosion is the danger. Do you know that, in point of fact, explosion is found to result where the process has been carried on to an undue extent?—I have heard of explosion resulting, and I have seen an arrangement at Fulham for the purpose of avoiding that. I might add, however, that I think it should not be difficult, as the exhauster gives a perfect power of controlling the current of air, so to regulate it as to prevent the temperature reaching this point.

Would there be a tendency in this ventilating process to carry over into the oxide of iron other sulphur compounds besides sulphuretted hydrogen?—I have made the best experiment it is possible to make. I have stood by the side of the brick trough holding the oxide of iron when the ventilating process was in action, and I have observed that on the surface of the oxide no smell, or next to none, was perceptible.

Cross-examination continued: In one of my letters I suggested that the purifiers might be under a shed or cover, and that that would reduce the nuisance, and I believe the plan is adopted at Pimlico. I believe the source of the nuisance is not the purifiers in the shed, but the emptying of the lime, as I saw it tipped from the carts in the Grosvenor Road into the barge. All the smell that lime can possibly give off arose when the contents of the carts were tumbled down a distance of between 20 and 30 feet. The lime was shot out in a solid stream from the tail of the cart into the barge.

Mr. POPE: The main difference between us comes to this—you rather attribute the nuisance to this dust than the sulphuretted hydrogen?

Witness: I think a great deal depends upon the condition of the lime when the purifier is being emptied. Sometimes it is extremely wet; and in that case, unless the ventilating process has been in use, the water in which the lime is damped will contain a considerable quantity of sulphuretted hydrogen; and I believe also that the lime, when damped, will give up the sulphuretted hydrogen more readily to the air than when it is dry. Of course, also, when it is damped, no dust will be blown from it; therefore the cause of the nuisance may vary according as the lime is damp or dry, and I believe it does so vary.

You doubt whether it is sulphuretted hydrogen at all?—No, I have not thought that; but I do not admit that if the lime is damped the smell coming from it must be sulphuretted hydrogen. I have said that the smell is of a complex character.

It is not merely a question of smell. You, as a chemist, would be able to recognize sulphuretted hydrogen, not only by the smell, but by the physical results?—As a chemist, I might recognize it by the chemical results.

There are well-known physical symptoms, the result of inhaling sulphuretted hydrogen, are there not?—I have never suffered from it. I know the smell very well; but a smell may be disagreeable without your suffering in health.

I was speaking of noxious, unwholesome, and unhealthy?—I have never heard of any evidence in the sense you use the word "noxious"—that is to say, injury resulting from the exposure of refuse lime at gas-works. If the air contained a sufficient portion of sulphuretted hydrogen, no doubt it would be poisonous. I have never seen a case of injury by sulphuretted hydrogen.

By the COMMITTEE: Between two and three years before I was appointed a Referee I was engaged in experiments at the Oxford Gas-Works, and I spent a great deal of time upon those works, during which time I became familiar with all the ordinary operations of gas manufacture. I was making those experiments on my own account. Some questions had been suggested to me by a friend of mine, who is the son of the manager of the Cheltenham Gas-Works, and becoming interested in the subject, I engaged in those experiments. I suppose, during a period of six months, I was there about every other day. I was engaged partly at the gas-works and partly also on similar experiments upon a smaller scale in my own laboratory. During that period the chief part of the leisure which I had for scientific work was devoted to experiments in connexion with gas purification, or to observations of the illuminating power of gas; and I have also undertaken experiments on a larger scale at gas-works. My opinion has always been that the small amount of sulphur which the lime purification removes is of no great consequence, but I do not consider that is a point upon which officially we had to form any opinion as Gas Referees. I

think the smell of sulphurous acid is observable in a room which is not well ventilated, and which is caused by the gas, when it contains rather a large proportion of sulphur. The gas which is supplied at Oxford is not so well purified as London gas now is, and I have observed, when there has been no fire burning, and we have been sitting three or four hours in the room, that I could recognize the smell of sulphurous acid, which, as a chemist, I am very well familiar with; and I think also it is likely—though in my opinion I am not clear—that it has been proved that injury to articles of furniture may arise from the deposit of sulphuric acid upon them, but I do not think there is any positive evidence upon that point. I do not think it likely that it produces any injury to health or life in any way. I have heard it stated that in the case of delicate persons it does so, and that may be the case. Wherever ammoniacal liquor is exposed, there is a smell of sulphuretted hydrogen much more distinct than that which is produced from refuse lime. There is always a little exposure of it, as it runs from the condenser into the pipes by which it is conveyed to the liquor well, and there is always a liability to some exposure of it in storeage and removal. I heard the evidence given by Lord Charles Thynne, but I do not remember whether he was able to state positively that the smell he observed was the smell of sulphuretted hydrogen. There certainly is some escape of sulphuretted hydrogen from the other processes in the neighbourhood of the well which holds the ammoniacal liquor, but it would be, I think, quite as easy to observe the presence of the sulphuretted hydrogen in the neighbourhood of an open purifier, and also in the neighbourhood of an oxide purifier when the oxide is damp; the smell of sulphuretted hydrogen at first is sometimes very perceptible. At the Fulham works, on the occasion of one of my visits, I observed a very bad smell, and I asked the superintendent, who was with me, about it, and found out that it was due, not to lime purification, but to a purifier containing oxide of iron, which had recently been opened, and had been partly emptied. The men had gone to breakfast, the material had heated in the purifier, and a worse smell proceeded from it than I have ever observed from any lime purifier.

The COMMITTEE: You said that, under the plan of purifying by oxide of iron, about 40 grains would be the sulphur impurity?

Witness: Not on the average, but the maximum. The present reduction from 40 to 20 grains depends entirely on the use of the lime process.

Supposing the lime process had not been discovered, if that were put out of consideration altogether, the process of purifying by passing over heated substances is not of so well ascertained a character that you could reduce it from 40 grains to any other standard?—I think it should be understood what the difficulty is. The introduction of this rests with the gas company. They would prefer that they should be freed altogether from the obligation rather than that they should have the chance of risk and failure that there is in the introduction of a new process.

No doubt, supposing it rests with you to determine the maximum, and that you had settled in your own mind that 40 grains was the maximum with the oxide of iron process. The lime process I put out of consideration altogether, but there is this process of passing gas in contact with heated surfaces, which would admit of further purification if it were a practicable plan. Do you consider that it is so far a practicable plan that you could at the present moment reduce, or that you would be justified in reducing, the maximum from 40 grains to any other figure?—No; I think if it were not for the existence of the lime process, and the possibility of conducting the lime process without a nuisance, that we should be obliged to prescribe a maximum of 40 grains.

Mr. MICHAEL: I should like to be allowed to state that we are exactly on all fours with Mr. Vernon Harcourt as to that, and I say so with a view of saving any expenditure of time upon the points on which we are in accord.

The COMMITTEE: It was entirely in the interest of your side that the question was put.

Mr. MICHAEL: It has entirely cleared up the matter, because that is exactly the view which we take. I am obliged to Mr. Vernon Harcourt for having so exactly stated the position, and in it we are entirely in accord with him.

By the COMMITTEE: I heard the evidence of Professor Church, Professor Barff, and other witnesses in the last case, and I feel no doubt that there is sulphuric acid produced; but my own belief is that it is only a small portion of the sulphur which passes at all into the air which is converted into sulphuric acid in the air of a room; and I thought the experiments which have been instituted by Dr. Odling and Mr. Russell, as well as the calculations upon the subject submitted by Dr. Odling, were very instructive. I attribute the destruction of pictures and of bookbinding more to heat and dryness than to any sulphur compound of the gas. As to the deposit of sulphate of copper, that undoubtedly occurs. I have myself collected from the surface of a brass tube, which was placed over a gas-burner with the intention of carrying off some of the products of combustion, a considerable quantity—half an ounce or more—of what I afterwards analyzed and found to be crystals of hydrated sulphate of copper. That was undoubtedly produced from the fact of the sulphur impurity. I think there is really no difference of scientific opinion upon the point that some sulphuric acid is produced by the combustion of gas containing sulphur. I quite agree in the opinion that, if the process of purification by lime for these sulphur compounds can be conducted without a disagreeable smell being produced, it would be worth while to continue that process. It appears to me to be purely a question of cost. I believe that the difference in the cost of purification down to the limit of from 20 to 15 grains of sulphur, and down to a limit of 40 grains, would not exceed something like 2d. in 1000 cubic feet, and my opinion as to the likelihood of some injury to books, furniture, pictures, and curtains, resulting from the deposition of this minute quantity of sulphuric acid upon them, is sufficient to make me think the difference of price worth incurring. I feel for myself, if I may state it in that way, that if I had the alternative of burning in my house either of the two samples of gas—either the one with the maximum of 40, or the one with the maximum of 20 grains—and I had to pay the 2d. more for the purer gas, I should choose the purer gas, and pay the extra 2d.

By Mr. O'HARA: I am aware of the fact that in 1876 the Chartered Gas Company came to Parliament for a new Act, and I understand that that Act of Parliament was the result of a negotiation between the company, the Board of Trade, the Metropolitan Board of Works, and the Corporation?

Mr. O'HARA: Was there any greater difficulty in the summer of 1875, and in the summer half of 1876, than there is now? or is there any greater difficulty in the summer half of 1877 than there was in the summer half years of 1875 and 1876, to comply with your prescribed maximum?

Witness: Only such as would arise from the continual increase in the amount of gas supplied. I am not aware of any special circumstances at present which make it more difficult for them to comply with our prescribed maximum than there was in those two summer half years, except the difficulty which has been pointed out in the disposal of large quantities of refuse lime; and, if the area on which it can be placed is small, that difficulty must also increase continually. That would be a question of situation, also of expense. When The Gaslight and Coke Company's Bill of 1876 was passing through Parliament, I was, as a Referee, con-

sulted about the change in the mode of inflicting the penalties. The gas company represented that it was a hardship that they should be liable to a penalty for the impurities of one day. I advised the Board of Trade that it would be fair to substitute an average for the result of one single day, and I believe I suggested to Mr. Phillips the actual wording of the clause. At that time, when the Bill was settling the capital and the initial price, and all sorts of matters connected with the company's affairs, no representation was made about the impurity question.

Mr. CRIPPS: You say that this is really a question of expense, so that, in fact, to relax the conditions, which my learned friends by their Bill are endeavouring to do, would be practically increasing to the consumer the initial price of gas? Do you follow me?

Witness: I follow you; it would make a difference of that kind.

In fact, you say it costs about 2d. per 1000 feet to purify the gas according to your rules?—I think the difference would be effected for that sum.

Putting that as the maximum; then we see the price of gas was fixed at 3s. 9d. per 1000 cubic feet, and at that time Parliament left you to prescribe the degree of purity or the maximum of impurity which was to be found in the gas?—Yes.

Supposing this 3s. 9d. to be the price of gas, purified according to your rule, that would be putting the price to the consumer of unpurified gas at 3s. 7d.?—If I am right in the figure, it does not represent any calculations of mine, but it is the difference that I have heard stated.

If you call the price settled by the Act of last year 3s. 9d., under this Bill 3s. 9d., *minus* x, ought to be the price if the conditions of impurity were relaxed?—That seems fair.

In 1876 the degree of purity that you prescribed was identical to that which you are prescribing at the present moment?—Yes; we have made no change for two years.

Had the gas company had the experience of 1875 and 1876 when they got their last Act of Parliament?—That is so.

May I take your evidence generally to be this, that the process required to be carried out by the company can be carried on without producing a nuisance?—I believe that to be so.

You believe that the purifying material, after it is used, can be effectually purified?—It gradually changes into an innocent substance by standing.

Cross-examination resumed: I have heard no evidence as to the particular explosion that has been referred to, but I can easily understand how an explosion would arise if air is drawn through so rapidly as to produce a rise in temperature up to the inflaming point of sulphur, which is not very high. I do not think the question of purification has been merely a matter of cost. I have no doubt that a great deal of annoyance has been caused to managers of gas-works, both by the difficulties which there undoubtedly are in the operation as it has been conducted—I think in many cases without the precautions which might be used—and, no doubt, the complaints of nuisance, so far as they are due to this cause, have been another source of annoyance. I do not myself (but I am only giving an opinion) consider that to gas managers generally it is simply a question of cost.

Mr. O'HARA: That is not quite an answer to my question. Supposing they had understood that, provided they were simply remunerated for any extra expense to which they were put in arriving at this degree of purity, so far it would be a question of expense?

Witness: Yes.

But being secured from loss and paid what they wanted, do you really think that you would have heard of all these difficulties?—I cannot say certainly.

Do you not think that the extra price would have removed a great many of those difficulties?—I do not know that I can form a judgment of what their motives would have been.

By the COMMITTEE: I have often considered this matter with my colleagues, and I believe they agree with my views.

Dr. William Pole, examined by Mr. ROUND.

Mr. Vernon Harcourt hardly correctly answered when he said I was appointed a Referee at the same time as himself, because I was appointed two years earlier—when Mr. Evans retired. At that time Mr. Evans's colleagues remained with me, and we formed the board till 1872, when they were not reappointed, and Mr. Harcourt and Professor Tyndall were appointed in their places, so that I am two years older in the appointment. I have been in the room the whole time, and have heard Mr. Vernon Harcourt's evidence, and I concur with what he has said. We have acted together all through, and we have been entirely agreed in everything that has been done.

The COMMITTEE: Is there anything you wish to add to what he has said?

Witness: No; except that there was a good deal of correspondence, and a great many events occurred between the time when we first fixed the maximum and the time when he began to give the historical account. The first act of our predecessors, in August, 1872, was to give notice of their intention to fix a maximum of 15 grains for Bow and Beckton, where lime could be freely used, but for other works they postponed the maximum. Our first step in the matter was to confer with the engineers of the gas companies. We knew there was a strong feeling that the sulphur must be reduced, because it had been a matter constantly discussed between our predecessors and the authorities of the public and the gas companies. It was a matter forced very strongly upon our attention, and since our predecessors had resolved to fix a maximum which had never been done before, it was, of course, a matter of serious consideration for us whether we should carry out that step. Accordingly, on the 5th of September, 1872, five days after our duties began, Mr. Evans and Mr. Harris, the then engineers of the Chartered Company, attended, at our request, at our office, to discuss the subject, and after a long and full discussion a decision was come to, which I will read an extract from the minute-book to explain:—

Mr. Evans and Mr. Harris attended, and were introduced to the Referees; the subject of the sulphur maximum was fully and lengthily discussed with them. It was agreed that the following passage should stand part of the forthcoming Instructions:—"For gas made at Beckton and Bow, where lime can be freely used for purification, the maximum amount of sulphur allowable has been fixed for the present at 20 grains per 1000 cubic feet of gas; for gas made at other works no maximum has yet been fixed, and meanwhile the quantity shall simply be recorded." Mr. Evans stated that he consented to this maximum, and would use every endeavour to adhere to it; but he wished a note made to the effect that he should hope for protection in case of a disappointment. Mr. Evans wished the attention of the Referees to be called to the great expense of lime purification as compared with that effected by oxide of iron. Mr. Harris called attention to an increase of sulphur as the quantity of gas made increased.

The maximum was accordingly fixed, as has been already explained to the committee. This proposal, as far as we could ascertain, appeared to work very fairly, and the sulphur was kept well down; and I do not remember any complaints from the company that there had been difficulty. Our attention then was directed to the purity of the gas supplied from the other works. Complaints were urged upon us of the sulphur it contained; I need not read them, but we knew that the attention of the public was drawn to it, and we had very strong complaints from private parties addressed to us. We made ourselves acquainted with the experience that had been gained elsewhere as to the use of lime in various

towns, and we inquired as to certain cases where lime was used in London. At Pimlico, for example, lime had been used. I have the minute here which will show we found that to be the case:—

On the 7th of February we went to the Horseferry Road and saw Mr. Brothers, the superintendent of the station. We went in with him to the Equitable works at Lupus Street, and looked over them. About four-fifths of the gas is purified by oxide of iron only, for one-fifth of lime is used in conjunction with the oxide. The latter is much reduced in sulphur, and improved in illuminating power. We did also notice that at one gas-work in the heart of London, (Blackfriars), belonging to the Chartered Company, the sulphur had been kept very low by certain precautions, as we believed, in the management of the works. The result of our consideration was a conviction that we might safely fix a maximum for the urban works; but before doing this, we thought it right again to confer with the gas engineers most interested, and on March 13, 1873, we had an interview with Mr. Brothers, one of the superintendents.

I will read the minutes of what took place:—

Mr. Brothers attended in support of his letter of the 11th of March, remonstrating against the assumed intention of the Referees to fix a 20-grain sulphur maximum for Lupus Street station.

He stated that though he would accept this maximum for the summer months, he should not be able to do so for the winter, as under the large make of gas his purifiers had not sufficient area to allow lime to be used in sufficient quantity, for if the area was limited under a heavy make of gas, the pressure necessary to drive the gas through became too heavy, and blew the seals. The disposal of the foul lime caused inconvenience; but he did not attach so much weight to this, as it might be got over with care and proper arrangements. At present about half his gas was purified by lime (bringing sulphur to say 10 grains) the other half by oxide (say 30 grains) average 20 grains. He was quite willing to accept 20 grains for Lupus Street and Kensal Green, for the summer, on the understanding it was to be reconsidered for the winter. The Lupus Street works were never intended for dry lime; they were limited for space, and their space could not be extended. Dry lime purifiers required so much more area than oxide.

On the 21st we saw another of the officers of the Chartered works—Mr. Mann—who had the management of the works, which are now abandoned, at Blackfriars. Our minute of the 21st of March is—

Mr. Mann attended and consented to a sulphur maximum of 20 grains for the Blackfriars works.

Upon this encouragement we decided to fix the maximum of 20 grains for the urban works. But we thought it would not be right to do it at once, and we gave the companies three months notice that it would come into force on June 30, 1873. Of course we received some protests, which were to be expected. It was our unpleasant duty to put some pressure upon the companies, and it was natural they should resist it as much as they could; but our duty was to convince ourselves that we were acting only fairly. We received several protests against any maximum being fixed, principally on the ground that the works would be likely to find a difficulty in avoiding the nuisance. I have the dates of several letters, and our answers, which can be read or not, as the committee may decide. Then we considered the matter very carefully. We had an interview with the Board of Trade, and we made ourselves acquainted with the experience in other quarters. I should say that during that time we had used every endeavour to find out what was done elsewhere, and I have a great number of memoranda of what was done in different towns which we visited, showing, at any rate, that we took all the pains we could to inform ourselves. We also visited some works where experiments were being tried, because the companies, very rightly and properly, before the date came when they would be called upon to adhere to the maximum, began to use the lime, to try what would be the effect of it. The 30th of June approached, when our maximum was to come into force, and then the companies remonstrated, and took a good deal of pains to show that they were not ready—the committee will have read that. We saw the justice of their complaints, and relaxed the maximum five grains on the 30th of June, for which the companies expressed themselves very much obliged. Then came other correspondence, complaining of the nuisance at some of these places, and every complaint was investigated and answered. The letters and answers are at hand, and can be produced if desired, showing that we spared no pains to inform ourselves as fully as we could. On the 3rd of July we had a letter from the authorities of the City, on the other side, complaining in strong terms of the relaxation that we had made, and that we had not kept the maximum so low as we ought to have done. The City were constantly complaining of us, and in a letter written and sent to the Board of Trade, a very strong complaint indeed was made that we were not doing our duty, and not keeping the maximum so low as we ought to have done. They even went so far as accusing us of being unfit for our duties, because we had not pressed the companies more. Afterwards, on the 30th of June, at the urgent request of the companies, we relaxed the maximum of five grains, and we received the following letter:—

Guildhall, E.C., July 23, 1873.

Gentlemen,—I have to inform you that the circular issued by the Gas Referees, with respect to the maximum of sulphur as proposed to be fixed by you for the winter months at gas-works other than Bow and Beckton, has been laid before the Gas and Water Committee of the City of London, and they have directed me to state that they feel much disappointed at the change proposed, as they had been led to expect that the maximum would have been diminished at all the stations rather than increased at any; the more especially as in their opinion ample time has been given to the companies for the necessary alteration in their apparatus for purification. I am further to call attention to the great desirability of diminution in the quantity of sulphur in gas from the deleterious effects it produces, not only upon substances exposed to its influences, but also to the health of those inhabiting the rooms in which gas charged with it is burned.

I am, &c.

JOHN B. MONCKTON, Town-Clerk.

Our answer merely stated that we had done what we thought just, and could not do more. There were then some further complaints, which were investigated and answered. There were also some complaints in 1874. On April 23, 1874, there was a very long communication from the town-clerk to the Board of Trade, complaining of our conduct generally as being too lax upon the subject of the sulphur maximum. That letter contained the following passage:—

The committee have, however, reason to believe from the reports received of the amount of the sulphur impurity, as tested at Beckton and Bow, that there is not now that care and attention bestowed upon the carrying out of the process of purification at these works, and more especially at Bow, which would obtain a much lower amount of sulphur in the gas than at present exists; and the committee cannot but think that were the maximum considerably lowered, the result would be a corresponding diminution of the daily proportion of the sulphur in the gas supplied from Bow and Beckton. As regards the other gas-works under the supervision of the Referees which supply the Metropolis, the committee consider that a sulphur maximum of 30 grains is no check at all upon the gas companies, seeing that equal results have been obtained without the adoption of any special means or process for removing the sulphur impurity. Such a maximum, therefore, appears to the committee totally at variance with the spirit and intention of the London Gas Acts, 1868 and 1869, and a failure on the part of the Gas Referees to discharge the duty entrusted to them under those Acts.

At that time Dr. Letheby was not advising the corporation upon that point, because he was the chief gas examiner, which was an independent position under the Board of Trade. The principal argument used by the corporation was that because our maximum had succeeded in giving an average very much lower than the maximum (which, of course, it would be) that was an argument why we should bring it down to that point, or near it. It was because the companies had worked very well under our maximum that we should lower it still more. I have a great

many more letters, but, unless the committee wish it, I do not think I need trouble them with them. Many of them contain evidence that we had visited the works, and did not find the nuisance which was asserted. I merely mention this to show that whether we were judging rightly or wrongly, we had given all the attention we possibly could to the subject. We also made ourselves acquainted with what was done elsewhere, in order to form our opinion whether or not this was practicable, and we came to the conclusion that it was.

By the COMMITTEE: We visited Edinburgh, and found that lime was used entirely there. The works were in one of the best parts of the town, between Carlton Hill and Canongate, and I went carefully over them. I spent some days with the manager. I found that lime was used exclusively. I was living in Princes Street during the time when the wind was blowing from the works towards the hotel, and I noticed no nuisance, and there was nothing in the gas which gave me reason to suppose that it would be impossible to purify it by lime. There were no complaints from the hotel-keepers. If there had been a nuisance it would certainly have occurred at that time, because it was the most favourable time for it. The wind was blowing strongly from the gas-works towards the hotel. I noticed that at the time, and I communicated with the authorities. I think the purifiers were opened while I was there. I may say that I also went to Nottingham, and found exactly the state of things that I had been given in evidence by Mr. Loam. I could not do better than refer to his evidence. I also went to Leeds. The Leeds Gas-Works are situated in a populous district and lime is used there.

By Mr. CRIPPS: I do not know the amount of sulphur impurity remaining in the gas. I also made inquiries at different times as to other towns. I was engaged myself professionally at Pontefract, a small town truly, but where gas was made for the whole population, and nothing but lime used there. They had never heard of the oxide process.

By the CHAIRMAN: I am not aware that they took any special precautions at Edinburgh. The purifiers were under cover, and the lime was put into railway trucks and sent immediately away. It was not stored. If it had been stored, the manager told me, they would have had some difficulty, but it was sent away immediately.

Cross-examined by Mr. MICHAEL: At Haggerston we discovered a nuisance, but nothing to speak of. At Pimlico there was a nuisance, decidedly. I myself did not direct the engineer at Pimlico to adopt any other measures than he was then adopting. Mr. Harcourt, as he told you, made several suggestions; but I do not think that personally I ever made any suggestion, because my view was that it was not our duty to do so. We were merely to satisfy ourselves whether the process could reasonably be carried on without a nuisance. I have never been an officer of a gas company, but I have had, as an engineer, a great deal to do with gas-works and gas manufacture, beginning from the year 1838, and continued more or less to the time when I was appointed by the Board of Trade. I told them very freely and candidly exactly what my qualifications were, and I asked them to refer to certain authorities—I mentioned the best known gas authorities in London—as to whether I might be considered a competent person to fill the post. What answers they got I do not know, but the result was that I was appointed in 1870.

By the COMMITTEE: In several cases we found there were no precautions taken at all. At Bromley, for example, the thing was worked just as if the material had been entirely innocuous and inoffensive. I am not quite sure whether or not I signified to the engineer that there was a want of proper care and precaution in carrying on the process. I think that Mr. Harcourt did; he has generally done that.

Mr. O'HARA: With proper care, do you think that the company could reasonably be required to keep their gas as pure as you prescribe?

Witness: We answer that by prescribing the maximum. It is more a question of expense than of care. I do not at present see that increased expense need be incurred, but it is possible that some expense might be.

The COMMITTEE: What Mr. O'Hara means is this. Do you agree that twopence would be saved if there was no restriction at all?

Witness: I have no knowledge about that. It is generally assumed by engineers that the total cost of purifying by lime is about a penny per 1000 cubic feet; and I know when the commissioners settled the price of gas some time ago, they allowed a penny per 1000 feet extra to the companies, on the ground that we had required them to use lime. I may say, upon the question of price, that we have been often assured by the representative of one of the largest companies in London, that the use of lime was not so expensive as was generally supposed, because it made the gas a higher illuminating power; but I have no knowledge on the subject myself.

Professor Tyndall, examined by Mr. ROUND.

I have listened to the evidence of Mr. Harcourt and Dr. Pole, and I entirely agree with my two colleagues as regards this question. I was very much struck by a remark that was let fall by Dr. Pole, that the nuisance was very frequently absent when we were there, for that entirely coincides with my individual experience on some occasions. I have made the remark that the nuisance appeared to me exceedingly small, and the answer of the engineer was: "This is a particularly favourable day. It is not so bad to-day as it is sometimes." I am quite within the mark in saying that that answer was given to me at least twice by different engineers. Again, I went down to Fulham, and went round the works there, and I must say I was exceedingly impressed with the great care bestowed upon this question at the Fulham works. The amount of care shown was infinitely greater than the care expended at the other works. I had the honour of being accompanied on that occasion by a person for whose opinion I have a very great esteem, and who has particularly good olfactory nerves—I walked in company with my own wife round these works. I took particular care to go to leeward, and Mr. M'Minn, the highly intelligent engineer of the works, was there. I said to him: "Why, Mr. M'Minn, we are here to leeward; the wind is blowing from the purifier towards us, and there is no nuisance here." He made the same remark as before, adding that possibly there might have been a nuisance half a mile away; that the nuisance might have got upon the air and have been wafted through the higher atmospheric regions, and might have descended at a distance; but I can truly say, as far as my observation went—and I gave the matter all due care—that I am disposed to give the gas company very great credit indeed for the care bestowed on this question at Fulham, although not at the other stations, I am bound to say. I think there is a great deal to be said for the gas company. It is a process that requires a good deal more trouble than appears, but I cannot entertain a doubt that if the company took it up with vigour, and with a determination to solve the problem, they are quite able to do it.

Cross-examined by Mr. POPE: I only visited Fulham once; but I have not the slightest recollection that two or three hours after I left there I experienced any effects as if I had inhaled sulphuretted hydrogen or anything of the kind.

Mr. POPE: Assuming that a person's experience on the spot was like your own, that this nuisance was exaggerated, and that you found two hours afterwards nausea and all the symptoms of inhaling sulphuretted hydrogen, how would you account for that?

Witness: If any such results had occurred to me, I should have given strong testimony against the lime purification.

Then I may take it that if that was the result of a visit to Fulham, although you at the time were unconscious of a nuisance, you would be prepared to state to the engineer that that was all "bosh"?—I never used that term, sir. The engineer at Fulham is, as far as I could judge, a perfect gentleman, and I conversed as a gentleman with him. If I could trace symptoms of that kind to the use of lime, I should say, "Away with it; let us not have it," undoubtedly.

But is it possible that you might have diffused through the atmosphere sulphuretted hydrogen, to an extent not appreciable by smell, so as to make it an insufferable nuisance, but afterwards acting so as to produce the symptoms I have mentioned to you?—If you ask me if such a thing is possible, you make the range of things so large that I should be very sorry to say it was impossible, but I think it is in the highest degree improbable.

At all events, your experience was limited to one visit. I should not myself have generalized from one visit; but it is from one experiment that you draw your conclusion that there was no nuisance at Fulham?—I have given you the data upon which I have founded my opinion. I have been at other stations besides Fulham. When I went to Fulham a light wind was blowing. I went to leeward while the purifier was being opened, and my private conclusion at that moment was that, if on all other occasions the selfsame amount of care was devoted to the emptying of these purifiers, that was devoted to the one when I was there, we should have very little complaint on the part of the inhabitants of Chelsea.

Did you at that time adopt any test to ascertain whether there was any sulphuretted hydrogen present?—None, save the test that nature gave me, which is one of the finest possible.

At Fulham the purifiers are in the open air, so that, at all events, the absence of nuisance at Fulham was not due to the purifiers being covered with a shed?—I can only say that the nuisance was certainly absent. I understand from Mr. Harcourt's evidence that care had been taken to draw air down, so as to carry the foul air away, and perhaps to the withdrawal of this foul air the absence of nuisance may have been due.

Cross-examination continued: When I was at Pimlico the lime was bare and naked when shot into the barge, and the stench was wafted from that bare and naked lime to my nose. I believe that was the sole weak point in the arrangement at Pimlico. If the source of nuisance when I was there was perfectly and properly dealt with, then I should say there ought to be no nuisance at Pimlico.

Mr. POPE: I understand both you and Dr. Pole rather referred to Mr. Harcourt for suggestions. Do you think the getting out of this sulphur of any great importance?

Witness: Perhaps I can best answer that question by entirely endorsing what has been said by Mr. Harcourt. Were I offered gas with the sulphur at 3s. 9d., and the same gas without the sulphur at 3s. 11d., I should certainly, without hesitation, pay the 2d. extra for the pure gas. It is very difficult—indeed, it is perfectly impossible—to state the proportion, or express numerically, the amount of danger or damage done by impure gas.

But, if you agree with Mr. Harcourt, he is of opinion that there is no great necessity for the removal of this extra amount of sulphur. Is that your opinion or not?—I should be very sorry to attach too great importance to it; still I think it is very desirable to have the sulphur as low as it practically can be kept. At all events, from the evidence I have heard and read upon the subject, there are possibilities open, and always, I think, on public grounds, it is better to err on the safe side.

Have you given personal attention to the investigation of the gas question at all?—Will you allow me to answer that question by referring to my first appointment as a Gas Referee? I was written to by Mr. Farrer, at the instance of the late President of the Board of Trade, I think Lord Carlingford. I wrote to Mr. Farrer, saying, "I am not professionally a chemist. I am a Professor of Physics in the Royal Institution. I do not undertake to make chemical experiments of the examination of gas. I am acquainted with the process of photometry, and if any physical question should arise, I might be able to cope with such a question." Mr. Farrer wrote in reply that "that is exactly what we want; we have Dr. Pole and Mr. Harcourt, and we want a gentleman of your acquirements to meet these other cases;" and he said, "I am perfectly willing to give you my advice gratis whenever you wish to call upon me." It was almost under pressure that I accepted the office of Gas Referee. I have not made any chemical experiments with regard to gas, but I am perfectly competent to form a sound scientific opinion upon the questions that come before me.

By the COMMITTEE: I have made no experiments regarding the effect of sulphur compounds upon health, or upon the binding of books or the gilding of frames. I have made experiments, but of so restricted a character that I should not state them here as experiments of authority.

MONDAY, MAY 14.

Mr. ROUND said he had done all he considered necessary, and would now no more than watch the proceedings, and see what course his learned friends took.

The CHAIRMAN said the committee were of opinion that, so far as the existence of the smell went, they were satisfied that there was a disagreeable smell produced from some of those works, and they did not require any more evidence upon that subject. Of course, they expressed no opinion as to the cause of that smell, nor as to the possibility of curing it.

Mr. Harry James Veitch, examined by Mr. RICHARDS.

I have resided at 34, Redcliffe Gardens since June, 1876, and carry on business at the Royal Exotic Nursery, in King's Road, Chelsea. I have there a very large conservatory, and a very choice collection of plants. I formerly resided at my place of business in King's Road for 23 years. The acreage of my garden is $\frac{1}{2}$ acres, and I believe I am one of the largest nurserymen in the world. I have frequently observed a disagreeable smell in King's Road, when the wind comes from the south-east, which I am certain comes from the gas-works. I have seen a slight vapour arising from the purifiers when they were being emptied. I have observed that smell in my glass houses, which are as impervious to the entrance of dust as we can make them, with regard to the cultivation of plants. The smell has been the worst when the atmosphere has been thick and muggy. I do not think it possible for the dust to be carried to the houses from the gas-works. I have never detected any dust in the atmosphere coming from the gas-works. The leaves of our rare plants are so looked after that dust would be immediately detected if it was there. I do not know of illness of any sort in the family of the foreman who resides in the nursery, but the wife of one of our other foremen has on several occasions, when the smell was bad, been quite sick. My own brothers and sisters have suffered from nausea, and from headache also, but they have never been actually sick. I drew up a petition to the Kensington Vestry last year, after I went to Redcliffe Gardens to live, to which I obtained one or two signatures from my friends, and then I left it with my landlord to obtain further signatures. I believe there were about 30 or 40 signatures in all.

Cross-examined by Mr. O'HARA: The smell has been much worse within the last two or three years. My gardens are about half a mile from the gas-works.

Mr. O'HARA: You stated that you saw vapour arising from the purifiers; how did you trace the smell to those purifiers?

Witness: I am generally in my business early in the morning; and when the smell on one or two occasions recently has been very bad, I have passed into the King's Road towards the gas-works, and from the bridge which passes over the railway adjacent to those works you can see the purifiers being emptied, and when the purifiers are uncovered the vapour rises.

Why did you go to live at Redcliffe Gardens, so near the smell, if you disliked it so much?—Because I wanted a better house, and I also wished to be as near my business as I could.

As near the smell as you could?—That I cannot help; but I should like the smell to be removed.

By the COMMITTEE: I have other nurseries besides the one at Chelsea, and in driving past to them I have detected the smell. I am told it commences as early as five o'clock in the morning, according to the state of the atmosphere. Sometimes our greenhouses have been permeated almost all the day. When the atmosphere is very heavy and foggy the smell will not go off; but if the air is lighter, it passes off perhaps by nine or ten o'clock in the morning. When the wind comes from the south-east, we have had it for four, five, or six mornings consecutively. I noticed it last Wednesday, but we have not had a great deal of south-east wind lately.

We had a great deal about a fortnight ago, was it bad then?—Not so bad as I have noticed it sometimes.

Do you find the health of your plants at all affected?—It is difficult to prove that they would be affected by it. We have noticed that when the gas fumes have been prevailing in the houses, and have continued morning after morning, the plants have not lasted so long as they do when the wind comes from another direction, but to say that it is caused by the fumes of gas is more than I can do.

Do you perceive anything on the leaves?—No; we have noticed the leaves of the plants and cannot. I have tried to detect anything on the water, but I have not been able at any time to do so.

Dr. Andrew White Barclay, examined by Mr. MICHAEL.

I am a physician, practising in Bruton Street, Regent Street, and am Medical Officer of Health for the Parish of Chelsea. There have been numerous complaints made to the Vestry of Chelsea with respect to the nuisance arising from the gas-works. The present series of complaints commenced about 1873, and have continued up to the present time. Towards the end of 1873 I visited the works for the purpose of ascertaining what operations were being performed which might lead to the nuisance, and I found they had been obliged to resume the use of lime. At that time they were largely increasing their plant (in order to meet fresh restrictions which they gave me to understand had been placed upon them) by which they hoped that the nuisance might be prevented. The vestry appealed to the Gas Referees, who reported that they had no power to control the manufacture of gas, and then steps were taken to apply for an injunction.

Mr. MICHAEL: In the end of 1876 and the beginning of 1877 did you continue to visit the gas-works?

Witness: Yes; and agreed with the solicitors, Messrs. Lee and Pemberton, that continuous observations should be made by the residents in the parish, as to whether there was any abatement of the nuisance subsequently to the date of the Gas Referees report. I visited the works on the 14th of January this year, in company with the resident engineer, and the process of purification was explained to me, so far as it was modified up to that time. I have seen the purifiers emptied, but not very recently. I saw one of the Powell purifiers emptied in 1875, I think, and at that time sulphur compounds were given out into the air, of a noxious character, and such as, in my opinion, would be injurious to health.

Mr. MICHAEL: As far as you could judge, do you think that any want of care was exhibited by the persons who had charge of the purifiers?

Witness: I do not think any want of care was exhibited. I have always appealed to the gas engineer whether other means might not be adopted; but, not being a skilled chemist myself, I have not been able to suggest any such means. Cards have been prepared, to be distributed among a certain number of residents, in order to have an accurate report of the condition of the nuisance up to the present time; but the returns are not yet completed. That is with the intention of applying to the Court of Chancery for an injunction against the works. It must depend upon the weather how long those reports are to be continued. We must have westerly winds before we can get accurate reports. There have been several letters from the inhabitants complaining of the nuisance.

Cross-examined by Mr. O'HARA: I drew up a large sheet of paper, with a column for each day, and wanted certain observations to be filled up in a tabular form, for the purpose of ascertaining whether there was any amelioration of the nuisance or not.

Mr. O'HARA: You say that in 1875, when you were at the works, you noticed smells, and you detected sulphur compounds; that is, that you think so—you cannot say?

Witness: One can generally detect them by one's nose.

You detected these sulphur compounds. Did you consider as to whether or not the lime purification could be done without causing this smell? Did you give your mind to that at all?—I have thought it over, but I cannot say that I have come to any satisfactory conclusion in my own mind.

Cross-examination continued: I heard of the great inquiry before Mr. Forster's committee about the supply of gas to the Metropolis, but I was not summoned on that occasion.

By the COMMITTEE: I think the arrangements at the Fulham Gas-Works are rather more complete than they were, and that there is substantially an abatement of the nuisance, but unless the purifiers can be deodorized at the time of opening, I see no means by which the nuisance can be entirely abated. I cannot say that the process of passing a down draught of air has obviated it to any extent, for the reason that the gas company have been in the habit of doing so almost from the first time I visited the gas-works after the lime process was introduced. They adopted it before it was suggested to them by the Gas Referees.

Mr. Richard Thomas Daniel, examined by Mr. RICHARDS.

I am a Fellow of the Royal College of Surgeons in Ireland, and a Bachelor of Arts and Medicine, residing at 20, Cathcart Road, South Kensington. I was selected by the men to act as surgeon to the Imperial Gaslight and Coke Company at Fulham, in January, 1865. During the last two years I have had several complaints from the men engaged in removing the purifying material. I found them suffering from sickness, nausea, and loss of appetite. In addition to the complaints of the men, I have had frequent complaints from residents in the neighbourhood. I presented a petition last year to the Kensington Vestry upon the subject, of which vestry I am a member. The smell was at first attributed to other causes, but I satisfied myself that it proceeded from the emanations of gas. When the petition was introduced to the vestry, I moved a resolution that Dr. Dudfield should be requested to go down and report upon this alleged nuisance. He did so, and his report was sent to the Metropolitan Board of Works, to the Gas Referees, and, in fact, to all the public bodies who could bring any influence to bear upon it.

Mr. O'HARA objected to the report being read unless Dr. Dudfield was to be called.

The CHAIRMAN said he could not allow the report to be read.

Examination continued: I have resided in the neighbourhood for 15 or 16 years, and, in my opinion, the nuisance from the gas-works has very largely increased within the last two or two and a half years. When the purification was entirely by peroxide of iron, the nuisance was nothing at all compared to this. I was not aware that Dr. Letheby has stated that 1 per cent. of sulphuretted hydrogen in the air would be destructive of human life, but I should say that would be the case. In consequence of Professor Tyndall's remarks the other day, I determined to go this morning to the Fulham works, as I knew it was likely the purifiers might be opened. I left my house at six o'clock, and went straight down in the direction of the gas-works, and I did not observe the slightest smell. I went into the works, and asked the foreman when a purifier would be opened; he said in a very few minutes, as the men were just coming in to open it. I witnessed the whole process, and the stench was most intolerable. The wind was not in the direction of our neighbourhood, and the weather was very foggy, warm, and misty. I felt myself quite nauseated by the smell. I saw all the process carried out, and all the suggestions which I heard Mr. Harcourt talking of the other day; I also made inquiries, and satisfied myself that there was a down draught of air being carried through the lime. The barges and all things else were covered up, and in no way possible could this small escape after the lime left the purifier. No suggestion occurred to my mind that would make the system more perfect.

Cross-examined by Mr. O'HARA: I went to the works because Professor Tyndall stated distinctly that he was present with his wife, and that there was no smell from the purifier, and I knew there must be some mistake, so I went to satisfy myself. I never passed a purifier from which there was not a smell, and I have passed them hundreds of times. I smelt some gas far this morning, but it is a very different smell from that which the purifiers give off.

The COMMITTEE: Do these men complain of their eyes or hands being injured by the lime at all?

Witness: Not their eyes. Frequently, if their hands get a little moist in shovelling out the lime they get very severe burns, which are worse than burns inflicted by plain lime; they get poisoned wounds, but I have never heard them complain of the dust.

With regard to Dr. Letheby, you said he calculated that if there was 1 per cent. of sulphuretted hydrogen in the air it would be injurious to health. Does that apply to gas burnt in a close room or in the open air? How do you apply this dictum of Dr. Letheby's upon the subject?—I apply it in this way—that sulphuretted hydrogen, to persons inhaling it with other compounds, is injurious to health.

In the open air?—Yes; it fills the rooms in our neighbourhood completely, although the windows are closed. My own servants complain of it, and it has been attributed to our sewers; but I have had everything done that can be done to our drainage, and I believe it is perfect.

Mr. Frederick Alexander M'Minn, examined by Mr. POPE.

I have been engaged at the Fulham station for 18 years, and have been chief engineer there for two years. That station originally belonged to the Imperial Gas Company. In the summer of 1873 our directors, who were then the Imperial, became aware that the Gas Referees would very shortly place them under the particular restrictions as regards purity from sulphur compounds, which they had previously insisted upon with regard to the Chartered Company, and it was therefore necessary to commence, in anticipation of their demands, some preparation, in order to enable us to purify our gas. We made up our minds that the requisite amount of purity could be obtained only by the use of lime. It was in June, 1873, after the Referees were appointed, that the purifiers were first charged with lime at the Fulham station. As soon as we commenced using the lime process, it was found that our purifying capacity was quite inadequate for the purposes required by the Referees. It necessarily involved a frequent substitution of fresh lime, in order to purify the quantity of gas required. We did succeed in keeping down the quantity of sulphur pretty successfully from that time, but it was with very great difficulty, on account of our limited purifying area. We had to change the purifiers very rapidly. A great nuisance was certainly created. In the winter of 1873-74 a number of lights were transferred to another station, so that we might enlarge our purifiers at Fulham. On the 9th of February, 1874, I received a letter from Mr. Chubb, the secretary of the Imperial Company, enclosing a complaint from the Metropolitan Board of Works with reference to the nuisance which was being created. By the winter of 1874 it was found that it had not been possible to get all our new purifiers ready in time for the winter, and we applied to the Referees for some relief from the maximum of sulphur which they required, but they declined to make any alteration in their order. Notwithstanding that our apparatus was not perfectly completed we succeeded in purifying the gas substantially as the Referees required; but we had great difficulty in doing it. On several occasions we were above the mark, but the matter was leniently considered, by reason of our works not being actually completed. On the 28th of January, 1875, Dr. Barclay visited our works with reference to complaints of the nuisance that were being made. He especially referred to a nuisance on the 20th of the previous December, and I explained to him that it was due to our being obliged to change the purifiers rather sooner than we ought to have done, because if we had allowed the matter to go on longer, we should have had our gas above the maximum. On the 24th of August, 1875, Dr. Barclay came to the works and made further complaints of the nuisance which the district and his neighbourhood were feeling. Up to that time I had been giving every possible attention, both to secure a proper purification of the gas, and to minimize the nuisance as much as possible. Up to the end of 1875 Dr. Barclay, from time to time, visited the works, and I explained to him the system of working the purifiers by rotation, which I hoped would do away with the nuisance. I may illustrate what I mean by this [producing six cards]. We have a set of six purifiers; they are placed in this way, and we thought that by continuing the flow of gas through the whole of the series, we should be enabled to convert the lime in the first purifier into carbonate of lime, so as to prevent the nuisance caused by the sulphide of lime; but we found that by adopting that process, it drew the whole of the sulphur out in this first purifier in such vast quantities, that it was impossible to prevent it going into the gas, and therefore we had to abandon that process. In July, 1876, I received still further complaints from Dr. Barclay of the nuisance arising from the Fulham works. He came to the works, and I was extremely vexed to see him, because my impression was that I had been successful in reducing the nuisance to such an extent that it would not be noticeable. I told him exactly what I had done, and what difficulties I found—that, in truth, I could not, by the rotatory system I have mentioned, purify the gas, and at the same time avoid the nuisance. From that date, therefore, the system of working the purifiers in rotation was abandoned.

Mr. POPE: Let me ask you this, because a great deal seems to turn upon it. Did you do everything which your knowledge, care, experience, and supervision could do, to carry out this in a successful way, in order to accomplish the double result?

Witness: I did.

Honestly, with the view to do it, if possible?—Yes.

I think you say that you thought yourself you had succeeded in minimizing the nuisance?—I did.

Examination continued: In September I received instructions from our directors, in common with the other engineers of the company, to try the ventilation of the purifiers that has been mentioned by Mr. Harcourt. I have a copy of the directors' order:—"That the foul lime at all stations be completely ventilated prior to removal."

Mr. POPE: How soon after that order did you proceed to apply to your purifying chambers this ventilating process?

Witness: I did not apply it further than on one occasion only. I found then that the temperature of the lime was increased to such a very great degree, and the length of time occupied in ventilating the whole of the lime would have been so great, that, in the first place, I could not open the purifier long enough, and, in the second place, I seriously apprehended damage to the vessel itself. I should also add that the nuisance caused by heating the lime was so much greater than that ordinarily caused, that I abandoned it simply on that account. After carrying the experiment on for, I think, five days, I found that I should want the purifier again for use, and I had to stop the process; and in order to get the purifier empty I had, as it were, to bribe the men to go into it on account of the terrible state the lime was in.

By the COMMITTEE: The heated condition of the lime was caused by the action of the oxygen of the air in passing down through it.

Examination resumed: I have since modified that process, and now simply carry it to the extent of removing the gas itself which remains in the purifier after it is shut off; and also, as I have always done from the introduction of the lime process, I draw the air down while the operation of emptying the purifier is going on. On the 17th of November I heard from Mr. Harcourt that, in consequence of the complaints of the Chelsea Vestry, he proposed to visit the works and inspect the process of purifying, which he did on the 22nd, in company with Dr. Pole. I showed Mr. Harcourt the whole of the arrangements that were going on—the trucks, the means of covering the lime, and the hood for shooting the trucks under; and I also showed them the means for covering the barge over to prevent the escape of dust, as far as possible. I delayed opening the purifier till the arrival of Mr. Harcourt and Dr. Pole, when the lid was raised, and the operation commenced. I mentioned that Dr. Barclay had suggested the application of chlorine gas to deodorize the lime, and I explained to the Referees how he suggested it; but they agreed with me that it was quite impracticable, and could not be carried out. Mr. Harcourt then observed that, while the men were removing the lime, there was some dust thrown up. The lime was dry—it very often is dry, but at other times it is quite moist in itself—and he suggested the application of water to the lime, as he thought that nuisance was caused by the dust escaping. I undertook to do that. Mr. Harcourt also proposed that we should cover the lime over with tarpaulins, or cloths of some sort, in order to prevent the escape of effluvia, and that I undertook to prepare for on his next visit. Before leaving, Mr. Harcourt thought over the idea that had been thrown out, about the application of chlorine gas, and then they proposed that we should try an experiment with chloride of lime; that we should take some wooden trays, and place some chloride of lime upon them. Supposing a purifier is being opened and the wind was blowing in a certain direction, the chloride of lime should be placed here [pointing on a model] and treated with an acid, so that the chlorine gas should be thrown off; and he thought that if those two gases came in contact with the air the one would deodorize the other. I undertook to do that on the next visit. I remember Dr. Pole suggesting that that would "catch it on the wing," but it did not seem to me altogether practicable to do it, because chlorine gas is a gas of very heavy gravity, and would fall quickly, whereas the other gas ascends; however, I undertook to carry it out.

Mr. POPE: Excepting the wetting of the lime and covering the surface during the discharge of the purifiers, was the whole of the rest of the process described by Mr. Harcourt in operation during the time that those complaints were being made against the stench from the works?

Witness: It was; everything was in use.

That being so, if there be any nuisance at Fulham, is it in any way due to negligence, or carelessness, or indifference upon your part, as to its existence or cure?—No, it is not. I have taken the greatest possible care that any man can to prevent that nuisance, and I am constantly supervising it.

I may ask you this question generally: Have you been able to get rid of the nuisance which is occasioned by this system of lime purification?—No.

In your opinion, is it possible to carry on a system of lime purification involving the reduction of the sulphur compounds to the extent prescribed by the Referees without causing a nuisance which may be offensive to the neighbourhood?—No.

You have exhibited no disinclination, whether natural or otherwise, to cope with this problem of gas purification?—None whatever. I have met everything that Mr. Harcourt has suggested to me most cheerfully, and endeavoured in every way to improve upon what we did before.

Mr. Harcourt seems to think that at Fulham, to do you credit, everything is done which can be done. Let me ask you, in your judgment, though everything is done which can be done, have you solved the problem at Fulham?—I have not. I suffer from it myself, and I would endeavour, if I possibly could, to remove the inconvenience for myself, if not for anybody else; but I have not been successful in doing it, although we have spent considerable sums of money in endeavouring to solve this difficulty.

In pushing the process of deodorizing the sulphide of lime to the full extent, is there any special danger which has been found in the manipulation of that process?—Yes, unquestionably a danger. The action of oxide of iron upon sulphuretted hydrogen is to form a sulphide of iron, and when the oxygen again meets with it, it re-forms the oxide of iron and precipitates the sulphur. That is in the form of uncombined sulphur, and the amount of heat evolved during that process is sufficient to ignite the sulphur. Then you have the purifier full of gas, and when you use the ventilating process you have to drive it down and pass it through the oxide, and that in itself is somewhat dangerous, by reason of its being an explosive mixture when mixed with common air. If you go on, and draw down the sulphuretted hydrogen, that, when mixed with common air, is also an explosive gas. Again, in carrying on this process, every time you do it, the heat here [pointing to the model] is sufficient to ignite the sulphur. We saw that difficulty long before the lime process was introduced, but more especially since then, because I constructed vessels, with closed covers, with a pipe to carry off the vapours other than sulphuretted hydrogen, and I put on them two large valves, in anticipation of such an accident happening as an explosion. We subsequently found, in carrying that process out at the Bromley station, that an explosion did happen there; and I then ceased using the closed vessel, and constructed this open vessel. We then introduced a steam-pipe into the oxide, the object being to moisten it, so as to endeavour to prevent the ignition of the sulphur. There is a great deal of heat given off from the purifier during the ventilation of the lime to the fullest extent, and the steam dries the

oxide to such an extent at the bottom layer that it is still liable to ignite. It becomes hot and dry, and then chemical action goes on, and the sulphur is heated, and sufficient heat is still created to cause an explosion, although you introduce the steam by way of preventing it.

As I understand, the ventilation that Mr. Harcourt spoke of in terms of praise cannot be safely carried beyond the point at which you carry it at Fulham, because of its tendency to heat the lime in the purifier itself, which, of course, renders the lime even more offensive than it is to begin with?—Yes, unless you carry it to the full extent, and completely deodorize it.

If you carry it to the full extent, then you run this risk of carrying over other sulphur compounds, and creating another smell, or an explosion, from the causes that you have mentioned, either the leakage or the heating?—Yes.

Have you therefore carried out this process of ventilation to the utmost extent that you consider it safe in your experience to follow?—Yes; seeing that I have a great number of men in my charge, I consider that I do carry that process as far as it dare be carried for the safety of the men.

Notwithstanding all that, there does exist the nuisance which you have mentioned at Fulham, and which is, to your mind, inevitable?—Yes. There is an incident I may mention. It appears to me, from all the Referees have said, that they have in their minds an idea that I do not carry out this process carefully. They always point to that, that if these processes are carried out carefully, there is no nuisance. I can only give you my honour as a gentleman that I do carry out these processes to the fullest extent; that is the most forcible way in which I can tell you. On one occasion, Mr. Harcourt came down to the works without a previous appointment, at a time when we were fully engaged in emptying a purifier. He came into the works, and went to the purifier that was being emptied. It was reported to me immediately that he came, and I was rather nettled, because I thought it implied a want of confidence that I was not carrying out these processes exactly as they ought to have been done, and I did not go to join him. I thought he might investigate as far as ever he chose. In about half an hour my foreman came to me and said that Mr. Harcourt had asked him to take a piece of lighted yarn, so that it would smoulder, and smoke, and hold it over where the lime had been removed, in order to see if the draught from the exhauster was really drawing down the air, but my foreman declined to do that. He said it was so dangerous an experiment that he dare not do so without my authority, and he came to me to ask whether he was to do it. I said that I was greatly obliged to him for not doing such an extremely dangerous thing, because there was a decided danger of a serious explosion, and it might have cut my works in half. I look upon that as an instance of the want of practical knowledge those gentlemen have in the internal economy of gas-works. A practical gas engineer would certainly never have dreamt of proposing such a trial as that. I do not desire to throw any disrespect on Mr. Harcourt in any way, or upon any of the Referees. They are no doubt able men; but I say that the practical knowledge which is so essential was absent.

Cross-examined by Sir E. BECKETT: We found it very inconvenient being under the 20-grain test in the summer of 1874, because our purifying apparatus was not large enough to enable us to comply with the Referees requirements.

Sir E. BECKETT: You received a letter upon the subject, did you not, from the Referees, on Nov. 14, 1874?

Witness: I do not know of any.

Sir E. BECKETT said it was not very long, so he would read it:—

17, Buckingham Street, Adelphi, Nov. 14, 1874.

We have to thank you for your letter of the 2nd of November, giving us the information asked in our letter to you of the 12th of October, in reference to the increase your company are making in their purifying apparatus. We were desirous to obtain complete information on the facts, before reconsidering the maximum of sulphur impurity we have prescribed, and we are happy to express our satisfaction with the measures your company are taking to increase the purity of the gas supplied by them, and our sense of the difficulties which have delayed the execution of those measures.

Having now the facts correctly before us, we have carefully considered your request; and we may say at once that if we were convinced that the retention of the maximum at the present amount would press so hardly on the company as to be likely to subject them to fine through the fact of the accidental non-completion of the new apparatus, we should be disposed to make a relaxation in their favour. But on carefully considering the data before us we cannot come to that conclusion. In the first place, looking at the sulphur returns of last winter, we find that, although the maximum then in operation was 30 grains, the actual amount did not often exceed 25 grains. The principal exception occurred at the Haggerston works in December, and at Fulham during the other half of the same month.

In the following month, owing, no doubt, to increased experience in the management of lime, although the make of gas had scarcely at all diminished, a maximum of 28 grains was never exceeded at Haggerston, and on three occasions only at Fulham. At the St. Pancras works the same maximum was exceeded twice only in each of the four winter months. Since that time two advantages have accrued to the company, which should enable them to supply gas of a somewhat higher degree of purity than last winter—first, the opening of the spacious works at Bromley, which enables them to transfer a portion of their make from works, the demand on which has outgrown the means of purification, to a place where every facility should exist for the reduction of sulphur to the lowest point; and, secondly, the experience gained not only from the experiments specially instituted by the company on the subject (as named in your letter), but from a year's working of a method of purification, which, even where imperfectly applied, reduces the amount of sulphur considerably below 25 grains. A comparison of the returns of the present year with those of the corresponding period of last year shows very much improved results, which (as there has been no increase of purifying apparatus brought into use at the urban stations) we can only attribute to increased knowledge, care, and skill in the mode of purification.

In the month of October, 1874, the maximum amount of sulphur returned was—

	Grains.
At Fulham	17.6
At St. Pancras	19.3
At Haggerston	18.2
At Bromley	15.4

(excepting two days, on which they were quite anomalous, and evidently accidental). In November the maxima have been—

At Fulham	16.1
At St. Pancras	13.1
At Haggerston	17.1
At Bromley	10.3

The averages have been as follows:—

	Oct., 1874.	Nov., 1874.
Fulham	15.6	14.8
St. Pancras	15.4	12.0
Haggerston	15.2	15.6
Bromley	10.4	7.3
General average	14.1	12.4
The average for the corresponding months of last year were	18.2	20.5

Hence it is clear that your managers are employing their existing purifiers much more successfully than at the corresponding periods of last year, and although the make is approaching its maximum they are keeping a long way below the prescribed maximum of sulphur. At Bromley, judging by the very low sulphur returns, there can be no reasonable doubt of the sufficiency of the purifying capacity; and at St. Pancras four out of six new purifiers are so far advanced that they may certainly be used before the depth of the winter. These two works yield nearly half the supply.

From these data we cannot doubt the power of your engineers, by skill and care, to keep during the winter within the present maximum under ordinary circumstances. It must be borne in mind that if it should be exceeded, owing to extraordinary contingencies, you have your power of appeal, and we have no doubt that in such a case the chief gas examiner would take into consideration any *bona fide* plea on your part founded on temporary difficulties arising out of the non-completion of the new apparatus.

You must, we are sure, be aware that the raising of the maximum would be viewed with great displeasure by the public, and it is consequently a step we could not resolve on, except under more urgent necessity on the part of the companies than we at present see. The public may reasonably expect a lowering of the amount of sulphur, now that the practicability of keeping it down has been established; and we hope that next year we shall be able to fix a lower maximum than heretofore.

We take this opportunity of expressing our satisfaction at finding that purification by lime has been carried on at Fulham during the summer without a repetition of the former complaint of nuisance to the neighbourhood. We were confident, at the time you brought this matter before us, that such a result might be achieved by care and skill on the part of your managers, and we are pleased to find that our anticipations have been realized.

That letter was signed by the Referees. (To witness:) Do you wish to make any remark upon that?

Witness: With regard to the question of sulphur, that is not the point at all. We have complied with the Gas Referees instructions entirely upon that.

Sir E. BECKETT: What do you say to the last paragraph?

Witness: I do not understand it. I never heard of the letter before.

Then Mr. Chubb did not think it worth while to communicate with you about it?—I do not know; I cannot tell you what was in Mr. Chubb's mind.

Then we must ask Mr. Chubb. Did you take any part in the proceedings in 1875 before Mr. Forster's committee?—I had nothing whatever to do with that matter at all. I was devoting my attention to suppressing the nuisance, although unsuccessfully.

If these Referees continue—or better Referees, if you would like to have some better—you would go on trying experiments to get rid of the nuisance?—I consider, so far as the lime process is concerned, that I have done everything that can be done, and the Referees agree with me.

When you say everything has been done that can be done, do you mean, to repeat Mr. Forster's question in 1875, that science is never going any further?—No.

If the Referees continue requiring you to keep down the sulphur, will not you go on continuing to try fresh experiments in order to do so?—Not after this lime process. My mind is made up on that point; I have brought it to the practical limit. I cannot improve on the experience that I have had, and I am not aware of any other process.

Everything must have a beginning. Will you take upon yourself to say you are satisfied that science can never find anything?—They may discover something a hundred years hence.

Supposing you are under two fires, the Referees on the one hand and the penalties on the other, do you not think it would be worth while going on, and possibly paying scientific men to try and invent some process?—I hardly think you mean that it would pay anybody to try and invent a process.

Such things have been done in the world?—It seems such an extraordinary question, that I find some difficulty in answering it.

It is an unpleasant question, no doubt?—It is a myth. I cannot define in my own mind how I am to set about giving a practical answer.

Mr. POPE: Then you think it is fair to say that we are to be put under penalties until somebody can invent something to get rid of the lime process.

The COMMITTEE: Mr. Harcourt told us that these limits depended entirely upon the lime process.

Sir E. BECKETT: I want to know whether this gentleman is confident that nothing more can be done by way of improving the lime process to get rid of the nuisance?

The COMMITTEE: The question to Mr. Harcourt was to that point, and he said if purification proceeded upon any other process the limit would have to be temporarily abandoned.

Sir E. BECKETT: Then he would abandon it. (To witness:) If, on the other hand, this Bill is passed, relieving you from the Referees, what motive will you have to try and purify the gas and get rid of the sulphur?

Witness: If we possibly could discover a process, we should. I have lately been trying experiments myself with that view—we are constantly doing so; and if we were to eventually discover such a process, we should, of course, adopt it.

Why "of course," without any Referees?—Simply we should, as we always have done, be doing our best to carry out the intention of reducing the amount of sulphur in the gas; but I have no grounds for saying there will be a success. The experiments I tried are entirely abandoned, and I do not at present know any other direction in which to make them.

Supposing the Referees are removed, as this Bill tries to do, what motive will you have for taking any trouble to find the means for removing the sulphur?—At the present moment I do not see what motive there is other than the endeavour to reduce the amount of sulphur in the gas supplied to the public.

Do you think there is any harm in sulphur as burnt in a room?—To what amount do you mean?

What amount of sulphur would you like—say 40 grains?—I do not think there is any practical difference between 20 and 40 grains.

You would not think it worth while to try and reduce the sulphur below 40 grains if you were free from penalties?—I say practically there is no difference between the quantity of sulphur at 20 and grains 40.

That being your opinion, would you take any trouble to reduce the sulphur below 40 grains if you were free from penalties?—If we had a process by which we could do it I would, but it is a question I cannot answer, because there is no process but the lime.

Mr. POPE: We take it for granted that if there were no penalties, practically 40 grains would be the maximum.

The COMMITTEE: Is there any amount of these sulphur compounds which is ever produced by the combustion of gas which you think would be injurious, because you speak of the difference between 20 and 40 as not being worth considering?

Witness: Not between 20 and 40; but if it went as far as 60 or 80 grains, or anything like that, I should be inclined to think it was decidedly advisable to remove it, because there would be a greater amount of sulphurous acid formed in the same amount of air in the room, the effect of which would be simply a question of disagreeableness in the room. So far as the injury to health goes, I think, even in that case, it would not be so in an ordinary ventilated room.

Is there much more difference between the injurious effect produced by 40 grains as compared with 60, than there is as between 40 grains as compared with 20?—It would increase in the same ratio as between 20 and 40 and 40 and 60.

You have thought 40 grains about the happy mean at which you begin to allow it to be injurious?—I think 33 grains was the average quantity of sulphur existing in the gas under the oxide process. I have looked at it in this light, that sulphurous acid is a disinfectant, in point of fact; and it struck me whether or not it is not an advantage, to some extent, to have sulphurous acid. It may seem to be a laughable thing, but sulphurous acid is, nevertheless, a disinfectant.

Would you be quite satisfied to have a limit of 33 grains?—No; because it is a process that we cannot exactly control. It never reaches more than 40 grains, but it will range between 28 and 30 and 33 grains when the purification is carried on by oxide of iron.

In July, 1876, you had the impression that you had succeeded in doing

away at that time with the nuisance; what did you form that impression from?—Through the means I adopted there, I thought I had reduced it to such a low degree that it would not be observable; or, if so, not sufficiently to draw forth complaints.

Is it observable in the yard at the present time, when there are complaints in the neighbourhood?—Yes; it is more noticeable on a damp, dull, wet morning; such a morning as this.

If it were noticed outside, I suppose there is no doubt you would notice it inside the works still more?—That would depend upon the condition of the atmosphere. If it was a bright, light, clear day, with a westerly wind, it would rise and go away, and be noticeable more at a distance than on the works, perhaps.

Have you made any suggestion to the referees that, instead of fixing a limit of 20 grains and 25 grains, they should give you an average of 33 grains?—No; we have not put it in that way, except that we have proposed that there should be no limit fixed.

But supposing you could not get that?—We were willing to take 40 grains; but we could not accept 33 grains as the maximum.

Supposing you had more room in your yard, and were, therefore, to have a greater number of lime purifiers, would not that reduce the nuisance very much?—No, I think not; because you have to take out a certain impurity—the bisulphide of carbon; and in order to do that you must have sulphuretted hydrogen and sulphide of lime. If you do not take it out it goes into the gas. Therefore you must remove the sulphide of lime, drawing with it the bisulphide of carbon, and if that has to be reduced to a certain point, no matter how, you must take it out.

Is it not the case that the oftener you change this lime, the oftener you open the purifiers, and the more rapidly you work, the worse is the smell in the neighbourhood?—If the capacity of the purifiers is not sufficient to reduce properly the sulphur compounds, they must be changed oftener. We have always done so in the summer to the fullest extent, and we are now increasing our purifying plant very largely to enable us to do it during the other months. But you still have to take out the same quantity of bisulphide of carbon, and you must have the sulphide of lime to do that; and if your purifiers are larger, the only difference is that you work them somewhat longer. You are able better to combine the sulphur compounds that have to be removed—that is, the velocity of the gas is less, and it is longer in contact—but, in point of fact, the more you purify the gas absolutely the more nuisance you must create, because you bring more impurity out.

What we want to get from you is this: Supposing you had more space, and a greater number of purifiers, would not that lessen the nuisance, both by the infrequency of opening the purifiers, and also because you would not have to force the gas through so rapidly?—It would lessen the frequency with which we should have to change the purifiers.

You also say if you have to force the gas very fast through the purifiers the effect is worse, so that in those two respects you gain an advantage?—We have an advantage—that is the reason why we have spent so much money in extending our purifying plant, and are proposing further extension.

That would, to some extent, reduce the smell?—In the very depth of winter it would reduce the frequency of changing the purifiers, but at the same time the bulk of lime is larger, and the operation of changing a purifier extends over a longer period; therefore, in point of fact, you have to perform precisely the same work, but in a slightly different way.

In cross-examination by Mr. ROUND, witness expressed his opinion that the foreman at the works had acted correctly in declining to hold a piece of lighted yarn over the purifiers, as requested by Mr. Harcourt, on account of the possibility of an explosion. He also stated that the foreman, although he had no scientific knowledge whatever, was in that particular case the better man of the two, because he had the practical knowledge. The danger of explosion would be from the valves, of which the foreman was thoroughly aware.

Mr. ROUND: This ventilating of the purifier had been going on for some time, had it not? The air had been drawn down through it for all that time, and Mr. Vernon Harcourt knew perfectly well that it was not inflammable, though you set against that the opinion of your foreman, who thought it was?

Witness: I undertake to say that it is most probable that there would be slight leakages from the valves at the bottom of the purifier, which were covered over by the layers of lime, and were not noticeable; and with this down draught, if a spark had been carried down, the gas would have gone below the layer of lime and have caused an explosion.

The operation of drawing down the air had been going on in the open air for hours; it was not covered?—It is open to the air, but the draught is drawing inwards.

Supposing it had resulted in an explosion, Mr. Harcourt would have been the first person to have been blown up?—Yes, and the men occupied in clearing out the purifier. Mr. Harcourt did not know of those two valves, but my foreman did, and he would not allow the trial to be made.

Sir E. BECKETT: Then you would have had a new Referee?

Witness: I should have preferred to have a practical gentleman to see my works.

Mr. ROUND: You give this decided opinion that an explosion would be the consequence?

Witness: Might have been the consequence, because there would be sulphuretted hydrogen as well escaping.

Mr. RICHARDS: Will you ask the witness whether a bit of fluff would not have shown the down draught just as well.

The CHAIRMAN: That is not the question.

Mr. ROUND: You would have the best possible means of seeing, by the smoke, whether there was a down draught or not.

Witness: Supposing an explosion had happened, and had interfered with one of those purifiers, and put it out of use, my works would have been cut in half. It was in mid-winter, too, and that would have been a very grave and serious matter.

One of the two cases may then be apprehended. Possibly an explosion from the presence of a small portion of sulphuretted hydrogen?—Not altogether.

You have alluded to leakage as one cause, but the other was sulphuretted hydrogen coming in contact with the air, and becoming explosive?—Sulphuretted hydrogen is an inflammable gas.

What proportion of sulphuretted hydrogen must there be escaping as compared with the air?—I cannot tell you what proportion. There must be an explosive proportion.

Now we know the extent of your chemical knowledge. I only wanted to know, before you gave your opinion, whether you were acquainted with the A B C of chemistry?—You have no means of ascertaining how much sulphuretted hydrogen is being given off.

We can judge of that theoretically. What must be the proportion of the one to the other before it explodes?—It is impossible to discover that.

Without reference to these particular circumstances, what proportion of sulphuretted hydrogen must be mixed with the air to cause it to explode?—I forget at the present moment, but that it does explode is quite certain; and in addition to that there was the escape of gas from the valves. I particularly mention that more than the sulphuretted hydrogen.

Mr. ROUND said there was a letter he wished to lay before the committee which Mr. Vernon Harcourt had accidentally taken away on the previous Friday. It was from Mr. Evans, dated the 28th of October, and he was merely going to read a passage, and ask the witness whether he agreed with it. Mr. Evans wrote to Mr. Vernon Harcourt as follows:—

My dear Sir,—In reply to your letter of the 26th on the subject of ventilating foul lime, I am quite certain, had you seen the process in operation properly, you would not have condemned it as you did by attributing the nuisance to its use. The ventilation of foul lime is not new to me. I adopted it at the Berlin works (I think 38 years since), and it worked admirably, and entirely got rid of the nuisance of foul lime.

(To witness:) Do you agree with that or not?

Witness: I do not know what Mr. Evans experienced 38 years ago, but I should judge that the works must have been of a very small size. I understand what Mr. Evans means there is the process, to the full extent, of ventilating the lime; but then you are dealing with 38 years ago, and, no doubt, with very small works. You have to deal here with very large bulks of lime indeed, and that is a great and essential difference.

Mr. ROUND: I am told I ought to read the next sentence:

In the year 1846 it was adopted at the Westminster station at an outlay of £2000 or £3000, and was only given up on my discovery, accidentally, of the renovation of oxide of iron.

We know that oxide of iron is passed away and done with as a purifier, and that was the only reason why it was given up. Do you agree with Mr. Evans as far as that goes?

Witness: I do not know what was the size of the Westminster works at that period, or what foul lime Mr. Evans had to deal with. I only judge from my own experience of the present bulk of lime we have to deal with. In carrying out the experiment of drawing air down through the lime, I was obeying the instructions contained in the directors' minute, but I do not know how the matter originated.

Is the exhauster which was used to produce the down draught of air connected with more than one set of purifiers?—It is connected with the whole.

I suppose you often have to open more than one purifier at a time, have you not?—We have sometimes in the winter to open two at the same time.

When that is the case, and when you have to open two at a time, is it not possible that the action of the exhauster might be limited to that one which presents the least resistance to the down draught of air?—When the sieves of the purifiers are exposed, the air will go through them instead of through the lime, which offers a great resistance; but, notwithstanding that, I have still been obliged to stop the exhauster before being able to empty the bottom tray of the purifier, on account of the heating of it.

Occasionally, will it not happen that one of the purifiers is being discharged without the protection that the down draught of air gives it?—No.

To a certain extent it would be deprived of it?—It is exactly the same thing, if you are only opening one purifier. As soon as you expose it, whether it is one or two, the air goes through the opening immediately, without touching the remainder of the lime; it takes the easiest passage for itself.

When you were discharging the purifiers, was the exhauster always left in action, previous to the time when the Referees came?—Yes. I think I have explained to Mr. Harcourt what I have done.

Mr. MICHAEL said he proposed to read the reply of the Referees to that letter from Mr. Evans.

Mr. VERNON HARCOURT: Then I think the whole of Mr. Evans's letter should be read.

Mr. ROUND: Very well. I will take it up from the point where I left off. We had for years previously been in the habit of burning refuse lime in an oven, and using it for purification, so as to diminish the amount of material to be removed; all this was expensive, and was got rid of by the use of oxide of iron. I believe this to be so far the best method of purification; but then you three gentlemen say that we must reduce the sulphur in the gas by some 8 or 10 grains, not, I believe, from any conviction of its necessity, but simply to meet not even the outcry of those who burn the gas, but of a few agitators in the Board of Works and the City Corporation. Now, when I was a Referee, I steadily refused to impose conditions on the gas companies which I knew were unequal and absurd, and resigned my appointment, worth £700 per annum, before I would be a party to what I considered a direct departure from the spirit of my appointment.

I venture to suggest that the sulphur question is a bugbear raised by Letheby who found it pay to keep it up. It is all very well to say there is no nuisance from foul lime. I contend there is, and when the time arrives when some of our people are killed (and many are often rendered incurable now) a coroner's jury may bring in an awkward verdict against our engineers for using this process. In little works, as at Silvertown, the purifiers are small, and easily and quickly changed; but when you have to deal with 800 to 1000 bushels of refuse material, it is quite another affair. It is like the earth closets for a small village, and its application to London or any large city.

In a sanitary view, I believe, a little sulphurous acid would do good, but you will never get enough to do any good from the combustion of coal gas, even with 40 grains. It is a curious fact that these few grains of sulphur appear to have a wonderful effect, while nothing is said about the carbonic acid produced by the combustion of a foot of gas (nearly one foot), and yet this is, after all, the great source of evil, where gas is burnt without a proper ventilation of the room. All this should be shown up to the public, and it was my intention of so doing had I remained in office. I trust, however, the day is not far distant when we shall get rid of this lime nuisance, which at present is a thousand times greater than that the sulphur in gas produces.—I remain, &c.,

F. J. EVANS.

Mr. MICHAEL: The following is the answer, written Dec. 30, 1876:—

My dear Sir,—I am obliged by your letter of the 28th. I attributed the nuisance at Shoreditch mainly to the nuisance of the ventilating process, and I did so in consequence of what you and Mr. Clark told me of the peculiarly nauseous smell which had there resulted from the overheating of the purifying material, and which you attributed to the action of heat on naphthalene. By all means introduce this process at all your works if you have not already done so. I have seen it at work on several occasions, and have never myself seen any approach to an overheating of the lime, or of the oxide through which the air is expelled. By keeping the lime damp, and drawing enough air through it, I believe the ill effects on the workmen and the nuisance to the neighbourhood, may be altogether avoided. I regret, however, as you do, the disuse of oxide, which I regard as far the best agent for removing sulphuretted hydrogen.

You have three impurities to remove—sulphuretted hydrogen, for which oxide should be used; carbonic acid, which needs lime, unless Hill's process proves to be better (or unless it should pay better to leave the carbonic acid in, and make up for the loss of illuminating power by a large dose of candle); bisulphide of carbon, which can be removed by lime fouled for the purpose, and needing only to be changed at considerable intervals.

Your estimate in the difference of the amount of sulphur, according as the gas is purified with oxide only, or with lime as at present, at 8 or 10 grains, surprises me. The present average is about 15 grains; the average with oxide is between 30 and 35 grains; the difference is from 15 to 20 grains. Which of the three statements do you dispute, or how comes your estimate to be half of mine?

I have read with satisfaction the Bill which you are about to introduce for abolishing the sulphur maximum, because if this obligation is to be taken off the companies it should be by the action of Parliament. It is the manifest intention of your present Act that you shall do two things—first, remove sulphuretted hydrogen wholly; secondly, remove other sulphur as far as practicable, within reasonable cost or difficulty, and without occasioning a nuisance. I think the Referees' duty is not to judge whether the reduction of sulphur is desirable, but how far, being desirable, it is practicable.

Very truly yours,

A. VERNON HARCOURT.

By the COMMITTEE: By the oxide process the lime would remove the carbonic acid after the sulphuretted hydrogen had been removed by the oxide. There is no sulphate of lime formed there.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 19, 1877.

Circular to Gas Companies.

THE Annual Meeting of the British Association of Gas Managers is naturally, to us, one of the chief events of the year; for, although we fully recognize the value of the services rendered to our art by the younger and smaller Associations, it is in the larger and parent gathering that most interest centres. We have before mentioned our regret that circumstances, which all will understand, do not allow of a longer meeting, and a more general attendance of managers. We should, for example, have been glad if some of our Scottish friends, who have experimented with Aitken and Young's process, had been present, so that we might have had the process discussed from what we may call a southern point of view. Until, however, Mr. Hartley has succeeded in convincing Directors of Gas Companies and others that the attendance of their managers at these gatherings is advantageous to their interests, we fear we shall have to put up with short meetings and limited attendances. We speak, of course, in a general sense, and it must not be considered that we deem the attendance at the late meeting as "limited." It was, on the contrary, larger than was anticipated, and the meeting was as successful as most in the annals of the Association.

The President for the year, Mr. R. P. Spice, was, of course, perfectly at home when addressing an audience of Gas Managers, and it is hardly necessary to say that his opening speech gave the greatest satisfaction to the members. At the commencement of his address he touched on a point which it was necessary to handle with some delicacy. The relations of Gas Companies and Gas Managers to the general public is an important matter to consider. A monopoly, as Mr. Spice very

properly put it, is always obnoxious to the public mind, and for this reason, when no other exists, a feeling of distrust and antagonism is created. It follows that, for the successful management of a monopoly, outside the financial part of the business, some special qualities of mind and manner are required. The mind can be easily formed by any one who will follow the President's advice, and adopt a liberal course of reading, which some may think beyond a Gas Manager's requirements, but we believe would prove of essential service to the younger members of our profession. The possession of knowledge, coupled with a faculty for communicating it, is the most valuable gift a man can have. "Knowledge is power," but knowledge in a man's brain may be like steam in the boiler—of no use without the machinery to transmit and distribute it. And here we may remark on the opportunities these meetings afford for acquiring that faculty for communicating information. The production of a paper, and engaging in the discussion which follows the reading of it, constitute a most valuable form of education. A lecturer also informs himself while teaching his audience. We are, therefore, glad to see the number of lecturing Gas Managers extending, and hope to see them still further increase; for it is within our own experience that, where Gas Managers are most in contact with consumers, there the greatest contentment exists. We have seen an intelligent new Manager, with a conciliatory and liberal spirit, restore a large town, with complaining local authority and dissatisfied consumers, to peace and contentment within a few months, a very substantial addition to the dividend of the Gas Company following in the natural course of events. We may refer to this matter again when we come to notice the able paper read by Mr. W. H. Bennett, on the "Means of Extending the Use of Gas and Coke, and How their Consumption may be Increased," and may pass to Mr. Spice's review of recent gas legislation. It is a source of unmixed satisfaction to us, and must be to all interested in gas and water enterprise, that the career of confiscation, which it was thought was inaugurated by the success of the Stockton and Middlesbrough Corporations last year, has been stopped—at all events, for the present. In this session of Parliament, and up till now, no attempt to make a compulsory purchase of a Gas or Water Company has been successful. Still, we have had to submit to what we may regard as hostile legislation in the shape of a new Standing Order. Mr. Spice appears to believe that this Order, which compels the introduction of auction clauses and the sliding scale into all Gas Bills, will work beneficially for Gas Companies and Consumers. We do not think so, and believe that their effects might easily be neutralized; but we shall not counsel opposition to the spirit of recent legislation. We leave the question to be settled by time and experience, with the simple remark that if it should prove advantageous to Gas Companies, we can only expect renewed agitation. The President truly states, as we have often done in these columns, that the great cause of the warfare between Local Authorities and Gas Companies has always been the success of these latter. It is the ten per cent. dividend that excites the cupidity of Corporations.

We shall not follow Mr. Spice in his remarks on trades unionism, nor shall we, to-day, refer to the great sulphur question which has so recently been discussed, further than to express a general agreement with Mr. Spice in the opinion that the efforts of managers should be directed towards the completion of purification in scrubbers or washers. And here we may conclude a notice of a very interesting and valuable address, making only one additional observation. We are pleased to notice that Mr. Spice did not skim the cream of novelty off the communications to be read, by giving the substance of them before they were made to the meeting.

We shall publish the papers read at the meeting, and the discussions, as fast as our space will allow, and now only make a remark or two on some proposed alterations in the constitution of the Association. There would appear to be some who advocate a certain amount of exclusiveness among the members. We cannot help thinking that this is a mistake. In our opinion, as wide a net as possible should be spread, to bring every one at all interested in, or connected with, gas or gas matters into the Association. Differential rates of subscription may very properly, in certain cases, be insisted upon, considering the primary object of the institution. The fact is before us, that the Association wants money, and as we think more funds are desirable for the increase of its usefulness, we hope the Committee, who have now to consider the question, will see their way to remove every restriction on the admission of all gentlemen who desire entrance to the Association. While we heartily wish that there may be few demands on the Benevolent-Fund, we rejoice to see that it has already reached the respectable sum of £838. This is a very excellent beginning, and we hope the amount will rapidly be added to. It only remains to add that the

dinner and the excursion went off with all the *éclat* that good fare, lively speeches, and lovely weather could ensure.

We may candidly say that we do not like officious friends; still, we can hardly blame Mr. Arthur Silverthorne for transmitting the remarks we casually made on Mr. Gladstone's Birmingham speech to that gentleman, and asking his opinion on the matter to which we drew attention. We do not think that the post-card reply received by our correspondent from the ex-Premier will much help him in his hostile designs against Gas Companies. Mr. Gladstone's answer is cautious, if not evasive. He has evidently given little consideration to the matter respecting which he was interrogated; but we may admit that his views are clearly expressed on one point. He looks with jealousy on the conduct of commercial undertakings by Local Authorities; but in order to ensure economic management, he is in favour of concentration. From that point of view only, he approves of the proceedings at Birmingham, and would endeavour to apply similar principles to London. Now, the principle of concentration, in order to ensure economic management, is what we have always advocated. We may leave the case of Birmingham out of consideration, for the Gas Companies there are past and gone. But we may very properly, in connexion with this correspondence, call attention to a matter which has for some time dropped out of notice, and that is the complete amalgamation of the Metropolitan Gas Companies. Mr. Gladstone's argument, if we may so call it, goes no further than this, that concentration of management is desirable for the sake of economy and public convenience. This can be effected as well by amalgamation as by sale of the undertakings to an authority, if there was one in a position to make the purchase. We hope the Companies will take the hint conveyed on this post-card communication.

We need not say much about Mr. Silverthorne's letter to Mr. Gladstone, but we may remark that, if he advised the Corporation of Hanley, in their proceedings this year, he has been singularly unfortunate. With regard to the other cases mentioned and referred to as compulsory purchases, we must protest that to only one—the Stockton and Middlesbrough Water Company—can the term be accurately applied. All the others were compromises. It is useless now to speculate on what would have been the result of a hotly-contested fight, carried, if necessary, from one House of Parliament to the other; but we must protest against the statement that the Birmingham purchases, even that of the Water Company, were in any sense compulsory. It is important to point out this distinction, in order that the cases may not be quoted as precedents, though we are certain that no parliamentary advocate would do so.

We publish to-day a "Communicated Article" on the subject of the Valuation of Ammoniacal Liquor, which, for reasons that need not be mentioned, describes a process identical with that detailed in the pamphlet by Mr. F. W. Hartley, noticed by us last week. We may mention, however, that Mr. Hartley's pamphlet contains a criticism of the older modes of valuation, which Gas Managers will do well to study, and also gives precise directions for the preparation of the standard solutions to be used in the new. It must be remarked, that the preparation of standard solutions which can be thoroughly relied upon requires great care; and a Gas Manager, who is not a skilled chemist, would do well to purchase them. The apparatus figured in our present number is essentially identical with that described by Mr. Hartley, and is all that can be desired for the successful employment of the new process.

The report of the meeting of the Rochdale Town Council was received too late for notice in our last issue. Our readers will have seen that it has been decided to reduce the price of gas fivepence per 1000 feet. This will absorb £4000, leaving an estimated net profit of £5000 to be carried to the borough-fund account. We cannot help thinking that, with such profit, the price of gas might have been still further reduced for the benefit of the consumers.

The Corporation of Leeds have just made their coal contracts, but only, it would appear, for one year. The price of coal ranged from 5s. 6d. to 9s. 7d.; and that of cannel from 10s. 10d. to 15s. 6d. The average price is 2s. 6d. per ton less than last year, so a reduction in the price of gas is expected to be made immediately. Threepence per 1000 feet is generally anticipated, but some sanguine people speculate on sixpence. The Perth Gas Commissioners have reduced the price of gas fivepence per 1000 feet.

The Corporation of Birmingham, some time ago, brought an action against the proprietors of a colliery in the neighbourhood of the gas-works at Swan Village, to restrain the parties from working their mine so as to cause subsidence of the surface, and to recover damages for injuries already sustained. After a long hearing, the action was dismissed with costs, and the defendants

then made a claim for the loss sustained on account of the stoppage of their workings. Upon inquiry, Mr. Roupell assessed the damages to which the defendants are entitled at £2042.

A judgment of much importance to Companies having their seat and origin in this country, but doing business abroad, was given in the Exchequer Division of the High Court of Justice last week. The Imperial Continental Gas Association claimed exemption from income-tax, in respect of such portions of their profits as were retained on the Continent to meet the exigencies of their business. The Court, however, decided that the whole profits of the Company were assessable, and gave judgment for the Crown accordingly.

Water and Sanitary Notes.

A FORTNIGHT ago the Local Government Board unexpectedly introduced a Bill to amend and consolidate the Acts relating to Public Health, which concern the Metropolis. The number of these, though not large, is sufficiently perplexing, and a very useful service will have been rendered when the eleven Acts have been consolidated into one statute. It must, we fear, be confessed that the Sanitary Acts have not been enforced by the Vestries and District Boards with the vigour that was expected of them. We may say, however, that they have often acted with a wise discretion when they have refused to take proceedings on the complaints of squeamish, and it might be spiteful, neighbours, and on sensational reports by their Medical Officers of Health. As a matter of course, this Bill is another step in the direction of centralization—that is, it will, in certain cases, transfer the powers of the Local Authorities to the Central Board. Thus, if a Vestry or Local Board neglect, or refuse, to take proceedings, on complaint being made of a nuisance, the Local Government Board may authorize any police officer in the district to take action, at the expense of the Local Authority. We cannot say that we approve of this provision, which would, unless the Local Government Board investigated every case of complaint, give rise to a great amount of vexatious litigation. There would thus be a double tribunal, occasioning the expenditure of much trouble and cost. We shall not to-day give any further consideration to the Bill, the provisions of which will presently be discussed by all our District Boards, but shall wait to gather and reflect upon the opinions expressed.

If any further illustration of the evils of divided authority were required, one is to be found in recent proceedings in the borough of Salford. There, it would seem (the case is not *unique*), the Corporation and the Board of Guardians both exercise certain sanitary powers. It has recently been discovered that additional hospital accommodation was required for patients afflicted with infectious diseases. The Corporation have a hospital, which was capable of extension. But the Board of Guardians thought they would have a hospital of their own. They therefore proceeded to acquire a site, and erect the building, at a cost to the ratepayers of £22,000. When, however, the building was completed, it was suddenly discovered that the position afforded no practical outlet for the drainage. Thus, it has been found necessary to abandon the site, which, the guardians having demonstrated to be unsuitable for building purposes, will have to be disposed of at a greatly depreciated price. The result has been that an arrangement, which ought to have been made in the first instance, has been completed, and pauper patients will be admitted to the Corporation hospital. In the meantime, the pockets of the ratepayers have suffered very considerably, and all on account of that division of authority which is one of the most pressing evils of these times.

The Select Committee of the House of Commons, who have for nine days had under their consideration the Metropolis Floods Prevention Bill, have reported that, in their opinion, the necessary work should be done by the Metropolitan Board of Works, and paid for by means of a rate levied all over the metropolitan district. This we have all along contended for. It is quite true that Hampstead, Highgate, and Brixton do not directly suffer from the floods as Lambeth and St. Olave's do; but a really metropolitan question is involved, and it should be dealt with in a metropolitan spirit. The Committee was adjourned until to-morrow, to give the Metropolitan Board time to consider what course they would pursue under the circumstances. We hope we shall learn that the Board have accepted the situation, and will proceed with the Bill, amended according to the terms of the Committee's report.

As we expected would be the case, the shareholders of the Southwark and Vauxhall Water Company received from the Chairman a full statement of the relations of the Company with the Richmond Vestry. We express an opinion at once that the

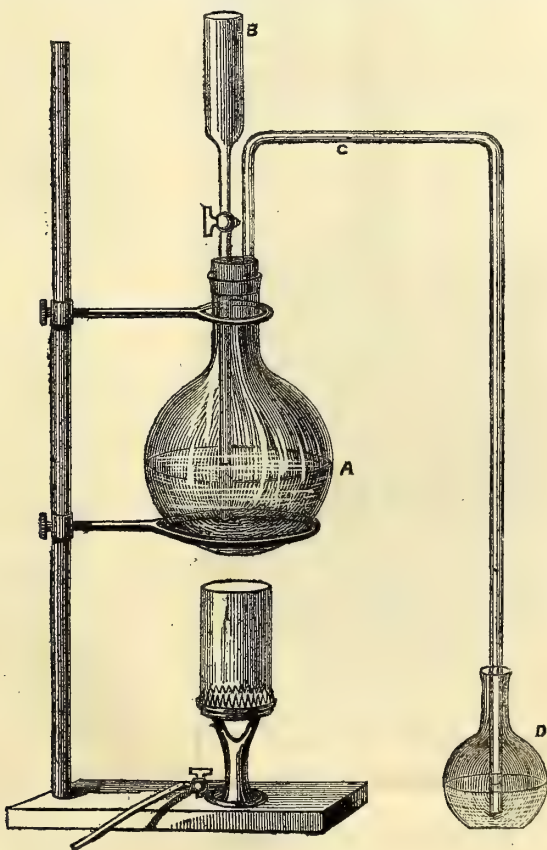
story told by the Chairman is a complete justification of the acts of the Company. It was clearly the design of the Vestry to get water supplied to Richmond for several months without paying for it. On the 3rd of January the Vestry issued a circular to the inhabitants, stating that they were at that date ready to furnish a full supply. On the night of the 13th, ten days later, the Company cut off their supply, and the Vestry had not a drop of water to distribute. The inhabitants of Richmond will not soon forget the Saturday and Sunday that followed. The Vestry had reckoned without their host, and thought that the supply to Richmond could not be stopped without cutting off the supply to Petersham and Kew as well. In this they were deceived; and Richmond was waterless, while the other districts were satisfied. The altered conditions of the supply to the town are worthy of remark, and must be severely felt. The Water Company furnished a daily supply of 1,200,000 gallons, for which they received about threepence per 1000 gallons, producing very little profit, if not involving an absolute loss. The Vestry make it rather a boast that they are supplying 250,000 gallons per day. We need not refer further to the matter. The ultimate failure of the scheme of the Vestry we regard as certain. It will, in the end, cost the ratepayers a large sum of money—much more than is dreamt of at present; and in the result we confidently expect that the Southwark and Vauxhall Company will again be in possession of Richmond.

Communicated Articles.

ON THE VALUATION OF GAS LIQUOR.

The knowledge of the presence of the so-called "fixed ammonia" in gas liquor—that is, of ammonia in a form not indicated by the ordinary acid test—has long necessitated the introduction of a more correct method of valuation, by which the whole of the ammonia contained in the liquor, irrespective of the form in which it is present, should be capable of direct estimation. The process which would almost naturally suggest itself to any one conversant with the subject would be distillation with an alkali, and this method is, in fact, the only practicable mode of obtaining *the whole* of the ammonia from gas liquor in a form which admits of its being directly estimated.

The object of the present article is to describe a form of apparatus which appears to be the simplest distillation process which could possibly have been contrived—a process in which the facility of manipulation renders it possible of accurate performance by any ordinary workman of average intelligence, and in this wise, therefore, as applicable to the desired purpose as the old and erroneous method of valuation by the employment of test acid, applied to the gas liquor direct. The method about to be described is now in practical use at the Phoenix Gas-Works, and was contrived by Mr. Thomas Wills, the chemist to the company.



The arrangement of apparatus employed is represented in the diagram, where A is a glass flask of about 16-ounce capacity, provided with a closely fitting india-rubber stopper. Through this stopper passes the tube of the long funnel, B, which is provided with

a glass stopcock, and likewise the tube, C, which is bent twice at right angles. The extreme end of the tube is slightly tapered, and dips into a 4-ounce flask, D. The body of the funnel, B, is graduated to deliver two ounces. The other apparatus required is a burette, with glass stopcock holding two ounces, and being divided into 32 equal parts, the graduations commencing from the lower part of the instrument; and two pipettes, one of 1-ounce capacity, and one graduated to deliver 2 ounces.

The test solutions used are three in number—viz., the ordinary 10 per cent. sulphuric acid, such as has been always in use for the valuation of liquor; a solution of ammonia of such strength as to neutralize an equal bulk of the test acid; and, finally a solution of caustic potash or soda, which may conveniently contain about 10 per cent. of either alkali. The two first-named test solutions should be made to correspond accurately with each other, but the potash or soda solution needs no precision in preparation.

The method of procedure is as follows:—One ounce of the liquor to be examined is introduced into the flask, A, being either measured by the graduated funnel, B, or, in cases where greater accuracy is required, the measurement should be made by means of the ounce pipette. The liquor is washed down with a little distilled water, and one ounce of the caustic potash or soda solution is then added, followed by about four ounces of water. The flask, D, is then charged with two ounces of test acid (measured by the pipette), and the apparatus is ready for use. Heat being applied to the flask, A, until the contents have reached the boiling point, brisk ebullition should be maintained for about fifteen minutes, at the end of which period the whole of the ammonia in the liquor will have distilled over into the flask, D, and have been there absorbed by the standard acid. The distillation being complete, the flask, D, is removed, a small quantity of tincture of hematine added to its contents, and the standard ammonia run in from the graduated burette until the change of the colour of the hematine from yellow to crimson indicates that all the excess of acid present has been neutralized. *The number of divisions remaining in the burette then indicates the "total ounce strength" of the liquor under examination.*

The main feature of novelty in the process above described consists in entirely dispensing with the use of a condenser, by which not only is the apparatus much simplified, but made more generally convenient. It might be thought that without proper means for condensing the ammoniacal vapours evolved during the distillation, a loss of ammonia would have taken place which would naturally have vitiated the result, and rendered the experiment valueless. Such a loss is, however, found in practice not to occur, and repeated experiments have proved that no loss of ammonia whatever takes place during the distillation, the absorption of the ammoniacal vapours by the test acid being complete even to the extent of being theoretically accurate.

The adjustment of the standard solutions used is also of great advantage in simplifying the test, more especially as the 10 per cent. acid now in use is made available for the purpose. A little thought will enable the reader to perceive the reason why the strength of the liquor under examination should be at once indicated by the number of divisions of test ammonia left in the burette at the conclusion of the experiment. As the test alkali is of equivalent strength to the test acid—that is to say, that equal bulks are required for neutralization—it follows that the bulk of test alkali left in the burette is really a direct indication of the measure of acid neutralized by the ammonia in the liquor, and thus of the strength of the liquor.

In the ordinary process of valuing gas liquor, equal bulks of the liquor under examination and of test acid are taken, and the latter gradually added to the former until neutralization occurs. If the whole of the test acid is required, the liquor is of 16-ounce strength, and consequently, if one ounce of liquor be taken, each 1-16th of an ounce measure of acid equals one ounce strength of liquor. It is obvious, therefore, that when one ounce of liquor is subjected to distillation, and the ammonia evolved conducted into two ounces measure of the test acid, if the whole of the latter had become neutralized, the first drop of test alkali added would change the colour of the hematine, and the liquor (reading from the burette divisions) would be of 32-ounce strength. If, on the other hand, it is assumed, for the sake of argument, that the liquor placed in the distillation flask contained absolutely no ammonia, it would be found, on the completion of the experiment, that the full measure of test alkali would be required to neutralize the contents of the small flask, and the liquid in the burette would stand at 0. The process will, therefore, indicate the strength of any sample of gas liquor up to 32-ounce, which is sufficient margin for all ordinary purposes. It is found to work well in practice, and the results are accurate.

Finally, taking into consideration the great value of gas liquor as a residual product, it needs but little to be said by us to urge upon gas companies the importance of basing all future liquor contracts on the *total* ammonia present, which can only be properly ascertained by the rejection of the old system of testing, and the adoption in its place of some such method as that which we have just described.

GLASGOW WATER SUPPLY.—Dr. Mills, of the Andersonian University, Glasgow, reports that the water supplied to that city from Loch Katrine during May was of a pale brown colour, and contained a number of muddy and hairy particles. Iron traceable.

BLACKPOOL CORPORATION GAS SUPPLY.—At the meeting of the Town Council on the 5th inst., a proposal was made that the price of gas should be reduced from 4s. 2d. to 3s. 9d. per 1000 feet. The mayor, however, moved an amendment, that no alteration should be made. The reason given was that there was a heavy debt on the gas premises which should be first reduced, and that what money they could spare should go towards forming a reserve-fund to cover the damage caused by any future storm. This was generally agreed to be the wisest course and it was adopted by fourteen votes to five.

THE BORING AT MESSRS. MEUX'S BREWERY.

Although somewhat late in the order of time, we believe that the following account of the bore-hole, recently sunk through the chalk and the gault strata into the lower greensand, at Messrs. Meux's Brewery, Tottenham Court Road, London, will be of interest to our readers:—

On Dec. 4, 1875, the Diamond Rock-Boring Company's machinery commenced sinking a bore-hole at the above brewery. Many years before, a well had been sunk through the tertiaries and the chalk to a depth of 265 feet below the Ordnance Bench mark in Oxford Street, which mark is 85 feet 7 inches above the mean level of the sea. In 1872-73 a bore-hole, 13 inches in diameter, had been taken down from the bottom of this well, by a rope boring-machine, to a depth of 803 feet below the same datum. The lower portion of this bore was out of the perpendicular and crooked, and at the above depth a heavy boring-head, weighing about 10 hundredweight, became detached from the rope, and got fast in the bottom of the bore. It was this bore that the company commenced to enlarge to 13½ inches in diameter, with a view of carrying down the hole to a greater depth, by means of a line of tubes having a diamond crown on the lower end.

The old bore-hole was successfully enlarged down to a distance of 490 feet from Oxford Street, or 225 feet below the bottom of the well, this portion of the old bore being pretty straight; and after reaching this depth the crown and line of tubes left the old bore, and cut a new bore-hole out of the solid chalk, and continued to do so till the depth of 547 feet was reached, when the old bore was again encountered, and was followed for a further depth of 13 feet. At a depth of 560 feet the new bore again reached solid chalk, and continued to be sunk in the solid until it was carried past the bottom of the old bore-hole. Fortunately the new bore-hole missed the boring-head in the old bore, and on the 21st of April last had been carried down to a total depth of 1024 feet.

Between a depth of 811 feet and 839 feet, the upper greensand was passed through; from 839 feet to 999 feet the gault was encountered; then came a layer of coprolite, 6 inches thick, succeeded by 4 feet 6 inches of limestone; and below the limestone the lower greensand was found—not in a loose condition, as is usually the case in a sand-pit, but in an indurated and solid state.

The bore-hole continued to be carried deeper, the sand being sufficiently indurated and hard to stand without being lined.

The bore-hole in the chalk, both with flints and without flints, is 13½ inches in diameter, and only 58 feet at the bottom is lined. The hole in the upper greensand is 13½ inches in diameter, and is lined throughout with a tube, having a minimum internal diameter of 11½ inches. The lower portion of this tube descends 30 feet into the upper stratum of the gault, and the upper portion ascends through the upper greensand and 58 feet into the lowest stratum of the chalk. The total length of the tube is 116 feet, the lower end resting in the gault at a depth of 870 feet from the Ordnance Bench mark in Oxford Street, to which depth the bore-hole is 13½ inches in diameter. A bore-hole 9¼ inches in diameter was afterwards sunk into the gault to a depth of 952 feet below the Ordnance Bench mark, and a water-tight tube, having a minimum internal diameter of 8¼ inches, was taken up from this depth to the top of the well. The remaining thickness of the gault and the stratum of limestone below is lined with a tube, having a minimum internal diameter of 7¼ inches. This tube is 225 feet long, the bottom reaching to a depth of 1005 feet.

The section appended shows the well, the lining tubes, and the thickness of the different strata passed through.

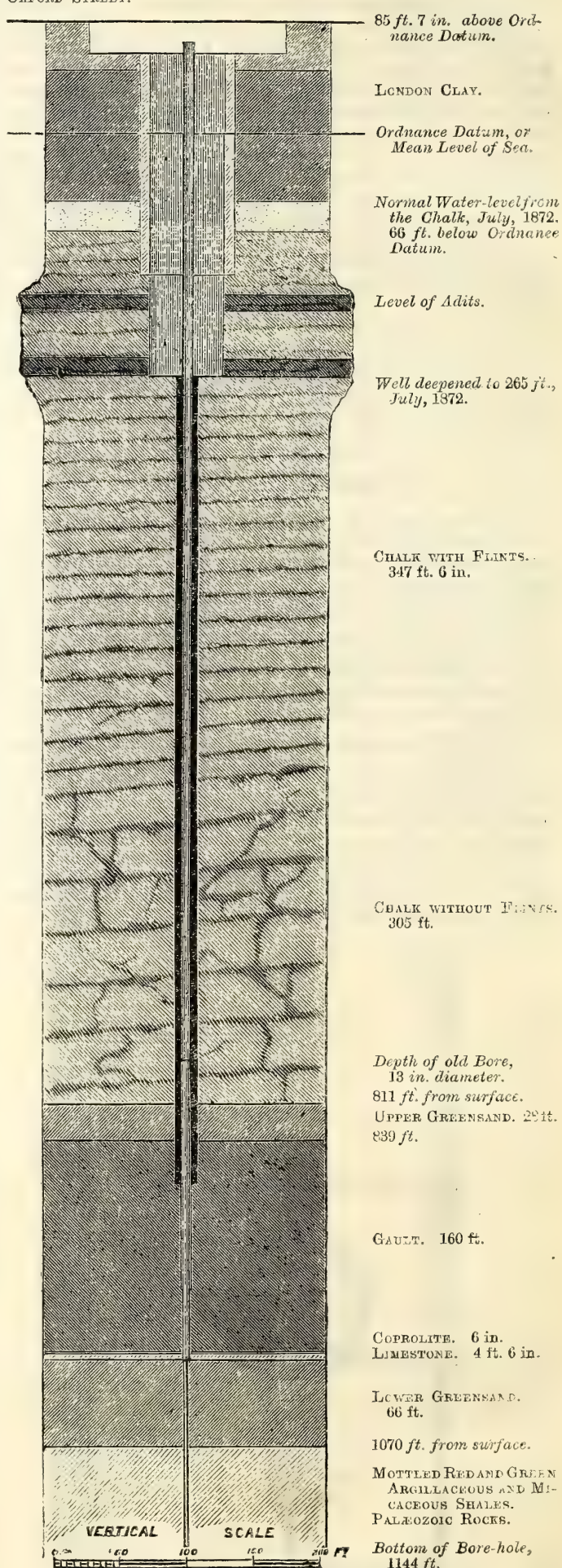
At 10 feet above the bottom of the well, or at a depth of about 199 feet 6 inches below Ordnance datum, the yield of water from the bore-hole, when it had reached the depth of 1022 feet, or had pierced the crust of the lower greensand 21 feet, was at the rate of about 1500 gallons per hour; and arrangements are now being made for placing a pump in the bore-hole at a depth of 200 feet from the bottom of the well, by which the delivery of water will be greatly increased. The temperature of the water is 57° Fahr.

The bore-hole was ultimately carried to a total depth of 1144 feet, the lower greensand proving only 66 feet thick, at a depth of 1070 feet, when the Palæozoic rocks were struck. These rocks were bored into a distance of 74 feet, the total depth of the bore-hole being 1144 feet.

The whole of this work has been carried on by the manager and engineer at Messrs. Meux's, under the superintendence of Mr. J. K. Gulland, who, until the end of March last, was chief engineer to the Diamond Rock-Boring Company. Mr. Gulland also superintended and carried out for that company the deep Sub-Wealden boring at Battle, in Sussex. Since resigning his connexion with the above-named company, Mr. Gulland has taken out a patent for an improved boring-machine, and has commenced to execute contracts for borings in connexion with the Diamond Drill Company, 6A, Victoria Street, Westminster.

WESTON-SUPER-MARE PUBLIC LIGHTING.—At the meeting of the Town Commissioners on the 13th inst., the question of the offer of the gas company, in reference to the public lighting, was further considered, and, after some discussion, it was resolved—"That the proposed terms of the Weston-super-Mare Gas Lighting Company for lighting, extinguishing, cleaning, and repairing the public lamps, at a reduction of 5s. per lamp per annum, and a reduction of £2 10s. on the lamps on the Esplanade, be accepted by this board for a term of five years."

OXFORD STREET.



Horizontal Scale, ¼ in. = 1 foot.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

MR. GLADSTONE ON THE TRANSFER OF GAS AND WATER WORKS TO CORPORATIONS.

SIR,—I think the enclosed correspondence would interest the opponents, as well as the advocates, of transfers, and, as it originates out of your own "Circular," of the 5th of June, it has occurred to me that it would only be fitting that you should publish it *exclusively*. I should, however, like my own letter to appear in connexion with Mr. Gladstone's reply, without which it is not intelligible, and I should really be pleased to find his reply set forth prominently. The admirable impartiality with which your estimable JOURNAL is always conducted, permits of my making the request, feeling beforehand it will be received in a cordial spirit.

ARTHUR SILVERTHORNE.

1, Westminster Chambers, Victoria Street, S.W.,
London, June 14, 1877.

[ENCLOSURES.]

The Right Hon. W. E. Gladstone, M.P.

Sir,—Will you permit me to respectfully call your attention to the enclosed cutting out of a newspaper, which, though circulating necessarily amongst the restricted circle associated with an honourable branch of British manufacture—the supply of gas—is acknowledged to have considerable influence on the interests of gas companies.

The views which the writer in the JOURNAL OF GAS LIGHTING, on behalf of the companies, builds on your presumed reticence may be perfectly groundless, and, on this account, some refutation may be necessary. I cannot say that I am acquainted with any public expression of yours on the subject, but I have no doubt that the transfer of gas-works to local authorities, whether "compulsory" or "by agreement," is a subject which has, at some time or other, occupied your attention, and that you are prepared to express your approval of that course, or to condemn it. I have myself attempted for some years to promote this course, and, under my advice, corporations have taken measures for compulsory purchase, notably Hanley, this session.

Although most of the large gas undertakings are rapidly passing into the hands of the corporations, it is chiefly by agreement, and unduly large amounts are paid, in consequence, for these undertakings, but the test of *compulsory purchase* presented to the private committees of either House is not frequent, and has only been successful in the cases of Glasgow, Aberdeen, Rotherham, Maryport, Stockton and Middlesbrough (Water), and Birmingham (Water).

To Mr. Chamberlain, M.P., and his committee is entirely due the spirited policy promoted at Birmingham by the "compulsory purchase" of the water-works in 1875, and of the two gas undertakings "by agreement," some account of which is furnished in a pamphlet of mine on the subject published last year, now out of print (copy enclosed). The result of the first year's working at Birmingham has been a net profit of £34,122—that is, after all payments of annuities to companies, and all interest on mortgages and debenture stock; so that, in consequence, an amount of £25,000 has been paid to the borough treasurer on account of the borough improvement fund.

This is one of the phases of local government which is beginning to attract considerable attention, and I hope that, in presuming to call your attention to the remarks in the JOURNAL OF GAS LIGHTING, I may be so fortunate as to elicit an expression of opinion which, whatever way it inclines, is certain to be accepted with that amount of consideration and respect with which your opinions are invariably received in this country.

I am, Sir, your very obedient servant,

ARTHUR SILVERTHORNE.

June 12, 1877.

Arthur Silverthorne, Esq.

Sir,—Though viewing with some jealousy the conduct of commercial undertakings by public authorities and representative bodies, I think there are cases in which it becomes advisable and gainful. One of these I take to arise where a business, which ought to be economically concentrated, is distributed into the hands of many bodies, with great waste and public charge, as well as with much inconvenience to those who use the streets. Without, therefore, pronouncing any judgment, in the absence of full knowledge of detail, I am prepossessed in favour of the proceedings at Birmingham, and of any endeavour to apply similar principles to London.

Your faithful servant,

W. E. GLADSTONE.

June 13, 1877.

CARBONATING FOUL LIME.

SIR,—In the evidence respecting the Crystal Palace District Company's Bill, Mr. Keates is reported to have said that I patented a process for deodorizing foul lime, by "passing the heated gases from a burning furnace through the purifiers, so as to use the carbonic acid, which was produced by the combustion, for decomposing the sulphide of calcium and producing carbonate of lime." There was such a patent taken out in 1853, but gaseous products of combustion from coke were taken from chimneys, and not passed through the lime *hot*. Again, he is reported to say: "He never carried it into execution himself, and nobody else has adopted it." Now, if any one will take the trouble to turn to vol. xxii., p. 1006, of the JOURNAL OF GAS LIGHTING, he will see what was done. The pipe for getting the products of combustion from the high chimney might have been seen reaching 100 feet up its side until a short time before the chimney was taken down, and the "ventilating" pipes remained connected to the purifiers from 1854 to the time that they were removed. I name this to show that the process was once in use, and refer to reasons why it was discontinued.

W. MANN.

June, 1877.

MEETING OF THE BRITISH ASSOCIATION OF GAS MANAGERS.

SIR,—Since the meeting at Bristol, I have been informed that the death of the late Mr. Wood, of Bury, occurred at the commencement of the past year.

The omission to refer to it in my Inaugural Address was purely accidental.

Mr. Wood was one of the earliest members of the Association, and for several years one of its vice-presidents; he enjoyed the high esteem of all who had the pleasure of knowing him, and occupied an important position, which he adorned alike by his talents and virtues.

21, Parliament Street, Westminster, S.W.,

June 18, 1877.

R. P. SPICE.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 11, 1877.

The following Bills received the Royal Assent by Commission:—Alliance and Dublin Consumers Gas (Bray Supply); Edinburgh and District Water; Longton Corporation; Maryport District and Harbour Gas; Middlesbrough Corporation; Sittingbourne Gas; Stamford Water; Warrington Corporation Gas.

The Examiners reported that the further Standing Orders applicable to the Bishop Auckland District Gas, Burslem Local Board, Carshalton Gas, and Christchurch Gas Bills have been complied with; that no further Standing Orders are applicable to the Newcastle-under-Lyme Borough Extension and Improvement, and Bridgewater Corporation Water Bills; and that the Standing Order applicable to the Local Government (Gas) Provisional Orders (Penrith, &c.) Bill has been complied with.

The following reports from the Standing Orders Committee were agreed to:—"That the Standing Orders not complied with in respect of the Newcastle and Gateshead Water and Colne Gas Bills ought to be dispensed with, and the Bills allowed to proceed." "That the Standing Orders not complied with in respect of the Wakefield Improvement Bill ought to be dispensed with, and the Bill allowed to proceed, provided that Part II. and the Schedule be struck out, unless proof be given before the Examiners that the Bill has been approved of by the proprietors of the Wakefield Water-Works, as required by Standing Order 64."

The United General Gas Company (Limerick) and the Woolwich, Plumstead, and Charlton Consumers Gas Bills, brought from the Commons, were read the first time, and referred to the Examiners.

The following Bills were read a second time and committed:—Ashton-under-Lyne Improvement; Bolton Improvement; Croydon Commercial Gas; Dukinfield and Denton Local Boards of Health; Epsom and Ewell Gas; Leicester Gas; Ramsgate Local Board; Wakefield Gas.

Petitions were presented against the Bishop Auckland District Gas Bill from (1) Witton Park Gaslight and Coke Company, Limited, (2) Churchwardens, overseers, and inhabitants of Shildon and East Thiekley; and in favour of it from Owners of property, &c., in West Auckland and St. Helen Auckland.

TUESDAY, JUNE 12.

The Examiners reported that no further Standing Orders are applicable to the Thanet Gas Bill.

The following Bills were read a second time and committed:—Glasgow Corporation Water; Heywood Water; Sunningdale District Water; Tudhoe and Sunderland Bridge Gas.

The Newport (Monmouthshire) Gas Bill was read the third time and passed.

The Waterford Gas Bill, brought from the Commons, was read the first time, and referred to the Examiners.

The Local Government (Gas) Provisional Orders (Penrith, &c.) Bill was read a second time, and committed to a Committee of the whole House.

Petitions against the Newcastle-under-Lyme Borough Extensions and Improvement Bill were presented, from (1) Trustees of the Newcastle-under-Lyme Marsh Lands, (2) Ratepayers and inhabitants of Trentham, (3) W. H. Dutton, (4) Rev. W. Sneyd and others.

THURSDAY, JUNE 14.

The Chairman of Committees informed the House that the opposition to the Dukinfield and Denton Local Boards of Health Bill was withdrawn.

The Examiners reported that the further Standing Orders applicable to the United General Gas Company (Limerick) Bill have been complied with; that no further Standing Orders are applicable to the Woolwich, Plumstead, and Charlton Consumers Gas and the Waterford Gas Bills; and that the Standing Order applicable to the Local Government Board's Provisional Orders Confirmation (Bishop Auckland, &c.) Bill has been complied with.

The following Bills were read a second time and committed:—Bridgewater Corporation Water; Burslem Local Board; Carshalton Gas; Christchurch Gas; Colne Gas; Newcastle and Gateshead Water; Newcastle-under-Lyme Borough Extension and Improvement; Stretford Gas; Wakefield Improvement.

The Local Government (Gas) Provisional Orders (Penrith, &c.) Bill was considered in committee of the whole House, and reported without amendment.

A petition in favour of the Kent Water Bill was presented from the Board of Guardians of Bromley Union.

FRIDAY, JUNE 15.

The Bristol United Gas and Thanet Gas Bills were read a second time and committed.

The Examiners reported that the further Standing Orders applicable to the Southend Gas Bill have been complied with.

The Local Government (Gas) Provisional Orders (Penrith, &c.) Bill was read the third time and passed.

HOUSE OF COMMONS.

MONDAY, JUNE 11, 1877.

The Lords amendments to the Dundee Gas Bill were agreed to.

The United General Gas Company (Limerick), and the Woolwich, Plumstead, and Charlton Consumers Gas Bills were read the third time and passed.

The East Worcestershire Water Bill (Lords) was read a second time and committed.

The Examiners reported that the Standing Orders not previously inquired into have been complied with in the case of the Londonderry Gas Bill (Lords).

WATERFORD GAS BILL.

Sir CHARLES FORSTER moved—"That in the case of the Waterford Gas Bill, Standing Orders 84, 214, 215, and 239 be suspended, and that the Bill, as amended in committee, be now taken into consideration, provided amended prints shall have been previously deposited."

Mr. BUTT said there was a very serious question whether the Select Committee had not exceeded their powers. Under their previous Act the company were required to give a discount of 20 per cent. on the price of gas. This Bill reduced it to 15 per cent., but no notice was inserted in the notices for the Bill that this reduction would be proposed. The Corporation of Waterford opposed the Bill, and this reduction was made in the absence of the opponents. The representatives of the corporation thought that was beyond the powers of the committee, and he moved, therefore, that the Standing Orders be not suspended.

Mr. R. BRIGHT (chairman of the Select Committee) said that the committee had passed the preamble of the Bill, with condition that the sliding scale and the standard price clauses should be inserted. The opponents of the Bill exercised their discretion, and withdrew their opposition. The committee were not altogether satisfied with the standard price proposed, but did not feel justified in altering it. After hearing the evidence of Mr. Spice, an eminent gas engineer, they thought the price was fair both to

the consumers and to the company, and that the discount of 15 per cent. was a reasonable amount. The committee thought themselves justified in taking the course they did, because this was not a final stage at which any grievance could be heard. There was another place at which any objection to the principles might be raised. He hoped the House would not accede to the amendment that had been proposed.

After some remarks from a member of the committee, who stated that an increase of illuminating power was given in the Bill from 8 to 14 candles,

The amendment was withdrawn, and the original motion for suspending the Standing Orders having been passed, the Bill, as amended, was considered.

PUBLIC HEALTH (METROPOLIS) BILL.—This Bill was read a second time and committed.

TUESDAY, JUNE 12.

The Waterford Gas Bill was read the third time, and passed.

The Examiners reported that the Standing Order applicable thereto had been complied with in the case of the Gas and Water Orders Confirmation (Brotton, &c.) Bill (Lords).

WEDNESDAY, JUNE 13.

The Gas and Water Orders Confirmation (Brotton, &c.) Bill (Lords) was read a second time and committed.

A petition against the Waterford Gas Bill was presented from Inhabitants of Waterford.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

MONDAY, TUESDAY, AND WEDNESDAY, JUNE 11, 12, AND 13.

(Before the LORD CHANCELLOR, the LORD CHIEF JUSTICE, and Lord Justice BRETT.)

ATKINSON v. THE NEWCASTLE AND GATESHEAD WATER COMPANY.

This case came on by way of appeal from the decision of the Exchequer Division refusing a new trial, and also as an appeal from a judgment of the same Court on demurrer.

The plaintiff is the owner of the Elswick Saw Mills, Newcastle, within the limits of the defendants district; and the defendants are a company regulated by a private Act, with which the Water-Works Clauses Act, 1847, is incorporated. By these Acts they are obliged to fix fire-plugs in the streets, and supply them with water at a certain pressure, and to supply the Town Commissioners with water for certain purposes, and to supply all the houses in Newcastle and Gateshead with water at the same pressure, under a penalty of £10, and (in the case of the Town Commissioners and the domestic supply to the inhabitants) an additional forfeiture to the party aggrieved of 40s. for each day's failure to perform their duty in that respect, unless prevented by frost, unusual drought, or unavoidable cause or accident, or during necessary repairs. They are also empowered to supply water by special contract for trade purposes, or purposes other than domestic. Under this power they had contracted to supply water to two hydrants on the plaintiff's premises, for the purposes of his business, but no express terms had been made as to pressure. The contract rate for all the water used by the plaintiff, including the supply to the hydrants, was £30 per annum. A fire broke out on the plaintiff's premises on Feb. 20, 1870. It was discovered at eight in the morning, but on the hydrants being put in requisition, it was found that for some reason the pressure, which was usually sufficient to throw the water to the top storey of the premises, was insufficient to throw it upon the fire at all, so that the hydrants were absolutely useless. The fire-plugs near the premises were found to be in the same state as the hydrants. In the afternoon the pressure improved, but not before the premises had been almost destroyed. At three o'clock the hydrants were at full pressure, and by them the fire was ultimately put out. At the trial, two causes of action were alleged—first, the breach of statutory duty of which the defendants were guilty, in not keeping the fire-plugs supplied; and, secondly, a breach of contract, in not keeping the plaintiff's hydrants supplied with water at the statutory pressure. The defendants demurred to their statutory duty, on the ground that their liability was limited to 40s. penalty. This demurrer was overruled by the Court of Exchequer, on May 25, 1871. At the trial, before Baron Martin, evidence was given showing that the water supply in Newcastle and Gateshead was effected by gravitation from the High Benwell and Whitwell reservoirs, and that if the communications and valves had been in order there must have been sufficient pressure; but no suggestion was made as to what was the cause of the absence of pressure. The jury, in answer to questions by the learned judge, found that there had been a deficiency in the statutory pressure at all the plugs, and at the hydrants, on the occasion in question; and that the deficiency was caused by an unavoidable accident; and also that there was no contract between the parties for the supply of water at the hydrants at the statutory pressure. The verdict was, therefore, entered for the defendants; and the plaintiff having obtained a rule *nisi* for a new trial, on the grounds of misdirection, and that the verdict was against the weight of evidence, the rule was discharged by the Court of Exchequer. Cross appeals were thereupon brought—by the defendants against the judgment on the demurrer, and by the plaintiff against that on a rule for a new trial.

Mr. CHARLES RUSSELL, Q.C., Mr. GAINFORD BRUCE, and Mr. SHIELD appeared for the plaintiff; and the ATTORNEY-GENERAL, Mr. HERSCHELL, Q.C., and Mr. CHROMPTON for the defendants.

The LORD CHANCELLOR, in delivering judgment, said the Court was called upon in this case, after a period of six years—a period which reminded him of the Statute of Limitations—to review the decision of the Court below upon demurrer, and to review also the proceedings upon the whole of the case upon the issues of fact. The questions which arose in the case were three. First, upon the occurrence, whether the first count of the declaration showed a sufficient cause of action. The second question arose on the second count of the declaration, and proceeded upon contract, whether the finding of the jury, that no such contract existed, was arrived at in a manner which ought to be satisfactory to the Court of Appeal. The third question was whether, supposing there was such a right of action as alleged in the first count of the declaration, or such a right of action under contract as alleged in the second, that which took place in this case, and which was complained of, was carried by the words, "unavoidable cause or accident," in the 42nd section of the Water-Works Clauses Act, 1847. With regard to the first question, he was of opinion that the construction of the Act was not to create any duty which would be the subject of action afterwards, at the suit of any individual who was in any way injured by its breach. It did not create a right to be enforced in the ordinary way by action, but the scheme of the Act was to lay down a series of duties to be performed by the company, and to provide, as a guarantee and security for the performance of those duties, certain specified penalties. It provided that, where it was convenient, the

penalty should go into the pocket of the party aggrieved; but where that was not possible, the wrong being a public one, the penalty should be public also. It would be impossible to hold that where the penalty was given to the individual there was no right of action; but where it was not so, as in the case of the fire-plugs, an action would lie; for then the result would be that persons who had paid for the water would have no right of action if injured by the failure to supply it, while those who had paid nothing would have their action against the company. His lordship then reviewed the authorities distinguishing and throwing doubts on that of *Crouch v. Steel* (3 Ell. and Black, 402), and said he dissented from the principle there laid down by Lord Campbell, that when there was a statutory duty in a person, and another showed that he had sustained injury by the breach of it, he could bring his action under the statute. That must depend in a great measure upon the particular statute, and this case was distinguishable from the one referred to. But he could not look upon *Crouch v. Steel* as any authority to decide the present case, for some other following it had been cited. Under those circumstances he came to the conclusion that the first count of the declaration did not set forth any cause of action for the plaintiff under the statute, and, therefore, the demurrer of the defendants must be allowed. The second count of the declaration raised a question of contract between Mr. Atkinson and the defendants, for the latter to supply him with water at the statutory pressure for the extinguishment of fire. The case pressed by the plaintiff was that as the additional supply of water was furnished under contract, it must be implied that it was to be used for the purpose of the extinguishment of fire, and to be kept at the statutory pressure. His lordship had a strong impression that such a contract was not implied, and that all the company undertook in the second supply was what they were bound by in the original supply. There was, therefore, no substantial misdirection by the learned judge, the question had been properly left to the jury, and their verdict ought not to be disturbed. As the third question (as to the meaning of the term "unavoidable cause or accident"), in the view which had been taken of the first two, did not arise, the appeal must be dismissed with costs.

The LORD CHIEF JUSTICE and Lord Justice BRETT concurred; the former, however, expressing some doubts as to whether there was not an implied contract between the parties to supply water to the hydrants on the statutory terms.

The judgment on the whole case is, therefore, for the defendants.

HIGH COURT OF JUSTICE—EXCHEQUER DIVISION.

TUESDAY, JUNE 12.

(Before the LORD CHIEF BARON, and Barons CLEASBY and HUDDLESTON.)

IMPERIAL CONTINENTAL GAS ASSOCIATION, Appellants, v. NICHOLSON, SURVEYOR, ETC., Respondent.

This was a case stated for the opinion of the Court under Part III. of the Act 37 & 38 Vict., cap. 16, as to income-tax.

The SOLICITOR-GENERAL and Mr. DICEY appeared for the Crown; Mr. A. CHARLES, Q.C., and Mr. A. MORTIMER were counsel for the appellants.

It appeared from the case that the offices of the association are at 30, Clement's Lane, Lombard Street, where the meetings of the directors of the association are held. The association possess interests of various natures and tenures in gas-works in France, Germany, Austria, Holland, and Belgium, the profits of which arise wholly in those foreign countries, and in such of them as have a tax equivalent to the income-tax, those profits are assessed to such tax. The appellants claim to be assessed on a sum of £210,665, while the Crown claims to tax in round numbers £50,000 more. For the appellants there was cited the 16 & 17 Vict., cap. 34, which directs that the rule of the former Act, 5 & 6 Vict., cap. 35, shall be followed. By this Act gas-works are expressly classed with lands, tenements, and hereditaments, and the learned counsel submitted that the present works should be assessed in this way, as being foreign possessions, though held by an English corporation, the profits of which were analogous to those accruing from land. This property should be assessed under Part V., as it was clearly foreign property. The whole policy of the taxes on property was to tax profits received in this country, and the case found that this money was also taxed abroad. The argument for the Crown was that the words of the Act must be strictly adhered to. These ran (16 & 17 Vict., cap. 34, sec. 2, Schedule D): "Any profits or gains arising or accruing to any person residing in the United Kingdom from any profession, trade, employment, or vocation, or from any property whatever, either in the United Kingdom or elsewhere." The Act was not to be frittered away by the rules, which were merely for the purpose of carrying out the Act. It had been already decided, in the case of *The Cesena Sulphur Company v. Nicholson*, that these companies were resident in England, and that case governed the present. This money was clearly within the words of the schedule as profits arising from a trade or employment.

The LORD CHIEF BARON, in delivering judgment, said that Mr. Charles's able argument for the appellants had raised doubts in the mind of the Court as to whether the *Cesena* case had been properly decided. After careful consideration, however, he was of opinion that the Crown was entitled to judgment, as there was no substantial distinction between that case and the present. The two companies were joint-stock, formed, registered, established, and, by the decision of the former case, resident in England. If Mr. Charles's contention was right, the *Cesena* case was wrongly decided, and this Court would have to overrule its deliberate decision, as mines were in the same category as gas-works. He (the Lord Chief Baron) would not, perhaps, shrink from taking such a course, if he thought justice required it, as there was no appeal in these cases. But that objection, which was not taken in the *Cesena* case, would not have prevailed then, and ought not to do so now. When gas-works were mentioned in the Act, it was plain those in the United Kingdom or Colonies were meant. The rules, therefore, applicable to such property in England could not be extended to those on the Continent. In his opinion, the whole profits of the undertaking were assessable. In conclusion, his lordship remarked: I am desired by my brother Cleasby to say, as he is a shareholder in the appellant company, he thought he ought not to be a party to this judgment.

Baron HUDDLESTON concurred, and said the question was whether income-tax should be paid by the appellants on £210,665, or on £48,005 more, on which exemption was claimed, on the ground that the profits were never transmitted to this country at all, but were retained abroad in liquidation of charges consequent on the exigencies of foreign lighting. This money was clearly the profits of a trade in ordinary parlance, as the making of gas was not distinguished from any other trade. If Mr. Charles's contention was right, the *Cesena* case was wrongly decided. Judgment must be for the Crown.

Mr. DICEY applied for costs; and

The LORD CHIEF BARON said he was afraid he must give them.

Mr. CHARLES hoped the example in the *Cesena* case would be followed, where each party was ordered to pay his own costs. His contention had never been put forward before.

The LORD CHIEF BARON said in that case the point had arisen for the first time, but this was in reality in the nature of an appeal from that decision. Judgment must go for the Crown, with costs.

CHESTERFIELD POLICE COURT.—SATURDAY, JUNE 2.
(Before Mr. BARNES and Mr. MARKHAM.)

CONVICTION OF A WATER COMPANY FOR ILLEGALLY CUTTING OFF SUPPLY.

The Chesterfield Water-Works Company appeared to a summons, taken out against them by Mr. William Bland, one of the masters at the New Whittington Endowed School, for neglecting and refusing to furnish him with a proper or any supply of water, he being entitled to the same, on the 25th of May.

Mr. Busby, who appeared on behalf of the complainant, stated that by the Act under which the information was laid, a person who had paid or tendered his water-rate was entitled to a supply of water, and if the company refused or neglected to supply the water they were liable to a penalty of £10, half of which went to the informer, and half to the overseers. In this case it appeared that there were three different schools and school-houses at Whittington. The company for some time supplied water to these schools for 12s. per year, but a short time ago increased the amount to £4 per school, or nearly seven times the amount agreed upon. The governors demurred, and, pending the settlement of the dispute, the company thought proper to cut off the supply of water. But they proceeded further, and cut off the supply from the masters houses, which were provided for separately, and for which the rate had been paid.

The receipt for water from Lady-day to Midsummer was handed in. Mr. William Bland, the complainant, was called, and stated that on Friday, the 25th of May, the water supply for his house was cut off, and was not restored until the following Wednesday. The rate was paid in advance. It was possible to cut off the supply to the school without interfering with his house at all. He sent a notice to the water company on Wednesday, the 30th ult., and the supply was soon after restored.

Mr. Jones, the manager of the water company, submitted that they were not bound to furnish a supply unless a person provided "his own connexion-pipe," which had not been done in this case. They had not received notice in writing according to section 53 of the Act. The company were not bound to supply the house on account of the water having to pass through the same pipe as that supplied to the schools, and the complainant not having laid down separate pipes, they treated him as having water on sufferance. He also urged that by special powers obtained by the company they were not bound to give a full supply above the Club Mill reservoir, on account of its high elevation. Whittington was above the Club Mill reservoir, therefore the company were only bound to give an intermittent supply.

Mr. BARNES said no doubt the company had very peremptory powers, but they should be exercised with great circumspection. It was clear that in stopping Mr. Bland's supply they had acted beyond their powers, and for so doing they must submit to the usual penalty of £10 provided by the Act.

BIRMINGHAM WATER SUPPLY.—Dr. Hill, the Medical Officer of Health for Birmingham, reports that the water supplied last month to that town was clear, and that the organic matter continued to decrease.

PRESENTATION TO MR. W. H. HOLLINGSHEAD.—An extremely interesting meeting, arising out of the recent amalgamation of the gas companies north of the Thames, has just taken place at the offices of the late Imperial Gas Company, High Street, Camden Town, the occasion being the presentation of a testimonial to their oldest officer, Mr. William Hardy Hollingshead, upon his retirement on superannuation. There was a large attendance of his former colleagues. The testimonial, exhibited in the room, consisted of a splendid drum-head marble and malachite timepiece, with vases to match, the clock bearing the following inscription:—"Presented, with the accompanying pair of vases, to Mr. William Hardy Hollingshead, on his retirement, after 38 years honourable service with the Imperial Gaslight and Coke Company. Presented by his late colleagues, with their best wishes for his welfare. May, 1877." The testimonial was accompanied by a document bearing the names of the 50 gentlemen who subscribed towards the object, and an address, as follows:—"22, High Street, Camden Town, May, 1877.—Dear Mr. Hollingshead,—With feelings of great pleasure we unite together to express to you, our old and much-respected colleague, our goodwill and good wishes on your retirement from active service, as the oldest officer of the late Imperial Gaslight and Coke Company. We beg your acceptance of the timepiece and vases, which we offer with our sincere regards for your welfare, and earnestly wish you a long and happy retirement. —Signed, &c." Mr. Randal occupied the chair, and opened the proceedings by explaining the object of the gathering. As chairman, the pleasing duty was imposed upon him to offer Mr. Hollingshead, for his acceptance, the testimonial now before them, which had been most cheerfully subscribed for by his late colleagues, as a token of their great regard and respect. He was pleased to have an opportunity of saying a few words in reference to Mr. Hollingshead, who had proved his excellent friend for 34 years. Mr. Hollingshead's good qualities were thoroughly appreciated by all who knew him. He might say now, what he never said before, that when he was appointed to do outdoor work Mr. Hollingshead gave him the benefit of his advice in regard to his duties, which was very valuable, and was an abiding influence. He was a young man then, and advice from a man like Mr. Hollingshead was very valuable at that time, when the Imperial were in active competition with the London, Equitable, and Western Gas Companies, and when great care was required to keep the company's connexion together, and secure fresh customers. He need not say that the personal qualifications of Mr. Hollingshead eminently fitted him to bring many customers to the Imperial Gas Company at the time to which he referred. They all knew how hard their friend must have laboured to be so successful at that juncture, when opposition was so powerful; but he might safely say that was the time when Mr. Hollingshead's services shone the brightest. He was certainly a man who had nobly done his duty, and was deserving of their admiration and respect. They all wished to give Mr. Hollingshead proof of their regard for him, and the clock before them was a practical illustration of it. Personally, he was sorry that so many old friends were leaving them one by one, because, with the exception of Mr. F. Dale, there were hardly any old faces left. They were all very glad to see their friend looking so well, and hoped he might have long life and happiness. The chairman then presented the testimonial and address amid much applause. Mr. Hollingshead, who on rising was loudly cheered, said this came upon him quite unexpectedly, but he must say that he felt very proud of the most handsome testimonial just presented to him, and of the friends who had subscribed to it. They might all rest assured that he would take care that the gift was never abused so long as he or his dear wife lived, and afterwards it would be handed down to his family as an heirloom. He really could not find words to express his thanks adequately. He quite agreed with Mr. Randal that there were great difficulties at the time referred to, and there was far more work then than there was now, because the duties were now more mechanical. The strife of former days was no good either to the company or the consumers. He had to thank them once more for the testimonial. Mr. F. Dale, of the chief office, Bedford Row, Mr. J. J. Bird, Mr. J. Holder, Mr. F. Purry, and Mr. Wills, spoke in eulogistic terms of Mr. Hollingshead, and a vote of thanks to the chairman brought the proceedings to a close.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The Registrar-General publishes the following return of the average daily quantity of water supplied by the London Water Companies during the month of May, 1877. According to this, 117,591,830 gallons, or 534,274 cubic metres of water (equal to about as many tons by measure, tons by weight), were supplied daily; or 220·8 gallons (100·3 decalitrres) rather more than a ton by weight, to each house, and 31·1 gallons (14·1 decalitrres) to each person, against 32·4 gallons in May, 1876. According to returns of the London Water Companies made to the Select Committee on East London Water Bills (Session 1867), it is estimated that, during the year 1866, about 82 per cent. of the total supply of water for all purposes was for domestic use. Applying this proportion to the total quantity supplied daily in the month of May, 1877, it may be estimated that about 96,425,301 gallons were used for domestic purposes, or about 25·5 gallons per day for each inhabitant, against 26·6 in the corresponding month of last year.

COMPANIES.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons during	
	May, 1876.	May, 1877.	May, 1876.	May, 1877.
Total supply	525,878	532,613	121,146,288	117,591,830
From Thames	247,713	250,034	62,037,956	59,218,609
„ Lea and other Sources . .	278,165	282,579	59,088,332	58,373,221
THAMES.				
Chelsea	28,670	28,741	7,936,500	7,560,600
West Middlesex	47,920	49,162	10,237,235	10,334,504
Southwark and Vauxhall . .	80,456	78,000	19,470,509	17,750,000
Grand Junction	36,616	37,683	11,653,121	10,698,605
Lambeth	54,051	56,448	12,760,600	12,874,900
LEA AND OTHER SOURCES.				
New River	124,182	125,180	26,629,000	25,973,000
East London	109,375	111,967	25,086,700	23,403,400
Kent	44,608	45,432	7,372,632	6,996,821

* Including that for manufactures and for various purposes other than for domestic consumption.
Note.—The return for May, 1877, as compared with that for the corresponding month of 1876, shows an increase of 6735 houses, and a decrease of 3,554,458 gallons of water supplied daily.

Dr. Frankland reports as the result of his analysis of the waters supplied to the Metropolis and some of its suburbs during May, that taking, unity to represent the average amount of organic impurity in a given volume of the Kent Company's water during the last nine years, the proportional amount of such impurity in an equal volume of water supplied by each of the other companies, and by the Tottenham Local Board, was:—Tottenham 0·3, Kent 1·2, East London 1·8, New River 2·0, Colne Valley 2·2, Chelsea 2·2, Grand Junction 2·2, Lambeth 2·8, West Middlesex 2·9 and Southwark 3·1. The river waters delivered by the Chelsea, West Middlesex, Southwark, Grand Junction, Lambeth, New River, and East London Companies had greatly improved since last report, and had assumed their summer quality. They were all efficiently filtered before delivery. The water supplied, from artesian wells, to the inner circle by the Kent Company, and to the outer circle by the Colne Valley Company and the Tottenham Local Board of Health, was wholesome and palatable, and of most excellent quality for dietetic purposes. The Colne Valley water was also soft and suitable for washing, but it was slightly turbid from suspended particles of chalk. Seen through a stratum 2 feet deep, the Kent and Tottenham waters were clear and colourless; the Colne Valley turbid and colourless; the New River, West Middlesex, and Lambeth, clear and very nearly colourless; the East London, clear and very pale yellow; and the Southwark and Chelsea, clear and very pale brown.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Mat- ters.	Or- ganic Car- bon.	Or- ganic Nitro- gen.	Ammonia.	Nitrogen, as Ni- trates and Nitrites.	Total combined Nitro- gen.	Chlo- rine.	Total Hard- ness.
Inner Circle.								
Thames—								
Chelsea	27·70	·121	·010	0	·238	·298	1·55	19·6
West Middlesex	27·54	·141	·031	0	·273	·304	1·53	19·6
Southwark and Vauxhall . .	27·28	·165	·016	·001	·262	·269	1·55	19·4
Grand Junction	28·10	·120	·012	0	·263	·275	1·50	19·4
Lambeth	29·50	·141	·025	0	·292	·317	1·55	20·1
Outer Sources—								
New River	26·78	·110	·009	0	·276	·285	1·50	19·6
East London	28·71	·097	·012	0	·246	·258	1·70	19·7
Kent	44·80	·066	·004	0	·524	·528	2·50	28·7
Outer Circle.								
Colne Valley	16·20	·121	·009	0	·208	·217	1·20	3·0
Tottenham Board of Health .	45·80	·016	·004	0	·420	·424	3·15	24·7
Corporation of Birming- ham*	27·80	·120	·023	·001	·206	·230	1·55	16·1
Corporation of Glasgow† .	2·64	·177	·000	·000	·003	·003	·75	·9

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of the Andersonian University, Glasgow.
Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.
(FROM OUR OWN CORRESPONDENT.)

It is almost universally admitted that business in this district has hardly ever been slower or more unsatisfactory, both as to extent and profits, than at the present time. The most careful observations and the most diligent inquiries fail to discover that there is any prospect of a real improvement in the iron trade within at least twelve months, unless before the expiration of that period the Eastern Question shall have been disposed of, and the present war ended. These contingencies are so im- probable, however, that some of the best commercial men we have are clearly of opinion that it may be eighteen months or more before there is any decided alteration for the better. This opinion has been publicly expressed by Mr. J. Stores Smith, of Sheepbridge Works, and other gentlemen of unquestioned ability and standing.
Hence at the present time there is considerable quietude in almost every branch of trade, with a current weakness of prices which is very materially in favour of buyers, particularly those who can throw large orders into the market. Pig iron here, in full sympathy with the Scotch and other

markets of the country, is weak, only a limited number of sales having been made this week on the bases of the following quotations:—Ordinary Derbyshire foundry brands, £2 5s. to £2 15s.; Lincolnshire No. 1 foundry, 59s.; No. 3, 53s.; No. 4, 50s.; No. 4 forge, 49s.; mottled and white, 47s. to 48s., f.o.b. at Frodingham; "Acklam" No. 1, 47s.; No. 2, 45s.; No. 3, 43s.; No. 4, 42s.; forge, 42s.; "Aireside Leeds" No. 1, 53s.; No. 2, 49s.; No. 3, 48s.; No. 4, 47s.; forge, 47s.; M., 46s.; W., 45s.; "Redcar," 42s. to 47s. 6d.; G.M.B. (Middlesbrough) No. 1 foundry 45s. 6d.; No. 2 foundry, 44s.; No. 3 foundry, 42s.; No. 4 foundry, 41s. 6d.; No. 4 forge, grey, 41s.; No. 5 forge, mottled, 40s. 6d.; No. 6 forge, white, 40s.; refined metal, 59s.; Kentledge, 46s.; and cinder, 40s.; f.o.b. for net cash.

There is a decidedly better demand for several kinds of fuel, house coal being, naturally, in least request at this season of the year. Somewhat singularly, however, statistics go to prove that more coal was conveyed to London by rail during May than any previous month this year. This may, perhaps, be repeated now, unless the settlement of the northern strikes should give seaborne fuel its proper status. Steam and gas coal are in fairly good request, the former for export, and the latter for long-dated contracts.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Contracts for the supply of gas coal for next season continue to be placed, and, in some recently given out, 9s. to 9s. 6d. per ton is being paid for mixed coal and cannel at the pit's mouth, but for ordinary screened gas coal not more than about 8s. per ton at the pit is, as a rule, being obtained. The stoppage of the pits in West Lancashire has not yet had any material effect upon the market, and for another week or so, should the strike continue, it is scarcely probable that it will be seriously felt, as the stocks on hand will carry colliery proprietors and consumers over the present month without much scarcity of supplies being experienced. In the meantime, prices continue firm, and in a few cases more money is being asked, chiefly from new customers, but the general pit prices are without any very material change, except that slack is a little dearer, an advance of 1s. per ton having been obtained in some quarters. House fire qualities of coal are in less demand; common coal also is not moving off quite so freely as a week or two back, and in the Manchester district coalowners have been taking less out of stock than they were at the end of last month. Good classes of burgy move off tolerably well. Pit prices may be given about as under:—Good Arley about 10s. per ton; best, 10s. 6d.; Pemberton four-feet, 8s. to 9s.; common coal, 6s. 6d. to 7s.; burgy, 5s. 6d. to 6s.; and slack, 4s. to 5s. per ton.

In the shipping trade prices are firm, but there is only a small amount of business passing.

The colliers in West Lancashire, who are out on strike against the reduction of 10 per cent., show no signs as yet of giving way, and, with the exception of the one or two districts which I referred to last week, there are very few of the colliery proprietors who show any signs of weakness.

The iron trade continues in a most depressed condition, and north country brands of pig iron are being pressed in this market at very low prices. The local makers are securing very little new business, but their quotations are without material change. In the finished iron trade also there are very few orders giving out, and local bars delivered into the Manchester district can be bought at prices ranging from £6 10s. to £6 15s. per ton.

Engineers are slack, and one large firm, I understand, will shortly discharge a considerable number of hands.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

Since our last report the whole of the Northumberland collieries have resumed work. As a number of orders had stood over during the strike, the pits are likely to be very well employed for the next ten days at any rate. The principal demand for steam coals is from Cronstadt and the Baltic. In consequence of the resumption of work at the Northumberland pits, trade is not so pressing amongst the Durham collieries, though at the same time a considerable number of orders which were given during the strike have to be completed. Shipments have been active from the Durham pits. The demand being for a class of coals which could be used as steam or manufacturing coals, the latter for the local factories and shipbuilding yards. The inquiry has not been quite so good for gas coals. Fewer have been shipped, but the prices are about the same, ranging from 6s. 6d. up to 8s. 6d., and in some few instances 9s. 6d. per ton. There will be a pretty active business at most of the collieries in the neighbourhood of the Tyne this week, as next week is Newcastle races, when most of the pits are closed for two or three days.

The supply of small coasting vessels has been restricted, as the recent strike in the Northumberland district induced owners to send their ships to other parts of the country to load coals. Last week, therefore, when the Northumberland collieries began to resume work, handy little coasters were found to be rather scarce, and more money had to be paid to such as could be beached with cargoes. The demand has been from the east coast and the British Channel; the advance has not been great, however, probably from 3d. to 6d. per ton. There has been no absolute change in ports open to steamers, as there is an ample supply of coasting steamers at the command of the coal shippers. Outward freights to the Mediterranean and Baltic are lower than they were, and a very quiet business is doing thence.

The iron trade of the North of England is absolutely without change. The Birtley Iron Company have a considerable quantity of gas and water pipes ready for shipment, and a good deal of business is being transacted in iron shipbuilding, marine engine building, and the manufacture of large cables for mooring purposes for the Government.

The chemical trade has improved. The fire-clay goods trade and the cement trade are only quiet, with moderate shipments abroad.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual general meeting of the Kirkintilloch Gas Company was held last Thursday—Mr. Malcolm Maitland in the chair. From the report submitted, it was shown that there had been a total income of £3159 11s. during the past year; expended on repairs and extensions the sum of £1301 11s. 7d.; written off for depreciation on works and plant, £275 6s. 10d. The dividend declared for the half year ending the 15th of May was at the rate of 10 per cent. per annum on the paid-up capital, leaving a balance at credit of £131 19s. 5d. The value of the works at that date was £8903 4s. 5d. On the motion of the chairman, the report was unanimously approved of, and the vacancies in the board of directors were filled up.

At a meeting of the Kirkintilloch Police Commissioners held on Monday, the 11th inst., the Provost gave notice that at the next meeting he would move a resolution in favour of the adoption of the Burghs Gas Supply (Scotland) Act.

On Tuesday last a meeting of the Alloa Gas Company was held—Mr. Thomas Brydie presiding—for the purpose of taking into consideration an intimation made to the company by the Burgh Commissioners, that they

were willing to treat for the purchase of the gas-works in accordance with the provisions of the Burghs Gas Supply (Scotland) Act, 1876. After the subject was considered at some length, it was agreed to dispose of the works by arbitration. The meeting also agreed to deduct 5d. per 1000 cubic feet of gas, thus reducing the price to 4s. 7d.

The annual meeting of the Dunoon Gas Company was held on Saturday week—Mr. Archibald Oswald, chairman of the company, presiding. A dividend of 10 per cent. was declared on the past year's business, and it was agreed to reduce the price of gas from 6s. 8d. to 6s. 3d. per 1000 cubic feet.

On Wednesday last the Kinross and Milnathort Gas Company held their annual meeting—Mr. Robert Burns Begg presiding. The affairs of the company were found to be in a prosperous condition, but owing to the heavy expenses incurred in the erection of a new gasholder the directors did not feel themselves justified in recommending a dividend of more than 4 per cent., which was agreed to.

Dividends of 6 per cent., 7½ per cent., and 10 per cent., respectively have been declared by the Blairgowrie, Largs, and Galashiels Gas Companies.

The annual general meeting of the Perth Gas Commissioners was held on Monday, the 11th inst.—the Lord Provost presiding. A statement of the income and expenditure of the past year was laid on the table, and an estimate of the same for the ensuing year. The treasurer moved that the price of gas be reduced to 4s. 2d. per 1000 cubic feet, a price which, he said, was as low as that charged in any town in Scotland. Dundee made six times as much gas as Perth, and the price there was the same as that which he had moved. The reason why it was not lower he did not know. Mr. Sime seconded the motion, and said that there could not be much further reduction, but the price would be no higher. He hoped the treasurer would not fulfil a threat which he had made to give up office, so that they might get on as "swimmingly" in the future as they had done in the past.

[If the treasurer of the Perth Gas Commissioners were as diligent a reader of the JOURNAL OF GAS LIGHTING as he ought to be, and as every person occupying a similar position ought to be, he would have learned long ere this time that there are at least two towns in Scotland—Coatbridge and Galashiels—where the price of gas is only 3s. 9d. per 1000 cubic feet. Of course, I admit that Coatbridge is near the coal supply; but Galashiels is certainly quite as far from the cannel coal seams as Perth is.]

Mr. Thomas Meldrum, who has been manager of the gas-works at Kenno-way, in Fifeshire, since their commencement, lately gave in his resignation. For the vacancy thus created there were a great many applications, and eventually, from a list of five candidates, Mr. Alexander Anderson, gas manager, West Wemyss, was elected to fill the post.

The Aberdeen Corporation Gas Committee have accepted tenders for the supply of 23,500 tons of gas coal for the city during the year ending the 30th of September, 1878, at a total cost of £25,116.

During the month of May the average illuminating power of the gas supplied to Broughty Ferry was 27.03 candles.

Glasgow Corporation Gas Annuities (9 per cent.) were negotiated last Thursday at a rise of £1, at 220.

The ordinary meeting of the Glasgow Corporation Water Committee was held on Monday, the 11th inst.—Mr. James Brown in the chair. From the minutes of the Sub-committee on Works it appeared that the quantity of water sent into the city and suburbs during the fortnight ending the 4th inst., amounted on the average to 34 million gallons per day, and that the quantity of water in store at that date was as follows:—In Lochs, 124 days supply; in Mugdock reservoir, 14 days supply; in Gorbals reservoirs, 159 days supply. The minutes were approved of, and Mr. Robert Wilson, interim treasurer, was afterwards unanimously appointed treasurer and registrar, at a salary of £250 per annum.

At a meeting of the Dundee Water Commissioners, held last Thursday, a report was submitted showing that the revenue for the past year had been £32,400, and the expenditure £32,225. On capital account there had been expended during the year fully £15,000.

The Town Council of Port Glasgow had the water question under consideration at their last meeting. From the monthly statement of the superintendent of the water-works it transpired that there had not been the same quantity of water in store in the month of June since the year 1871, the quantity being equal to a supply for 93 days for all purposes, as against 79 last year. Bailie Hagart, convener of the Water Committee, moved—"That the council, as the Police Commissioners under the General Police (Scotland) Act, incorporated with the Port Glasgow Police Act, 1865, finding that the requirements of the burgh for water have outgrown the capacity of the works at Leperstone, hereby resolve to provide additional water supply for the burgh, and having fully considered the two schemes mentioned in the reports by Mr. Gale, C.E., Glasgow, the council further resolve that the Auchendores scheme, as detailed in Mr. Gale's report, be adopted; that the cost thereof, in terms of said report, be estimated at the sum of £15,803; that application be made to the Public Loan Commissioners under the provisions of the Public Health (Scotland) Act, 1867, and the Amendment Act, 1875, to meet the expenses of the new works, and also to repay the balance of the loan due to them on the present works, and the other sums borrowed for these works on mortgages, the whole loan to be applied for amounting to about £29,000; and that it be remitted to the Finance Committee to make the application and get the loan arranged." In moving the above, he said it would be agreed that such an increase was an absolute necessity. During many years back the inhabitants had been for a portion of the year on short allowance. When the present works were projected, they were estimated to furnish a supply for a town of 12,000 inhabitants. But they all knew that Port Glasgow had considerably exceeded that population. The motion was seconded by Mr. M'Bryde, and adopted, Mr. Fyfe dissenting.

It has been resolved by the Town Council of Paisley to avail themselves of the powers which they already possess for increasing their water supply.

The annual meeting of the Galashiels Water Company was held last Tuesday, when it was resolved to empower the directors to arrange for the winding up of the company at an early date, in view of the introduction of a general water scheme. A dividend of 10 per cent. was declared.

The opponents of the Perth Water Bill have intimated to the promoters that their opposition will be confined to the proposed amendment to the effect that the Police Commissioners be named as first commissioners under the Act instead of the present promoters.

The monthly meeting of the Kirkcaldy Water Commission was held on Tuesday night, when the superintendent's report was read. It showed that the average daily quantity of water sent into the district during the past month was 82,000 gallons (of which 20,000 were sent to Wemyss; 17,000 for public works) being 25 gallons per head to a population of 23,000. For the past month the rainfall was 2.02 inches, and for the corresponding month last year 1.25 inches.

During the past week the tendency of the Glasgow pig iron market has been decidedly downwards. A good deal of business has been done, and on Friday afternoon prices were at least 3½d. down, as compared with those of the previous Friday.

Some descriptions of coal are in good demand, but others are very dull and inactive. Supplies are large, and prices, if anything, are a little easier.

LIGHTING BY ELECTRICITY.

[Translated from the *Journal des Usines à Gaz.*]

M. Denayrouse has presented to the Academy of Sciences a note relative to the suppression of carbons in the production of the electric light. This invention, which has excited considerable attention, is due to M. Jablochkoff, and consists in introducing into the central circuit of an electro-magnetic machine, the interior wire of a series of induction coils, and in causing a spark from the induced current to pass on to a plate of kaolin placed between the two extremities of the exterior wire of each coil.

The electric current is first of all made to pass on to a kind of priming of greater conducting power disposed upon the edge of the plate of kaolin; this latter is heated, becomes red hot, and eventually luminous.

M. Jablochkoff hopes by this means to succeed in producing as many as 50 luminous focuses with a single electro-magnetic machine.

Such, briefly summarized, are the terms of the communication made by M. Denayrouse to the Academy of Sciences, and subsequently repeated by him at a sitting of the Society for the Encouragement of National Industry, at which we were present. We are thus enabled to speak of this invention with some knowledge.

We ought to say, at the outset, that the idea of M. Jablochkoff is very ingenious, and that the experiment is a very interesting one from a scientific point of view, and very pretty to see in a lecture-room; but we will add that it does not appear to us to possess any chance of success in practice. We shall give our reasons presently.

Let us commence by stating that M. Jablochkoff is not the inventor of the pretended *divisibility of the electric light*, as we cannot reasonably give this name to the production of several intense focuses with the same machine or the same pile. This pretended divisibility has no connexion with the *indefinite subdivision* of the light of gas.

The idea of the divisibility of the electric light belongs to Mr. King, whose English patent is dated Nov. 4, 1845, and it would be difficult to say whether that gentleman's process is not superior to that of M. Jablochkoff. The basis of the invention is the employment of metallic conductors, or continuous carbons, raised to a white heat by the passage of an electric current. When carbon is employed, the graphite from gas-retorts is brought into use, it being rendered incandescent in a tube in which a vacuum has been produced. When the current is of sufficient intensity, a certain number of lights may be placed in the same circuit, taking care that the power of the machines, or of the piles, shall be in proportion to the number of lights to be obtained. In this way what is called *lighting by incandescence* is produced.

This process had for a long time been forgotten, when M. Lodugvine a Russian physicist, invented a small lamp, constructed on the same principle, which was perfected by MM. Kohn and Bouliguine. Then came the remarkable invention of M. Jablochkoff, upon which we are about to dwell at greater length, in analyzing the method of lighting the Magasins du Louvre, and the experiments made at the Society for the Encouragement of National Industry.

M. Jablochkoff's apparatus has been fitted up with the object of lighting the Salle Marengo, situated between the Rue de Rivoli and the Rue St. Honoré; this is effected by means of eight electric "candles," surrounded by globes, thickly painted a zinc-white colour to soften and diffuse the light, and provided with reflectors to direct it. These candles are composed of two parallel carbon points 0.004 of a metre (0.15 inch) in diameter, and 0.12 of a metre (4.72 inches) long, insulated by a plate of siliceous material; they are fixed upon two copper tubes, and fastened together by a tampon of asbestos. These points are brought into communication by means of a small piece of charcoal, which serves for the lighting of the candles.

The apparatus is set in operation by two of the Alliance Company's electro-magnetic machines, each equal to 250 Carcel lamps, and driven by two six-horse power steam-engines.

This part of the Magasins du Louvre is usually lighted by eleven gaseliers, having altogether 74 globe burners, each consuming about 100 litres (3.5 cubic feet) of gas per hour.

In order to compare the two modes of lighting, a visit must be paid on several consecutive evenings, not only to the Salle Marengo itself, but to the opposite footway in the Rue de Rivoli, in order to judge well of the effect.

The first thing that will be noticed is that the electric light is not in action every evening, and even when it is it never continues so for the entire evening. This observation is very important, because it is by not taking it into account that persons are led to bring forward imaginary net cost prices, giving the advantage to the electric light.

In fact, if the electric light is not in action every evening, it is either on account of certain inconveniences attending its use, or because the apparatus has to be repaired; but if, on the other hand, when the light is in action, it is only so for a portion of the evening, it is because it is not economic.

Now that simply results from the fact that the electric light is indivisible, while gaslight may be divided indefinitely. In fact, what takes place in an establishment like that of the Magasins du Louvre? At dusk the gas-burners are lighted, but are kept turned down to a small jet; as the evening advances they are opened in proportion to requirements. Similarly at closing time, when the public are no longer admitted, the shopmen and others require light for clearing away and arranging the goods, though this work does not necessitate the large consumption required when the establishment is full of customers. A certain number of lights are therefore extinguished, and the others lowered so as to obtain only the necessary amount of light. Finally, when the place is closed, light is still required for the clerks and cashiers, but a few jets only are necessary. Nothing of this kind is possible with the electric light, which is always at its highest illuminating power, or if not, expends almost as much carbon and motive power as though it were.

The consequence is that the gas-burners remain alight (small jets, it is true), even when the electric light is in action. Therefore double fittings and double expense are necessitated on the one hand, and on the other, the net cost per hour of the electric light cannot be arrived at by calculating the interest and depreciation of the apparatus on the footing of a number of hours lighting equal to that of the lighting by gas, since these apparatus are in use for a portion only of this number of hours. Or rather the expense of the two methods of lighting must be compared not with the equality of light, which is absolutely of no signification, but by taking into account the fact that the superabundance of electric light during certain hours is quite useless, and consequently lost, since it cannot be lowered and the expense reduced.

It is somewhat difficult, for several reasons, to appreciate exactly the difference in intensity between the two methods of lighting. First of all, as we have just said, the gas is never entirely extinguished; then a large amount of light is furnished from the neighbouring galleries; lastly, the colour of the light is altogether different. However, by standing on the opposite footway, it will be noticed that with either system of lighting the articles and customers in the shop are equally well distinguished. It may be admitted, therefore, that the eight electric candles of M. Jablochkoff are equal to the 74 gas-burners; and in the case of the former giving a

superior light, this extra light would be superabundant, since the idea of increasing the number of burners has never been conceived.

Let us then give the comparative net cost of the two systems of lighting:—

By Electricity.

(Expenses of First Establishment.)

	Francs.	Sterling.
Two probable 6-horse power steam-engines	12,000	£480
Two Alliance electro-magnetic machines	16,000	640
Conducting wires and M. Jablochkoff's apparatus	2,000	80

Total 30,000 . . £1200

Being, at the rate of 15 per cent. per annum, for interest, depreciation, and maintenance, 4500 frs. (£180).

By Gas.

	Francs.	Sterling.
74 burners, at 25 frs. each (including meter and service-pipes*)	1850	£74
Being, at the rate of 15 per cent. per annum, for interest, &c., as above 277f. 50c. (£11 2s.)		

We will admit 500 hours lighting in the year for each system in operation separately.

By Gas.

	Fr. c.	Sterling.
Interest and depreciation	277 50	£11 2
74 burners, burning 100 litres (3.5 cubic feet) per hour for 400 hours, at 30c. per cubic metre (35.3 cubic feet)	888 00	35 10
74 burners, burning 50 litres (1.75 cubic foot) per hour for 100 hours, at 30c. per cubic metre	111 00	4 8

Total for the year 1276 50 . . £51 0

Being at the rate of 2f. 55c. (2s.) per hour.

By Electricity.

	Francs.	Sterling.
Interest and depreciation	4500	£180 0
Coal (1.50 kilogramme per horse power per hour, at 40 frs. per 1000 kilogrammes) for 500 hours	360	14 8
Stokers, 500 hours, at 50c. per hour	250	10 0
Graphite points, at 36c. per hour	180	7 4
Lubrication, at 18c. per hour	65	2 12
	5355	£214 4

Being at the rate of 10f. 71c. (8s. 6d.) per hour. That is to say, the cost of lighting by either system is in the proportion of 1276.50 : 5355 = 100 : 419. The electric light, therefore, costs more than four times as much as gas.

If, on the other hand, we compare the two systems as they are now working in the Magasins du Louvre—that is to say, either gas alone, or the electric light concurrently with gas burning low for several hours, and burning alone for the remainder of the time—we arrive at the following figures:—

Gas Alone.

	Fr. c.	Sterling.
Annual expense, 500 hours, as above, or 2f. 55c. per hour	1276 50	£51 0

Gas and Electricity.

	Fr. c.	Sterling.
Interest, depreciation, and maintenance of fittings (gas)	277 50	£11 2
Idem (electricity)	4500 00	180 0
500 hours lighting by gas (small jets)	555 00	22 4
200 hours lighting by electricity, at 10f. 71c. per hour, as above	2142 00	85 14

Total 7474 50 . . £299 0

Being at the rate of 14f. 96c. (12s.) per hour. That is to say, the cost of lighting by either system is in the proportion of 1276.50 : 7474.50 = 100 : 586. The mixed system of lighting is, therefore, more than five times as dear as the gas alone.

There are other inconveniences to be pointed out in M. Jablochkoff's system applied to the lighting of large retail establishments:—

1. The "candles," being composed of carbon which burns and of a siliceous matter which volatilizes, produce a white smoke, formed of very fine particles of silex, which, as is well known, has a very injurious effect upon the respiratory passages.

2. The "candles" have to be renewed every half hour.

3. The white light produced by electricity, which, it is true, allows the stuffs to be seen in their natural colours, is very unfavourable for the selection of those stuffs when they are to be viewed by artificial light, whether it be gas, candles, or lamps. With regard to those that are to be seen by daylight, it is more simple to select them during the day.

Finally, the faces of the visitors wear a pallid hue; and upon this point it is necessary to take the opinion of the ladies, which is altogether unfavourable to the electric light.

A few figures will still further demonstrate the absolute impossibility of bringing the electric light into general use in an establishment like that of the Magasins du Louvre, which, however, appear to be the best adapted for the employment of this system of illumination. We have seen that the lighting of the Salle Marengo required 74 gas-jets, and that to replace these, two six-horse power steam-engines, driving two Alliance electro-magnetic machines, were required. Let us generously admit that this system of lighting replaces even 100 gaslights. Now, the Magasins du Louvre employ altogether 3000 lights, to replace which, therefore, a motive power of 360 horses and 60 of the Alliance Company's electro-magnetic machines would have to be employed. It will thus be seen that it would be necessary to erect a complete works, and the cost of the ground alone would render the application of this system of lighting impracticable.

We will conclude this article by quoting a few passages from a very interesting volume by M. Fontaine, on the subject of lighting by electricity.† This well-known electrician says, in page 126 of his work:

"Manufacturers who only pay 30c. per cubic metre for their gas, and who find their establishments sufficiently lighted with 20 burners, should not seek a more economic light, unless they keep their works going every night without interruption."

Then on page 226 he says: "We assert that, from a practical point of view . . . notwithstanding the remarkable works of M. Jablochkoff, and the no less remarkable initiative taken by M. Denayrouse, there is no lighting system in existence at the present time (May, 1877) which is simple in application, or which could be recommended for a preliminary trial and *a fortiori* for definitive application."

* We do not speak of the value of the gaseliers, which is altogether independent of the lighting, and would be identical for the two systems, in the case of luxurious fittings being employed.

† "Eclairage à l'Electricité. Renseignements pratiques par Hippolyte Fontaine." Paris: Baudry. 1877.

Further on he says: "We believe that for such great efforts to be crowned with success, it will be necessary to discover a new source of electricity, or find a means of utilizing atmospheric electricity for industrial purposes."

Finally, on page 227, he says: "The error committed by inventors is in wishing to make the employment of their apparatus too general, and immediately talking of suppressing gas lighting. True, electricity has

already an immense field of operations. But from thence to taking everywhere the place now occupied by gas is a distance which will very probably never be completely traversed. We have never so much admired the facility of employment, the simplicity of fitting up, the indefinite divisibility, and the multiplicity of uses of gas, as since we have been occupied with lighting by electricity."

We have never said anything else.

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly Ordinary General Meeting was held at the Company's Offices, Sumner Street, Southwark, on Thursday, the 14th inst.—Mr. HENRY WHITING in the chair.

The following report and statement of accounts were presented:—

1. The directors beg herewith to submit to the proprietors the half-yearly statement of accounts of the company to the 31st of March, 1877, which have been duly certified by the public auditor appointed by the Local Government Board and by the auditors of the company.
2. During the past six months the working of the various departments of the company's business has been thoroughly investigated, and your directors have introduced many improvements in the conduct of the business, which they believe will greatly conduce to the prosperity of the company. Alterations have been made in the engineer's staff, which our chief officer assures us will enable him to carry out the whole of the details of his department with the greatest efficiency. The secretary's department has been entirely reorganized, and greater efficiency ensured in recording the minutes and correspondence of the board, and also in keeping, checking, and examining the company's accounts. A new department has been organized for the purpose of supervising the collection of the rates and placing the assessments in the company's rate-books. An alteration has also been effected in the system of collection, whereby your directors are enabled to exercise a more direct supervision over the collectors, and hope, when fully carried out, will ensure greater promptitude in the payment of rates, and diminish the amount of arrears and losses. In making these alterations, your directors have been actuated by a desire to disturb as little as possible the old servants of the company, and they received prompt assistance from all the officers and collectors in obtaining the details to enable them to efficiently deal with a very intricate and difficult business. Although they have established this new and important department of supervision, yet the saving of expense effected in many directions has enabled the board not only at once to diminish the working expenses of the various departments, but to provide for a further considerable reduction as the older officers retire from their duties.
3. With the ordinary staff and in the company's workshops important repairs and

- renewals are now executed at a greatly diminished cost, compared with similar work performed in former years. Care is taken to secure by tender the best stores and appliances at the lowest prices, and all old materials are returned to the company's premises, to be re-worked up or disposed of to the best advantage of the company.
4. The amount which has been directed by the Government auditor to be credited to capital is in accordance with the terms of his order, being replaced from revenue. Messrs. Harvey's claims against the company have been arranged, and will be in the same manner periodically paid off.
5. The report of Mr. Bateman on the Peckham works has been received, and shows that they are not in a condition to be brought into active service. Considerable alterations must be made before they will be available for the purposes for which they were designed and constructed.
6. The thorough cleansing, reinstating, and improving the filters at Battersea and at Hampton, though a heavy charge on the current revenue, is making satisfactory progress, and the engines, boilers, and works generally are being overhauled, and, where necessary, repaired and renewed, as before stated, by our own staff.
7. Your directors have received several communications from the inhabitants of Richmond respecting the water supply of the town, all of which have engaged their attention and consideration, and their replies have been such as to convey to them the company's desire to give a supply on fair and equitable terms. Arrears to a considerable amount are due for the last quarter's water supplied to Richmond, and your directors are taking legal advice as to the proper course for their recovery.
8. The increase in the income of the half year is satisfactory, the amount received being £71,498 9s. 5d., as against £68,343 12s. 3d. in the preceding half year, but your directors regret that in consequence of the extraordinary charges above referred to they can only recommend that a half year's dividend at the rate of 4 per cent. per annum on the ordinary stock and class D shares, 5 per cent. per annum on the preference stock and on the preference shares, and £4 10s. per cent. per annum on the new ordinary No. 1 shares of the company, be declared, payable on and after July 15, 1877.
9. In closing their report, your directors desire to express their satisfaction at the efficient manner in which the principal officers of the company are discharging their duties.

No. 1.—STATEMENT OF STOCK, SHARE, AND LOAN CAPITAL, on March 31, 1877.

Acts of Parliament authorizing the Raising of Capital.	Description of Capital.	Maximum Dividend Authorized.	Number of Shares Issued.	Nominal Amount of Shares.	Called up per Share.	Total Paid up.	Amount Issued, but not Paid.	Remaining to be Issued and Called up.	Total Amount Authorized.
8 & 9 Vict., cap. 69, 14, 1845	Ordinary stock.*	10 per cent.	3036	£100	£100	£303,600	..	..	303,600
15 & 16 Vict., cap. 158, 17, 1852	Ditto.*	10 "	3036	25	25	75,900	..	..	75,900
18 Vict., cap. 24, 11, 1855	Ordinary shares.	7½ "	1265	100	100	126,500	..	..	126,500
27 Vict., cap. 8, 4, 1864	Ordinary stock.*	10 "	1265	100	100	126,500	..	..	126,500
Ditto ditto	Ditto.*	10 "	590	100	100	59,000	..	..	59,000
30 Vict., cap. 5, 4, 1867	Ditto.*	10 "	518	100	100	51,800	..	..	51,800
Ditto ditto	Ditto.*	10 "	500	100	100	50,000	..	..	50,000
35 Vict., cap. 3, 3, 1872	Ordinary shares.	10 "	A 760	100	100	70,000	..	£160,000	230,000
					Ordinary ...	£863,300			
18 Vict., cap. 24, 11, 1855	Preference stock.*	5 "	1265	100	100	£126,500	..	..	126,500
30 Vict., cap. 5, 4, 1867	Ditto.*	5 "	1982	100	100	198,200	..	..	198,200
35 Vict., cap. 3, 3, 1872	Preference shares.	5 "	1700	100	100	170,000	..	..	170,000
					Preference...	£494,700			
					Total.....	£1,358,000		£160,000	£1,518,000
8 & 9 Vict., cap. 69, 18, 1845	Bonds.	..	..	..	..	87,000	..	..	120,000
Ditto ditto	Debenture stock.	..	..	..	..	33,000	..	..	112,000
15 & 16 Vict., cap. 158, 18, 1852	Ditto.	..	..	..	..	112,000	..	..	112,000
18 Vict., cap. 24, 21, 1855	Ditto.	..	..	..	..	150,000	..	..	150,000
35 Vict., cap. 3, 6, 1872	Ditto.	..	..	..	..	49,981	..	50,019	100,000
					Total.....	£1,789,981	..	£210,019	£2,000,000

* Shares converted into stock in accordance with Companies Clauses Act, 1845—8 Vict., cap. 16, 4.

RATES OF INTEREST PAID ON MORTGAGES AND DEBENTURE STOCK.

	4 per cent. on £2,000	0 0 mortgage.	
£87,000	4½ "	23,500 0 0 "	
	4½ "	31,500 0 0 "	
	4½ "	30,000 0 0 "	
344,981	4½ "	84,316 0 0 debenture stock.	A—£4 10s. payable until June 30, 1877.
	4½ "	260,665 0 0 "	
£431,981		£431,981 0 0	

Dr.				CAPITAL ACCOUNT.				Cr.			
	Certified Expenditure to Sept. 30, 1876.	Expenditure during Half Year.	Total Expenditure to date of Account.		Certified Receipts to Sept. 30, 1876.	Receipts during Half Year.	Total Receipts to Date of Account.				
To Expenditure on works to March 31, 1871	£1,437,110 4 6	..	£1,437,110 4 6	By Ordinary stock	£607,800 0 0	..	*£666,800 0 0				
Lands, water-rights, quit-rents, and easements, acquired by the company; reservoirs, wells, pumps, shafts, conduit-pipes, and works for the collection or impounding and storing of water, including service reservoirs and filtering-beds	89,016 9 9	2,061 7 3	91,077 17 0	Ordinary share capital	255,500 0 0	..	*198,500 0 0				
Main and service pipes connected with the distribution of water	179,688 6 7	2,018 7 4	181,706 13 11	Preference stock	324,700 0 0	..	324,700 0 0				
Meters, fitting, and service works, including labour	14,202 10 9	2,067 11 8	16,270 2 5	Preference share capital	170,000 0 0	..	170,000 0 0				
Law and parliamentary expenses (promoting)	1,858 13 10	8 3 6	1,866 17 4	Mortgage capital	94,850 0 0	..	+87,000 0 0				
Engineers expenses chargeable to capital	3,925 0 2	..	3,925 0 2	Debenture stock	336,631 0 0	£8,350 0 0	344,981 0 0				
Interest at 4½ per cent. on new ordinary share capital, 5 per cent. on new preference share capital, and 4½ per cent. on debenture stock, raised per 11th section of 35 Vict., cap. 3	17,034 1 1	..	17,034 1 1	Premiums received on shares issued	423 0 0	..	423 0 4				
	£1,742,829 6 8	£6,155 9 9	£1,748,984 16 5	+Less mortgages paid off	..	£8,350 0 0	7,850 0 0				
Excess of income received over payments	..	..	41,419 3 7								
			£1,790,404 0 0								
					£1,789,904 0 0	£500 0 0	£1,790,404 0 0				

* Ordinary share capital to the extent of £59,000 has been converted into ordinary stock.

No. 3.—REVENUE ACCOUNT.

MAINTENANCE.			
To Maintenance and repair of impounding and service reservoirs, filtering-beds, works and pipes, or for obtaining and storing of water, including the cost of materials and labour	£433 9 10		
Maintenance and repair of mains, pipes, fittings, meters, and works connected with distribution of water, including the cost of materials, labour, and renewals	£3,240 3 0		
Repairs of engines, &c., at the several works, included in Messrs. Harvey's accounts	4,000 0 0		
Pumping and engine charges, including the cost of coals, wages, &c.	7,240 3 0		
Filtration, including cost of materials and labour	10,717 10 6		
Salaries of engineer, superintendent, and clerks, and wages of inspectors and turncocks	4,067 16 5		
Rents	2,313 7 1		
Thames Conservancy	49 5 0		
Rates and taxes	500 0 0		
	4,147 13 9		
	£29,469 5 7		
MANAGEMENT.			
Allowance to directors	506 5 0		
Allowance to company's auditors	21 5 3		
Salaries of secretary, accountant, and office clerks	721 0 2		
Superannuation	147 3 9		
Commission to collectors	2,246 13 7		
Stationery, printing, and general establishment charges	1,062 17 8		
Law and parliamentary expenses	1,198 13 2		
Official auditor and water examiner	96 12 5		
	6,000 11 0		
Balance carried to next account to provide for losses	3,500 0 0		
Dividend and interest account for transfer of profits	35,629 14 5		
	£74,599 11 0		
		By Balance brought from last account	£3,500 0 0
		Add surcharges on water-rental to Sept. 30, 1876.	1,723 19 5
			£5,223 19 5
		Less allowances for empty houses	£1,924 5 7
		Ditto overcharges	493 9 9
		Ditto bad debts	716 14 3
			3,134 9 7
		Difference between ascertained and estimated losses	£2,089 9 10
		Water-rents accrued to the date of this account	72,438 3 11
		Rents received	71 17 3
			£74,599 11 0

No. 4.—DIVIDEND AND INTEREST ACCOUNT.

To Interest accrued to March 31, 1877, on mortgage and loan capital	£9,622 15 8		
Dividends paid on preference stock and shares to Dec. 31, 1876	£6,183 15 0		
Dividends accrued on preference stock and shares to March 31, 1877	6,183 15 0		
	12,367 10 0		
Balance applicable to dividend	17,758 19 0		
	£39,749 4 8		
		By Balance brought from last account on Sept. 30, 1876	£23,657 16 2
		Less dividend declared for the half year at the rate of $\frac{1}{2}$ per cent. on ordinary stock or shares, and $\frac{1}{2}$ per cent. on new stock (A and B)	£19,422 0 0
		Less interest on temporary loan for revenue purposes, charged as dividend	125 2 6
			19,547 2 6
		Interest on deposits	4,110 13 4
		Revenue account for profits transferred	8 16 7
			35,629 14 5
			£39,749 4 8

No. 5.—STATEMENT OF THE LIABILITIES AND ASSETS (BALANCE-SHEET).

To Capital account—		By Capital account—	
Amount received, as per account No. 2	£1,790,404 0 0	Amount expended for works, as per account No. 2	£1,748,984 16 5
Revenue account—		Water-rates and service accounts due to the company	72,438 3 11
Provision for bad debts, as per account No. 3	3,500 0 0	Water-rates in hands of collectors for collection	1,349 10 10
Dividend and interest account—		Stock in hand—	
As per account No. 4	17,758 19 0	Pipes, meters, fittings, coal, and general stores	4,524 10 5
Unclaimed dividends	532 5 8	Suspense account	509 15 9
Outstanding tradesmen's accounts, &c., owing by the company	16,466 16 3	Cash at bankers	£1,515 3 9
Temporary loans and interest on ditto	18,094 8 9	Less outstanding cheques	386 13 10
Interest accrued to March 31, 1877, on mortgage and debenture stock	8,916 12 3		1,128 9 11
Interest accrued to March 31, 1877, on preference stock	6,183 15 0	Cash in office	7 14 5
Deposit suspense account	6,000 0 0	Deposit account	6,000 0 0
		Income-tax	135 6 4
		Capital suspense account	32,778 8 11
	£1,867,856 16 11		£1,867,856 16 11

Subject to the sum of £32,778 8s. 11d., now in suspense, being made a charge against the accruing revenues of the company during the next four years, I hereby certify that I have examined the foregoing accounts, and find the same correct; and that the sum of £17,758 19s. is available for dividend on the ordinary stock and share capital of the company, amounting to £863,300.

ALLEN STONHAM,
Auditor appointed under the Metropolis Water Act, 1871.

The CHAIRMAN said: Before I formally move the adoption of the report, I believe it will be acceptable to the shareholders that I give them a detailed account of the withdrawal of our water supply to Richmond, and also the reasons why we are obliged to return to the dividend of 4 per cent. In 1875 the Richmond Vestry applied to the Local Government Board for the loan of £28,000 at $3\frac{1}{2}$ per cent. for the purpose of constructing works and a well to supply the town with water. Our then solicitors advised us to oppose this loan. I would ask you to remark that it was not a question of opposing the scheme of the vestry, but simply opposing their borrowing the money at $3\frac{1}{2}$ per cent. We were, of course, unsuccessful, as I informed the then chairman that a most eminent lawyer had stated would be the case. We then placed our law business in the hands of Messrs. Bircham and Co., who were already solicitors to the East London Water Company, and who in previous parliamentary contests had been entrusted by the eight water companies to draw up the general brief applicable to all the companies. You can well imagine how difficult it was for these gentlemen to conclude satisfactorily a case commenced and carried out by other solicitors. However, the matter was closed at an expense of £1000, and as we had already paid our former solicitors £2580 the total law costs of Richmond were £3580, all paid out of revenue. The Vestry of Richmond having obtained the loan of £28,000, issued tenders for the necessary works, when our then chairman, considering that we had our pipes and distributing plant already laid in the town, and which plant would be useless if the vestry were to lay fresh mains and pipes, made the following offer to the vestry that we would take over the works and scheme of the vestry, and expend thereon £28,000, to see if a supply of water could be procured from the chalk (about which there was very great doubt); if successful, however, we would supply the town with chalk water through their present pipes; the well failing, that we would then continue our supply of river water as before. No notice was taken of this offer. By December, 1876, the vestry had completed laying the larger part of their mains, and had made great progress with their well. At this time one of the vestry distinctly told our collector that the company would never get the next rate, because no one would pay it. The fact was that the vestrymen felt confident that their supply would be ready before or by the 30th of March, when our six months collection would be made. This very man now owes three-quarters of a year's rates. It was bad enough to supply the town for three months without being paid, but we felt that it would be still worse to pump water for six months and get no return. Therefore, on the 13th of December, 1876, our engineer wrote to the vestry-clerk that "on the 19th of January, 1877, we shall discontinue the supply to

Richmond," but with this proviso, "unless it is the wish of your vestry that we should continue the same, in which case I shall be glad, and in the most friendly spirit, to meet you for the purpose of arranging terms for the continuation of the water supply to the town of Richmond." To this we received the vestry-clerk's invariable reply: "I beg to acknowledge receipt of your letter." On the 28th of December the vestry issued a circular that they were ready to give an ample and efficient supply to the town, and invited the inhabitants to enter into an immediate contract to take their good, instead of the company's bad water. On the 2nd of January last they issued a further circular that 2200 inhabitants (very nearly all the town) had entered into the required contract, and that the vestry were now prepared to give the supply. On the night of the 13th of January we ceased our supply to the town. This was a Saturday, and our engineer was abused by the vestry-clerk for doing the necessary work at night. Had we severed the connexion during the day, we should have been told how wrong it was to deprive the poor of their water supply for Sunday, and that we were interrupting the traffic in the streets of Richmond, which are very narrow. On Monday, the 15th, the truth came out that the vestry had been most cruelly deceived by two builders, members of the vestry. These two persons had assured not only the vestry, but other persons outside, that it was physically impossible for the company to discontinue the supply to the town of Richmond without ceasing at the same time to supply Kew on the right hand and Petersham on the left. The vestry were not ready, and had no water to give the town; they relied on our not being able to cease the supply, and then they intended to have our water without paying for it. But now our former liberality to the town did us good service. To supply a drinking fountain on the Hill without charge we laid a special pipe from our main, 400 yards long, in order to give a constant supply. When, therefore, we disconnected Richmond from our main-pipe, we simply turned this pipe, destined for the fountain, into the Petersham pipe. The possibility of doing this was unknown to one of our turncocks, who had been induced by the vestry to leave our employ at a week's notice. This, gentlemen, is the true reason of the intensely angry feeling of the Richmond Vestry—that our engineer was clever enough to withdraw from Richmond, and yet continue to supply Petersham and Kew. On our part there has been every disposition to oblige the inhabitants. For instance, when a gentleman asked us to continue his supply, he was informed that it would not be to the company's interests to serve a single house; but again calling in the following week, he informed us his daughter was dangerously ill with scarlet fever, and that the vestry had no water. We immediately laid on a supply to his

house, and he wrote to tell me, "Your Southwark water restored her to health." Again, the chairman of another water company called upon me, and said that it made him most anxious as to the supply of water to the town in case of fire, and urged me to inquire of the vestry if they were prepared in such a contingency. I wrote the letter; I received no answer, and the chairman of the vestry at the following meeting said it was a most important question. Our present position is this: We gave Richmond a daily low service of 850,000 gallons, high service of 350,000 gallons, or a daily total of 1,200,000 gallons, for which we received £5531 a year, or 3d. per 1000 gallons. We have not received the major part of six months rate—viz., £2000, and yet our revenue shows an increase of £3154 for that period, which proves that we have found new customers, who appreciate and pay for the water we give them. The Richmond Vestry state that they are now giving a supply of 250,000 gallons a day to the town. Such is the history of Richmond. With regard to the return to the previous dividend of 4 per cent., a 4 per cent. dividend per annum requires for the half year £17,441, an additional $\frac{1}{2}$ per cent. per annum for the half year £2000, or for $\frac{1}{2}$ per annum, £19,441. This half year we have had the following exceptional charges to pay off:—Messrs. Harvey's old account, £4000; re-making filters, £3000; Richmond law bill (which was left in suspense from last time because Mr. Stoneham was in doubt about passing it), £1000 which makes 1 per cent. per annum; cessation of supply to Richmond, £2760. Your directors recommend a dividend of 4 per cent., because the Government auditor has certified that there is a sufficient sum available to pay that rate. Your directors consider that it would be too severe on the present proprietors not only to pay debts contracted in former years, but in addition, at the same time, to provide a reserve-fund for future shareholders. As our engineer will make a report once a year only, I will touch on a few points connected with his department. Mr. Rumble has occupied the post of chief engineer for very nearly a year, and all the anticipations of the directors as to the advantages to be derived from his selection have been more than fulfilled. In his department 4000 letters have been written in the year, against about 100 in the same period of the late engineer's reign. Our complaints were about 1600, but are now reduced to about 400 a year, and these arise chiefly from the tenants neglecting to keep their fittings in good order. For the last six years we have paid Messrs. Harvey for repairs an average of £3930 per annum. We now do our engineering work in our own shop. During the last year, Mr. Rumble has only paid £220; the wages of two extra fitters at our works cost £200; tools and materials, say, £200—total, £620 against the former outgoing of £3930. For this sum our No. 1 engine has been thoroughly repaired, about three dozen large valves made equal to new, tools and plant made for pipe-laying, a great part of which we do ourselves, instead of by Messrs. Aird, and our works in general placed in a far better condition than they ever before were. We formerly made our own gas at Battersea, and this required three men at 26s. per week, or per annum £203; cannel coal, £100; making a total of £303. We now purchase our gas at 3s. 6d. per 1000 feet, which, we believe, will cost us £120, and effect a saving of £180 a year. Still referring to the engineer's department, I should tell you that, whereas formerly, when leaky valves were cut out, and broken pipes taken up, they were carried off by some one, and seen no more; the valves are now repaired in our shop, and the broken pipes sold for the benefit of the company. At Hampton Mr. Rumble has effected a great economy. Before his time filtered water was used for condensing at the new works—the quantity required being 500,000 gallons a day—at 3d. per 1000 gallons. This is £6 a day saved; or if not saved, it gives us this daily additional quantity of filtered water for the supply of our customers. The unfiltered water is also far better than filtered water for the condensers and boilers, the fur or incrustation, by using the former, being so much softer, and less in quantity. Our engineer at Hampton informs me that the old boilers, which have been working 20 years with unfiltered water, are in a better condition than the boilers of the new works, which have worked only nine years. One of our large consumers was paying us £250 a year for a 7-inch pipe, running night and day. This arrangement of our late engineer had been going on for six years. Mr. Rumble, feeling convinced that we supplied this at an actual loss, placed a test-meter on the establishment, and found that the average supply exceeded 200,000 gallons a day, which, at our lowest charge, amounts to over £1800 a year. The waste is now stopped, and the establishment uses, and is satisfied with, only 40,000 gallons a day. This enormous waste did them no good, and was ruinous to us. In addition to the increase of the revenue of £3155, an amount of £704, net profit, has been earned, and received from the engineer's department, for work never before so undertaken. This amount the Government auditor, however, decided should be put to the decrease of capital, so that, if not benefiting revenue directly, it does so indirectly, by reduction of capital. But we have earned £704 in addition to the £3155. For opening ground and making connexions, every penny paid is now received by the company, amounting, at the present time, to £1200 or £1500 a year, and it is likely to increase. Since our last meeting, we have proceeded to re-make our filters, both at Hampton and Battersea. Two of the large filters at Battersea will be divided, for convenience and economy in working, as our engineer says that no filter should exceed an acre. With regard to the Battersea land, when we last met the question of its sale was raised by one of the shareholders, and the only information I could then give was that it remained *sub judice*. The directors make no mention of this subject in their report, because it was only on Tuesday last, at 5 p.m., that our solicitor brought the offer from the General Investment Company, to whom we had contracted to sell the land, that they would waive all claim to the fulfilment of the contract for sale upon the return of the £6000 deposit, together with £1500, to cover their law and other costs out of pocket, and interest upon the deposit, which we have had for nearly a year, and which, at 5 per cent., came to £300. This the board have accepted rather than enter into litigation—at all times uncertain—though undoubted right was on our side. Upon this settlement I congratulate the shareholders. It now leaves the question of the Battersea land unincumbered, and will enable your directors to deal with this valuable site in such a manner as must be beneficial alike to the shareholders of the company and to the consumers in the company's district. With reference to the Peckham works, as already stated in the report, Mr. Bateman's opinion is in perfect accord with the previously expressed views of our present chief engineer. Considerable alterations will have to be made before filling them with water. Mr. Bateman's report recommends strengthening the walls inside, thus reducing the capacity. The matter having been referred back to our engineer, he has the subject under his most anxious consideration, and hopes to be able to devise some other method whereby their capacity may be maintained, and their stability and efficiency ensured at a less cost than the method first suggested by Mr. Bateman. Generally, while the directors regret to have to recommend for your adoption a smaller dividend, owing to the extraordinary charges which have accrued under the management of their late officers, they feel that better times must ultimately come, inasmuch as the revenue is fast increasing, and the expenses are diminishing, and the district and works in every sense are in better order; and when the cleansing of the filters is completed, there can be no doubt even the sensational articles of "Dr. Frankland will cease, and your directors be enabled to show, at least,

a 5 per cent. dividend for distribution. In conclusion, I ask you, when criticizing the work and labours of your directors, to remember that in succeeding to such a legacy as refunding from revenue to capital Messrs. Harvey's accounts for £32,000, and the cost of cleansing the filters, which has come upon us so suddenly, in addition to very many similar charges, time alone will enable you to profit by the increase of revenue and the more efficient working of the concern. I ask you to remember that we are not the people who originally endorsed the bill. I will now move—"That the report of the directors submitted to this meeting be received and adopted, and that, as recommended by the directors, the half-yearly dividends be declared payable on and after the 14th of July, at the rate of 4 per cent. per annum on the ordinary shares and the class D shares, 5 per cent. per annum on the preference shares, and $\frac{1}{2}$ per cent. per annum on the ordinary No. 1 shares." I may add that we have had a collector of the name of Wilson for 34 years. He has been a zealous servant of the company, and the directors propose to give him a retiring pension of £100 a year, and I shall ask your confirmation of the allowance. He worked up to the last, and just before he retired he was knocked down and robbed of £50.

Mr. VIALS seconded the motion.

Mr. STURGE asked what the engineer estimated the necessary repairs at Nunhead would cost, in order to render the works sufficient. It was rather new to him to find that the Richmond Company belonged to the Southwark Company. He had thought they were a separate company with a distinct capital. He wished to ask whether there was any other claim besides Messrs. Harvey's which the official auditor considered had been misplaced, or whether the whole of the disagreeable business was now known. If, despite what was done at Richmond, more than £8000 should be available, would the excess over Messrs. Harvey's claim go to dividend, or would the Government auditor insist on its being paid back to capital?

Mr. BRADFELD, referring to the accounts, said the rentals appeared to be more in the corresponding half year of 1876 than they were for the six months ending March, 1877. Did the receipts vary in this company as they did with other concerns?

A PROPRIETOR asked if there was still money owing to Messrs. Harvey, and how much had been paid to them since the proprietors first discovered that they were so largely indebted. He also wished to know if it was all paid under the certificate of the then engineer. He would also like to be informed how much money had been spent on the Peckham reservoir, and whether that was certified by Mr. Quick. Had any steps been taken to get the company recouped by Mr. Quick?

Mr. ATWELL considered that the bad debts, £716 14s. 3d., formed a very large item. The commission to collectors was £2246 13s. 7d., or nearly 3 per cent. of the rental. If the other servants were paid in proportion, he did not wonder at the dividends being so small. About the misdeeds of the past, it appeared to him this was a case similar to that which took place with the Great Central Gas Company, where Higgs was allowed to take £72,000 without the directors knowing anything about it. If the same incapacity prevailed at this board, he thought the sooner an alteration was made the better. For a water company, with the capital of the Southwark Company, only to declare 4 per cent., showed a want of management and discernment, to say the least of it.

Mr. WRIGHT asked what amount of capital had been expended at Richmond on mains.

Mr. GLANDON hoped that the engineer would be very careful about the Peckham reservoir, after the condemnation of Mr. Bateman.

Mr. WHITE asked how many of the old directors who were cognizant, or ought to have been cognizant, of these goings on, still remained on the board. He could not understand how the directors could have gone on from year to year with their eyes shut, and not looking into the affairs of the company.

The CHAIRMAN said Mr. Bateman had only given a rough estimate of the repairs that would be required to be done at Nunhead. The present wall was only 18 inches thick from top to bottom, and Mr. Bateman recommended a lining all round it; whether it would cost £20,000 or £30,000 he did not say, as he was not exactly applied to for an estimate. The object of the directors, in asking him to go to Peckham, was to ascertain whether it would be safe to charge the reservoirs with water, because the inhabitants of Peckham had been seriously alarmed, and Mr. Bateman distinctly said that it would not be safe. Mr. Bramwell also went into the reservoirs, but declined to give any opinion. He very handsomely returned his fee of 20 guineas, and said: "I must decline to give any report upon the reservoirs." If he had believed that they were fit to be filled with water, could it be imagined that he would not have said so? Richmond originally was supplied by the Richmond Company, who drew their water direct from the Thames at Richmond Bridge. That water was never filtered, and the inhabitants were continually calling out about it. The Richmond directors got sick of the job, and applied to the Southwark Company to buy them up. The Southwark Company agreed to do so, and as the Richmond directors wished the purchase to be carried out very rapidly, £16,500 was given for the concern. The land upon which the old works stood, and the old engine, were sold for £1500, leaving the cost of the Richmond Water-Works £15,000, without filtering-beds, and without any appliances for properly supplying the town. The supply then became merged in the Southwark Company.

A PROPRIETOR: Was that by consent of the shareholders at a meeting?

The CHAIRMAN said it was unanimously approved by the shareholders, and at the time was supposed to be a most advantageous arrangement both for the town and the company. The agreement was that the money should be at once paid, and that parliamentary powers should be sought to confirm the purchase. Parliament, however, refused to sanction it. It was opposed by the town of Richmond, who wished to have a 4 per cent. rate instead of 5 per cent. That was a very unjust demand, considering that a part of the town was at an enormous elevation, and the cost of pumping there was at least 3s., if not 4s., per 1000 gallons. A second application was made to Parliament, and opposition was again offered to it, so that the company's lawyer said it was advisable to withdraw the Bill. When the vestry decided on making works for themselves, the company tried to prevent them, but everybody knew that they had no *locus standi*.

Mr. STURGE said if the Richmond people wanted to be supplied by the company, they ought to be willing to pay reasonably for it. As far as he could see, the original blunder was taking the works without first obtaining parliamentary powers. However, it might be more profitable to try and get some money from Mr. Quick.

The CHAIRMAN said there was no reason for blaming Mr. Quick on account of the Richmond job. That was an affair of the lawyers, and there could be no doubt that the then lawyers neglected their duty in not calling attention to the fact that if Parliament refused the powers, Richmond might at any time turn round and say, "We will not pay what we owe you." With regard to the Peckham reservoir, Mr. Rumble was anxiously considering whether he could not adopt a cheaper scheme than that recommended by Mr. Bateman, and in all probability he would succeed in doing so. In the case of Messrs. Harvey's claim, not only did the Government auditor require them to transfer £32,000 from revenue to capital, but there was also a bill for £10,200. Of that, £2000 odd had been paid off, leaving the debt £871. A civil engineer, who was asked to inquire

into the reasonableness of Messrs. Harvey's charges, reported that they were far too high, and it was a subject of serious discussion at the board whether legal proceedings should not be taken. It was at last agreed to throw over the odd hundreds, and the remaining £8000 was to be paid off at the rate of £2000 a year with interest at 3 per cent.

A PROPRIETOR asked what work had been done for the money.

The CHAIRMAN said general repairs, and perhaps a little new work. He believed he might safely say that when that claim was extinguished no other charges would be brought forward. During the half year £71,000 had been received against £68,000 for the corresponding period last year, notwithstanding that the company had lost Richmond, and that Richmond at the present time owed them £2000, and the vestry £142. The directors were now investigating the question whether they could legally recover the amount. They were taking counsel's opinion about it, and the reason they discontinued to supply the town was that they were told distinctly that they would never get the present rate. If the Richmond people would offer to pay what they owed, and then wished for a supply in the hot weather, the company would be happy to give it. They had no ill feeling against Richmond; their duty simply was to get dividends for the shareholders.

A PROPRIETOR: Have we power in this company to make the consumers pay in advance?

The CHAIRMAN answered in the affirmative, but said in rich districts like Chelsea and West Middlesex the people sometimes asked to be allowed to pay in advance, as they might be going abroad; but Southwark was a poor district, and the great difficulty was to get the money when it was due. The money which had been paid to Messrs. Harvey was on the certificate of Mr. Quick. Nothing was ever paid by the directors except on the certificate of the engineers, but he (the chairman) had before proved that those certificates were not always correct. The question of whether any steps should be taken against Mr. Quick did not arise until the whole matter of the Peckham works was gone into. Mr. Rumble became the engineer in July last, and had been busy night and day since then, but it could not be said as yet whether it was the contractor or the engineer who was responsible. One gentleman had referred to the bad debts (£716) as being rather large; but the only concern he knew of that had succeeded in keeping bad debts at a lower figure was the Manchester Water-Works, the bad debts of which were only £200 a year. The amount paid as commission was £2476, which included £139 for the broker who got in the rates the last month out of the six. The collectors endeavoured to get in as much as they could, but at the end of five months the books were handed over to the broker. The collectors received from sixpence to ninepence in the pound. The difficulty of getting the water-rate was much greater than that of getting the gas-rate. £15,000 was paid for the Richmond works; £10,000 for the extension of mains, &c., there; £15,000 for a special main from

the works at Battersea to Richmond. Then there was a provision for £10,000 for extra cocks, &c., which, however, had not been laid, and in point of fact the Richmond outlay stood in the company's books at about £60,000. In that was included a share of the filters, which produced a revenue of £5000. About £40,000 might be taken as the cost of the plant. Mr. Vials, Mr. Carbone, and himself were the only three members of the present board who might be called old directors, having been on the board when things went wrong. At that time Sir William Clay was chairman. He was a very large holder of shares, and was virtually the dictator of the concern, and it was quite impossible for the other directors to oppose a person of such knowledge and standing in the company, for, of course, he could have carried anything. His chief confidential adviser was the late engineer, Mr. Quick. When Sir William Clay died, Mr. James Clay took his place. He was succeeded by Mr. Arthur Clay, and Mr. Quick was the adviser of both those gentlemen also, and the other directors simply endorsed whatever was proposed by the chairman. The secretary at that time was Mr. Robinson, but he had resigned; if he had not he would have been dismissed. Therefore, when it was asked, "Why did you not find out these things before?" his answer was, that when an engineer was paid £1200 a year, his son £600, and the secretary £1400, the board was justified in expecting that those gentlemen would work for the benefit of the company. Directly it was discovered that they had not done so, their resignations were accepted, and there had been a total reconstruction of the staff of the company. There was now not a single man on the staff who did not earn his money.

The resolution was unanimously agreed to.

The CHAIRMAN next proposed—"That this meeting sanctions the grant by the directors to Mr. Wilson, a collector in the employ of this company for 34 years, of a retiring allowance of £100 a year, during the pleasure of the board."

Mr. VIALS seconded the proposal, which was agreed to.

Mr. BURT (solicitor to the company) said he was a member of the Richmond Vestry, and, in consideration of his peculiar position, the directors had been good enough to relieve him from personally advising them with regard to the Richmond dispute. In that matter, the company were advised by another gentleman, who was in no way personally interested in it.

A vote of thanks to the chairman, directors, and engineer was agreed to.

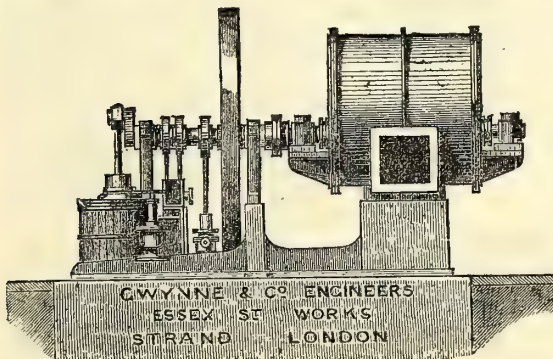
Mr. RUMBLE thanked the shareholders for the compliment, but reminded them that it was to the directors that credit was due, it resting with him simply to carry out their desires. He said he should give due consideration to Mr. Bateman's suggestion with regard to the Peckham works, but it would be readily understood that it was less expensive to do the work outside than inside the reservoir.

The CHAIRMAN also acknowledged the vote, and the proceedings then terminated.

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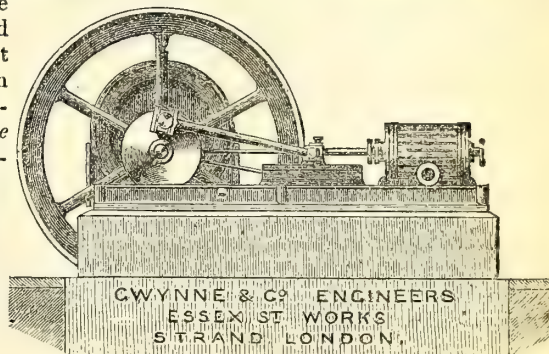
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FOR SALE—A Set of Four Purifiers, 8 ft. by 6 ft., with covers, grids, centre-valve, and 6-in. connexions complete. Apply to J. GILL, Gas-Works, BRIDGNORTH.

READING GAS COMPANY. **FOR SALE, as they now stand, and at any reasonable price,** as the ground upon which they stand is wanted, four 12-ft. square Cast-Iron PURIFIERS, with centre-valve and connexions, grids, tee bars, &c., complete. Apply to Mr. E. BAKER, Engineer, Gas-Works, READING.

GOVERNOR FOR SALE. **THE Newmarket Gas Company have for immediate SALE a 6-in. GOVERNOR** in excellent condition by H. Balfour and Co. (1875); also a 6-in. Anderson's Four-Way VALVE. Apply to THOMAS WILKINSON, Manager, Gas Company, NEWMARKET.

TO GAS MANAGERS AND OTHERS. **A MOST useful Lot of Second-hand APPARATUS FOR SALE,** including Two 7 ft. square Purifiers, 6-in. Centre-Valve, Condenser, with 6-in. valve and bye-pass, &c., &c. Full particulars to be had of Mr. GEO. THORNELOE, Engineer, 57, Barbican, LONDON, E.C. The above may be seen at the Gas-Works, Basingstoke, by applying to Mr. THOMAS, Manager.

THE Newport (Mon.) Gas Company have FOR SALE the following PLANT at their Works, Newport, Mon.:—Two Cylindrical Boilers, 13 ft. by 4 ft., with fittings complete, and steam-pipes to engines. Two Horizontal Engines, each cylinder 9½ in. diameter, and stroke of each 1 ft. 6 in. Two Beale's Exhausters, made to pass 20,000 cubic feet per hour each, with regulators and bye-pass. The above are in good order, have been working during the past winter, and are now offered for sale because larger ones have been fixed. Particulars and prices given for the whole or a portion of the Plant on application to the undersigned. They can be seen at the Works, Mill Street, Newport, Mon. THOMAS CANNING, Engineer. May 18, 1877.

THE Newmarket Gas Company invite TENDERS for the supply of a 9-in. GAS GOVERNOR, and a 9-in. Four-Way VALVE, delivered at Newmarket Railway Station. Tenders to be sent to the undersigned on or before the 5th day of July next. The Directors do not bind themselves to accept the lowest or any tender. By order, THOMAS WILKINSON, Manager.

GASHOLDER FOR SALE.

ONE Telescopic Gasholder, 70 feet by 20 feet, complete, with cast-iron tank, columns, girders, and inlet and outlet pipes, valves, &c., of modern construction. In first-class condition, and made by Messrs. Piggott and Co., of Birmingham. To be seen at work at the Gas-Works, Birkenhead. Cause of removal to make room for extensions. To be sold a bargain, taken down, and re-erected ready for work. For particulars, apply to Messrs. ASHMORE and WHILE, STOCKTON-ON-TEES, or to view to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

TO PERSONS OR PARISHES ABOUT TO ESTABLISH GAS-WORKS.

THE whole of the fixed Plant of Works in the country, about 40 miles from London, to be DISPOSED OF in consequence of their being too small for the Company, who have had to erect larger ones. The Plant consists of Two Holders, one 30 ft. diameter, and one 27 ft. diameter, each 10 ft. deep; Three Sets of Modern Purifiers, Condensers, Hydraulic Mains, Washer, &c. The above would be admirably adapted for a small town or village, as most of it is in good order, the purifiers and one holder being of comparatively recent erection. Applications to view and treat to be made to Messrs. CONDER and SONS, Estate and Land Agents, Auctioneers, &c., Biggleswade, BEDS.

TO CONTRACTORS AND OTHERS.

THE Directors of The Gaslight and Coke Company are prepared to receive TENDERS for the undermentioned GOODS, viz.:—Portland Cement, Grey Lime, Sand, Wrought-Iron Tubing and Fittings, Oils, Tallow, White Lead, in accordance with specifications to be obtained at this office. Proposals to be sent in on or before Thursday, the 28th inst.

By order,
JOHN ORWELL PHILLIPS, Secretary.
Chief Office: Horseferry Road, Westminster, S.W.,
June 16, 1877.

TO BRICKMAKERS AND OTHERS.

THE Directors of The Gaslight and Coke Company are prepared to receive TENDERS for the purchase of the BREEZE manufactured at several of their stations in accordance with a specification to be obtained at this Office. Proposals to be sent in on or before Thursday, the 28th inst.

By order,
JOHN ORWELL PHILLIPS, Secretary.
Chief Office: Horseferry Road, Westminster, S.W.,
June 16, 1877.

WHITCHURCH AND DODINGTON GASLIGHT AND COKE COMPANY, WHITCHURCH, SALOP. **TENDERS for the year's supply of Gas COAL,** from 800 to 900 Tons carbonized, may be sent to the Company on or before the 26th day of June inst. G. T. JOHNSON, Secretary.

TO MAIN LAYERS.

THE Directors of the Hungerford Gas Company are prepared to receive TENDERS for the laying of about 400 yards each size of 5 in., 3 in., and 2½ in. MAINS, and other works in connexion. Further particulars may be obtained on application to the Secretary. Tenders to be sent in on or before the 30th day of June, 1877, addressed to the Chairman of the Hungerford Gas Company. J. H. WOOLDRIDGE, Secretary.

GLASGOW CORPORATION GAS.

RESIDUAL PRODUCTS FOR SALE.

THE Gas Committee of the Glasgow Corporation Gas Commissioners are prepared to receive TENDERS for the purchase of the TAR and AMMONIACAL LIQUOR produced at the Tradeston Gas-Works, from and after Nov. 11, 1877. The contract to be for such number of years as may be agreed upon. Forms for tender, on which offers must be made, may be had, and further particulars obtained, on application to the Manager, at the Gas Office, 42, Virginia Street, Glasgow, and offers, endorsed "Tender for Residual Products," will be received by the subscriber up till the 10th of July next. The Committee do not bind themselves to accept the highest or any tender. J. D. MARWICK, Town-Clerk, Clerk to the Commissioners. City Chambers, Glasgow, June 12, 1877.

TO CONTRACTORS, GASHOLDER MAKERS, TANK BUILDERS, AND OTHERS.

THE Directors of the Rye Gas and Coke Company, Limited, invite TENDERS for the following WORKS:—

No. 1.—For the construction and erection of a Gasholder, about 52 ft. diameter, and 17 ft. high.
No. 2.—For the construction of a Brick Tank for the same at the Company's Works at Rye. Parties tendering for either or both contracts can inspect plans and specifications between the hours of Ten a.m. and Four p.m. at the Office of Messrs. Messer and Thorpe, Engineers, 8, Quality Court, Chancery Lane, London. Tenders must be sent in on or before Monday, the 25th day of June inst., endorsed "Tender for Gasholder and Tank," and addressed the Secretary, Watchbell Street, Rye, Sussex. The Directors do not bind themselves to accept the lowest or any tender. By order, G. SLADE BUTLER, Secretary.

Rye, June 5, 1877.

TO GAS APPARATUS CONTRACTORS AND BUILDERS.

THE Crediton Gaslight and Coke Com-pany are prepared to receive TENDERS for the construction of a Brick GASHOLDER-TANK and GASHOLDER at their Works. Plans and specifications may be seen, and full particulars obtained, on application to Thomas Dand, C.E., Post-Office Chambers, Exeter. Tenders are to be sent in on or before Saturday, the 30th day of June inst., endorsed "Tender for Gasholder, also for Brick Tank," addressed to the undersigned. The Directors do not bind themselves to accept the lowest or any tender. W. SNOW, Secretary.

Crediton, Devon, June 11, 1877.

THE Directors of the Chelsea Water-Works Company invite TENDERS for providing, laying, and jointing in their district about 1800 yards of 18-in., and 2500 yards of 12-in. Straight and Irregular Cast-Iron PIPES.

The specifications and drawings can be seen at the Company's Office, No. 35, Commercial Road, Pimlico, London, any day after Monday, the 18th June inst., between the hours of Ten and Four. Tenders, addressed to the Secretary, are to be sent in to the Company's Office before Ten o'clock on Thursday, the 28th inst.

The Directors do not bind themselves to accept the lowest or any tender. By order, ALBERT GILL, Secretary.

TO CONTRACTORS FOR GAS-WORKS.

THE Smethwick Local Board of Health are prepared to receive TENDERS for the construction of Two Brick GASHOLDER-TANKS, 87 ft. diameter, according to the plans and specifications of F. J. Bramwell, Esq., M.Inst.C.E., which, with the form of tender, may be seen at the Offices of the Local Board Public Buildings, Smethwick, on and after the 20th of June, 1877, and between the hours of Ten o'clock a.m. and Four o'clock p.m. Tenders must be sent to the undersigned not later than the 23rd day of July, 1877.

RALPH DOCKER, Clerk to the Local Board.
Public Buildings, Smethwick, near Birmingham,
June 11, 1877.

TO GASHOLDER MANUFACTURERS.

THE Smethwick Local Board of Health are prepared to receive TENDERS for the construction of Two TELESCOPIC GASHOLDERS, 85 ft. diameter, with their standards, &c., &c., according to the plans and specifications of F. J. Bramwell, Esq., M.Inst.C.E., which, with the form of tender, may be seen at the Offices of the Local Board Public Buildings, Smethwick, on and after the 20th of June, 1877, between the hours of Ten o'clock a.m. and Four o'clock p.m. Tenders must be sent to the undersigned not later than the 23rd day of July, 1877.

RALPH DOCKER, Clerk to the Local Board.
Public Buildings, Smethwick, near Birmingham,
June 11, 1877.

TO LAMP-PILLAR MANUFACTURERS.

THE Rural Sanitary Authority of the King's Norton Union are desirous of receiving TENDERS for the supply, within a limited period, of 205 LAMP-PILLARS, ready for the fitting on of the lanterns, the pillars to have received one coat of paint, and to be delivered free of charge at Moseley, King's Heath, and Selley Oak, in such number at those places as the Board may direct. Tenders may be forwarded to me not later than on Tuesday, the 26th day of June, 1877, accompanied by drawings of the several designs manufactured, and stating within what period the lamp-pillars can be supplied. The tenders will be opened on Wednesday, the 27th day of June, 1877, at Two o'clock p.m.

By direction,
RALPH DOCKER, Clerk.
Union Buildings, Selley Oak, near Birmingham,
June 13, 1877.

TENDERS FOR GAS COAL.

THE Corporation of Walsall invite TENDERS for the supply of 20,000 Tons of Staveley, Yorkshire, or any other good GAS COAL, to be delivered, during One Year, from the 1st of August next, either at Walsall Railway Station, or by boat at Walsall Old or New Gas-Works. In the latter case it will also have to be unloaded and stacked in the coal-shed, or such other place at the Gas-Works as may be directed. The Coal will have to be delivered at the rate of from 180 to 700 Tons per week, as the Corporation may from time to time require. The weight, if delivered by rail, must be 2532 lbs. to the Ton; if by boat, it must be 22 cwt. to the Ton, boat gauge. Payments monthly.

The Corporation do not bind themselves to accept any tender, and they reserve the right to divide the contract between several firms. Tenders, sealed, and marked outside "Tender for Gas Coal," and stating the price for large Coal, and also for Nuts, are to be sent to the undersigned, on or before Thursday, the 28th of June inst.

SAMUEL WILKINSON, Town-Clerk.
Bridge Street, Walsall, June 6, 1877.

PAMPHLET ON GAS.

COOKING AND HEATING. HINTS ON GAS-BURNERS, &c.

For GAS COMPANIES to distribute to their Gas Consumers.

Specimen Copy by post Threepence, from the Author, MAGNUS OHREN, Gas-Works, Sydenham, S.E.

Just Published, Price 2s. 6d.,

COMMON SENSE FOR GAS USERS,

Being a Catechism of Gas Lighting for Householders, Gas-Fitters, Architects, Engineers, Millowners, &c.

By ROBERT WILSON, C.E.

CROSBY, LOCKWOOD, & CO., 7, STATIONERS HALL COURT, E.C.

SUPPLEMENT TO THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

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LONDON, JUNE 19, 1877.

No. 736.

HOUSE OF COMMONS COMMITTEE.

MONDAY, MAY 14.

(Before Mr. D. R. PLUNKET, Chairman; Mr. FOLJAMBE, Mr. STARKEY,
and Mr. COURTNEY.)

THE GASLIGHT AND COKE COMPANY BILL.

(Continued from p. 960.)

Mr. Horatio Brothers, examined by Mr. MICHAEL.

I am the engineer of the western division of The Gaslight and Coke Company, and also a member of the Institution of Civil Engineers. I have had upwards of 30 years experience in the erection and management of gas-works. At the period of the amalgamation of the Equitable Company with the The Gaslight and Coke Company I was engineer of the former company, whose works were in Lupus Street, Pimlico. At those works we used oxide of iron for purifying our common gas. During the 12 years that I was the engineer of those works I do not remember any nuisance being complained of; in fact, I was complimented by the inspector upon the manner in which the works were conducted, and the freedom from smell. The works were in a densely populated and highly respectable neighbourhood, being situated just at the back of St. George's Square. The amalgamation of the Equitable with The Gaslight and Coke Company took place in 1871, and in 1873 we became subject to the restrictions that were imposed upon the latter company. Then I began to use lime moderately; but directly I began to use it in a larger quantity we had complaints from the surrounding neighbourhood, especially when the wind blew from the east or south-east over St. George's Square. In close, damp weather the complaints were more numerous. I do not believe in the theory of dust being carried from the purifiers, because I never found it so. On a wet day, no doubt, it would arise, and be carried, probably—the wind being in a higher quarter—over a greater distance; but St. George's Square is so very near, and the tops of the houses, I might almost say, abut upon the works. Complaints were made by authorities of the parishes of St. Margaret and St. James, and they sent their medical officer—Dr. Barnard Holt—to view the management of the station, and he made a report to the vestry. From previous experience I felt that the use of lime at Pimlico would result in a complaint of nuisance. Thirty-three years ago I used lime (before oxide was invented) at the Salford Corporation Gas-Works. They used it solely there, and in 1858 the nuisance became so great from the large quantity of gas being made, owing to the increase of the population, that, hearing the oxide purification was in vogue in London, the Gas Committee sent me up to make inquiries, and after those inquiries we came to the conclusion to use oxide instead of lime for the sulphur. I feel that, after all the care I have taken at Pimlico, it is impossible to avoid a nuisance if the use of lime is to be continued. In 1872, upon the amalgamation of the Western Gas Company with The Gaslight and Coke Company, I was appointed engineer at the company's station at Kensal Green, which was in such a dilapidated condition as not to be able to comply with the requirements of the Referees, and some time was allowed in order to reconstruct the works, and to put up better purifying apparatus. I have carried out the instructions of the Referees, and have been generally able to keep down the quantity of sulphur, although occasions have arisen where I have been unable, as there always will be. The Pimlico station is in a very low part of London, abutting on the river, in a very densely populated neighbourhood, inhabited by highly respectable persons. The Kensal Green station is in the country, with a population around it of the labouring class, and the purifiers are a long way remote from the habitations; the smell is, therefore, not very perceptible, because the houses are so far off. Living on the works myself, when the wind is in the direction from the purifiers to my house, I smell it very badly. We have about 6000 yards of refuse lime every year to get rid of, and we are now completely stopped in the disposal of it. I have advertised in all the local papers down the line on the Great Western Railway, and I have offered to put it in barges and trucks free of expense, and yet I cannot sell a single load. I do not see how it is possible to be continued to a very much larger extent, for I have in my place between 10 and 12 feet in depth of refuse lime. I do not know of any other mode of getting rid of the sulphur compounds but by the use of lime. I have never known of an instance where lime has been used as a purifying medium without its creating a nuisance; but where it is on a small scale, of course, the nuisance is not so great as it is on a vast scale, like we have it in London.

Cross-examined by Sir E. BECKETT: I do not propose to get rid of the nuisance of lime altogether, but simply to use it for taking out the carbonic acid. The lime would be innocuous then, and there would be a very small quantity compared with what we now have—I should think somewhere about one-third. It would be of some value upon heavy lands in farming, and I should be better able to sell it or give it away, because it would be free from smell. The difficulty now is that persons will not take it, because of the smell arising from the use of it.

Mr. RICHARDS said the letter of the Referees had produced a painful impression upon the minds of the company's engineers, because it seemed to have reflected upon their conduct, and they were rather anxious to repudiate anything of the sort. They were all present for examination if the committee wished it.

The CHAIRMAN: Do you think it will advance your case much?

Mr. RICHARDS said he did not think it would, although it would satisfy the committee that each one of them had made an honest *bonâ fide* effort to carry out the directions of the Referees to the very best of his power; to effect purification by lime without causing a nuisance and yet had failed to do so. There was no ground for suggesting that they had ever been trying how not to do it.

Sir E. BECKETT said it would not be the business of the Referees to give

directions. The only mistake which the Referees had made, in his opinion, had been in yielding to the companies. It would have been much better to have said to the engineers, "It is not our business to say how the manufacture of gas is to be conducted; if you do not do it in a proper manner we shall judge for ourselves, and give the required certificate accordingly."

Mr. ROUND said that, on the part of the Referees, he did not impute anything to the engineers of the company. They had to deal with the uniformity or the want of uniformity in the system which those gentlemen individually had to carry out, and they never in any way desired either to say, or to wish it to be inferred in the slightest degree, that there was anything derogatory to them or to their individual ability, but to the system as it had been carried out by them, doubtless in obedience to orders.

After some conversation, during the course of which the letter of the Referees, dated April 20, 1877, was again read,

Mr. RICHARDS expressed himself satisfied that there was not any imputation cast upon the engineers.

Mr. George Carless Trewby, examined by Mr. RICHARDS.

I am the engineer at the Beckton station, and also a member of the Institution of Civil Engineers. I have been engaged in the manufacture of gas for a quarter of a century. The Beckton works are by far the largest in the world. The site there has been made up to a very great extent with spent lime, partly derived from the operations on the works, and also from lime brought from other places. During the last twelve months we have covered something like 10 acres. The other stations have no other place to deposit it but Beckton. Taking the average for the last twelve months, the depth has been from 6 to 9 feet, spread over 10 acres. If the present system of lime purification is continued at Beckton, and if we have to find space for the refuse lime, and the gas supply goes on increasing, the quantity to be deposited at Beckton will be upwards of 100,000 cubic yards per annum; and when we extend our buildings we shall have to excavate it, and remove it elsewhere.

Mr. RICHARDS: Will not danger arise from so large a deposit fouling the watercourses?

Witness: Yes; We have had an action already commenced against us for fouling a watercourse. It is almost impossible to prevent percolation.

Have you found the difficulty of getting farmers and other persons to take away the refuse lime?—Yes; there is a very limited demand for it.

In point of fact, the only place where the company can deposit it at present is the Beckton works?—That is so. I have heard the evidence given as to the nuisance created by this lime, and I endorse every word of it. By the old process of peroxide of iron, a certain quantity of lime was used to take out carbonic acid, but no nuisance was caused. I have worked both systems.

Cross-examined by Sir E. BECKETT: The refuse lime has been accumulating ever since the Beckton works were started, five or six years ago. In 1875 the filling in of the lime simply kept pace with the increase of the works, but the amalgamation with the Imperial Company had not then taken place.

Sir E. BECKETT: Did you suggest to anybody in 1875 the expediency of getting rid of this accumulation?

Witness: We were in hopes, if we addressed a proper representation to the Referees upon the matter, that they would give us relief.

Then you complain personally of the action of the Referees, and not of the system? Is that so?—Well, I take the two things combined together.

But is it the two things combined together? You say that you were in hopes, in 1875, that a proper representation to the Referees would give you relief?—In 1875 the question of the accumulation of lime had not presented itself to our mind.

Of course I cannot investigate your mind, but the fact is that the lime was increasing at a known rate, was it not?—Just so.

Well, the lime increasing at a known rate, and you, being before the committee, and discussing the work as an engineer, did not think of asking the committee to set you free from that obligation?—I believe not.

When you talk about the Referees, you knew that the Referees had been in existence before then?—Yes.

Then what it is you are really complaining of now I do not understand?

—As far as I am concerned, I am complaining of the amount of refuse lime that is brought down to my station, and also of the nuisance, because it not only affects my health, but it affects the health of the persons who are bound to live upon the works. On a day like this, from inhaling the sulphuretted hydrogen and the sulphur compounds over the whole area of our works, it causes depression of spirits.

Re-examined by Mr. RICHARDS: The amalgamation with the Imperial Company took place in 1876, and it is since some of these stations have been added to The Gaslight and Coke Company that the evil has become much more conspicuous.

By the COMMITTEE: As things are going on at present, I think our spare ground will be filled up with the spent lime in less than three years.

By Mr. ROUND: The land at Beckton is about 6 or 7 feet below the level of high-water mark, and we have been utilizing this lime hitherto for the purpose of raising the level of our land.

Mr. ROUND: I do not wish to underrate the inconvenience you have alluded to, but could you not go on for the next two or three years and rather benefit your property?

Witness: No, because if we extended our works we should have to excavate into the deposit. We are already doing that, and the nuisance to the men is something more than can be imagined.

Do you mean you are already excavating lime that you have in the last two or three years deposited?—Yes.

And you are not depositing in order to raise your land up to the level of

high-water mark?—We are depositing it because we have no other place to put it in. For no other purpose.

But there must be many parts of your property at Beckton which it would be desirable to raise to a higher level than they are at present, are there not?—No, it is already done.

Dr. Thomas Stevenson, examined by Mr. MICHAEL.

I have been Medical Officer of Health for St. Pancras for nearly nine years. In the autumn of 1875 it was brought to my knowledge, by the inspector of nuisances and others, that there had been complaints going on for some time with regard to the nuisance arising from the gas-works at King's Cross. The complaints were serious, and in the month of December I called on Mr. Chubb, and I went on the same day to the works; I also visited them several times subsequently. I found a great stench arising from the works, and I learnt from Mr. Chubb that it arose from the fact that they were obliged to use lime in the purification of the gas. I was well aware of that fact, so I made myself thoroughly acquainted with the works. I saw the lime purifiers opened, and there was a very powerful odour during the operation. The odour of sulphuretted hydrogen and ammonia was very strong near the purifier, and I could detect sulphuretted hydrogen outside the works, in the neighbouring streets; but upon investigating more I found that the nuisance extended to a very considerable distance—even to Argyle Square, which is 600 yards south of the works, where no sulphuretted hydrogen could be detected. I say that undoubtedly there is something besides, or in addition to, the sulphuretted hydrogen causing the nuisance, for when the nuisance has been at the worst, you could detect, by various means, sulphuretted hydrogen on and about the works; but, after going a certain distance from the works, you could not detect any sulphuretted hydrogen, and then the peculiar odour of this gas lime—this sulphate of calcium—came out. I cannot say that a smell of such a kind is injurious to health, neither can I obtain any distinct evidence of it, but it is a very disgusting, disagreeable smell, and very annoying. A small quantity of sulphuretted hydrogen will produce powerful effects. There are various experiments recorded where, if it exists to the extent of one per cent., death is the result. I have had cases within my own experience where great danger to life has ensued from inhaling sulphuretted hydrogen. That occurs when it is liberated in any way, especially from chemical causes. I asked the authorities of the then Imperial Company to carry out certain steps which I thought would modify, or, in a great measure, abate the nuisance. Those were ventilation of the purifiers before employing them, if possible, by the passage of carbonic acid through them, with the subsequent passage of the air which is drawn through the purifiers, through oxide of iron, or a furnace, in order to get rid of the foul gas from the purifiers; practically the mode, such as has been described and illustrated upon this model. My proposals were not carried out on those works. Plant was put upon the works to do so, but in consequence of what I heard as to the effect of the process at other works, I did not insist upon my proposals being carried out. I went down to Bromley, and saw the effect; there had been great heating of the purifiers, by which they had been materially damaged. I was also shown certain apparatus, which I was told had exploded through carrying out this system of purification, and was told by Mr. Wright, the engineer, that the rubbish arising from carrying out the process was so great that the cure was worse than the disease. I do not think that any such quantity of sulphur as would be left in the gas, after careful oxide of iron purification, would result in injury. I work in a laboratory where gas, purified by the old oxide process, is used. I tested the gas almost continuously during the months of February and March last, and I found, on an average, 38 grains of sulphur per 100 feet. I have not found any injurious effects to my health from the use of such gas. I do not think, if the amount of sulphur does not exceed 40 grains, it would cause any likely amount of injury. I have made a series of experiments, by which I am enabled to give that evidence, the results of some of which have been already given on the previous Bill.

Cross-examined by Sir E. BECKETT: If there is not free ventilation, even 15 grains might cause a considerable amount of damage and discomfort, but I do not think the difference between 15 grains and 35 grains would require any material increase in ventilation, because the sulphur would be so small in effect.

Sir E. BECKETT: Then you think that the company might safely be left to the 40 grains, do you?

Witness: I think that 40 grains would exercise no prejudicial effect.

Then I am afraid this committee must have made a great mistake upon the other Bill?—That is not for me to express an opinion upon.

The COMMITTEE: You do not deny that there is some difference in the inconvenience and the nuisance between 20 grains and 40 grains?

Witness: I have not been able to perceive any appreciable difference in burning the two gases.

That is a question of ventilation, but you will not deny that, under the same conditions as to ventilation, there would be a considerable difference?—I deny that there would be a considerable difference. I found in my experiments about 5 per cent. of the sulphur was converted into sulphuric acid, but the difference between 5 per cent. on the 15 and 30 grains, I think, would not be material.

Do you mean to say, supposing you burnt gas with 15 or 20 grains, under the same conditions that you burnt gas containing 40 grains, that there would be no difference?—There would be a difference, but it would be so small, I think, that the effect upon health and upon the destruction of furniture, and so on, would not be appreciable, and I do not think the difference could be weighed against the nuisance arising from the lime method of purification.

By Mr. ROUND: I did not communicate any of these complaints to the Referees; I have acted for my own Sanitary Committee, and I have nothing to do with the Referees.

TUESDAY, MAY 15.

M. Felix Le Blanc, examined by Mr. RICHARDS.

(Mr. ALBERT sworn as Interpreter.)

I am a Chevalier of the Legion of Honour, Professor of Analytical Chemistry to the Central School of Arts and Manufactures in France, a Member of the Council of the Society for the Encouragement of National Industry, and have been engineer-in-chief for the verification of the gas supplied to the Municipality of Paris since 1863. I know all the conditions arranged in the treaty made between the Municipality of Paris and the Paris Gas Company. Those conditions were drawn up between M. Dumas on the part of the town, and M. Regnault on the part of the company. My duty is to see that those conditions, so far as they relate to the testing and verification of the gas, are obeyed and carried out under Article II. The reports are made 24 times a month, at 11 offices, corresponding to the seven gas-stations in the City of Paris, and I produce the report of one day's experience at all the stations. The Paris Gas Company have not only fulfilled all the obligations imposed upon them by the treaty, but in many instances they went beyond those conditions, by supplying a better gas than they were obliged to do. The following are the requirements as to purity:—"The efficient purity of the gas shall be stated or proved by bands of white paper not starched, which have been previously prepared by dipping the same into a solution of neutral acetate of lead, in distilled

water, containing one of salt per hundred of water. These strips of paper shall remain in a current of gas during the duration of one of the relative trials or tests of the illuminating power—that means to say, one quarter of an hour—and if they shall not get brown the purity is perfect. This test, anyhow, shall be made in conformity with the prescribed instructions of MM. Dumas and Regnault." The paper must not even get yellow; that is the only condition as to purity. I can state, from my own knowledge, that before the treaty was concluded there were continuous complaints, but at the present time those complaints have ceased to be preferred, and for several years none have been made. It is very seldom indeed that the examiner finds any discoloration of the paper, which otherwise would be the subject of a fine. The gas is purified with oxide of iron, which is generally prepared with sulphide of iron and lime; and a current of water and air is carried through. It is well understood that the deposit of tar and ammonia is found in the purifying-boxes; however, no conditions as to that are imposed upon the company. The company have never used lime alone in Paris. I believe that the company find it to be to their interest to employ oxide of iron, because not only the sulphur, but the sulphuretted hydrogen, is entirely absorbed by it, and also because there is economy in it, as the purifying material, when they have been used for some time and get black, are put upon trays. Then there comes the revivifying process, when that iron with the sulphur is oxidized and can be used again.

Mr. RICHARDS: Do you think the use of lime would prove a nuisance in the City of Paris?

Witness: I am not a medical man; but in London, when I went to Beckton, to where the purifying-boxes were open, I found a smell which was very disagreeable. In Paris I found that the purifying material gave off a smell, certainly, but it was more an ammoniacal smell, and not such a foetid smell as in London; and the medical men over there constantly apply to the company to allow invalids, and people who suffer from cough or whooping-cough, to inhale those vapours, but I will not guarantee the efficiency of that. I have never found any smell of sulphur in rooms in which gas is burnt in Paris. I must, however, state that there is a very slight acidity in the products of combustion; there is a small amount of ammonia, but the treaty does not prohibit that. In the combustion there may also be formed a small quantity of sulphurous acid, but so small, indeed, that nobody takes the slightest notice of it, and it never gives rise to any complaints from the consumers. There are only a few libraries in Paris, to which readers are admitted, where gas is burnt in the evening, and the librarians do not make any complaint. If there were any complaints, they would be made to the Prefect of the Seine, who would send them to his engineers. Another remedy is that a suit can be instituted against the gas company. I know the celebrated shop of MM. Christophel, who are silversmiths, and do silvering and gilding. Before the treaty which was entered into between the company and the City of Paris they thought it to their advantage to make their own gas. Their purpose was to have gas entirely free from sulphur, and that gas was made by decomposition of water by charcoal. Since the treaty they have given up making their own gas, but they have never complained either to the company, to the town, or to the engineers. It is quite evident, in case the gas contained sulphur, that it would, the moment they opened the tap, have an effect upon the silvering process. I beg to say, also, that the purpose or object of the commission, by which the treaty resulting from it was made, was that a certain quantity of ammonia should be allowed in the gas.

In the discussion before the treaty was made, was the question of the presence of sulphur compounds, other than sulphuretted hydrogen, discussed at all?—Although nothing appears upon that point in the treaty, still I will tell you what occurred from what I have heard stated by M. Dumas.

Can you tell us of your own knowledge anything which took place with reference to the discussion upon the sulphur compounds?—There is a certain quantity of ammonia which is allowed to exist favourable to the purification of the sulphurous compounds, and I will tell the reason. Sulphide of carbon, for instance, in the presence of ammonia, is much better kept or held in the purifying-boxes. Chemists know that the sulphide of carbon acting upon the ammonia can easily produce sulpho-cyanide of ammonia; therefore this is a system to prevent the sulphide of carbon mixing up with the gas. Sulpho-cyanide has for some time been employed for photography, and the man who buys from the company the old material from the purifying-boxes extracts that sulpho-cyanide of ammonia for sale as a matter of business. After a great number of these purifying processes have taken place, then it is sold to M. Conchatt.

Mr. RICHARDS said a report had been sent by M. Dumas, which he proposed to lay before the committee, and, after a short discussion, it was read, as follows:—

*Institute of France, Academy of Sciences,
Paris, May 11, 1877.*

Mr. President,—Lord Lyons having informed me of the desire of the Government of Her Majesty the Queen to know my opinion upon the gas question, I have the honour to send it to you, and to beg you to communicate the same to the committee charged with the Bill of The Gaslight and Coke Company.

Accept, Mr. President, the assurance of my respectful sentiments,

J. B. DUMAS, the Perpetual Secretary of the Academy.

Opinion of Monsieur J. B. Dumas, late Minister of Agriculture and of Commerce, Great Cross of the Legion of Honour, Perpetual Secretary of the Academy of Sciences, Vice-President of the Superior Council of Public Instruction.

I was one of the Municipal Council of the City of Paris during sixteen years, and I have had the honour to preside over it during more than ten years.

In this capacity I have often had to occupy myself with questions relating to the manufacture of gas for lighting purposes, to the verification of its practical qualities, and to the consequences of its use.

I have been especially called upon to prepare the treaty which has regulated for sixteen years the interests of the Parisian Gas Company and those of the City of Paris, and to determine the obligations to be imposed upon the company, and the means to ensure their exact performance of them.

Before the treaty was interposed the situation was intolerable.

In consequence of errors committed, the exigencies relative to the appreciation of the illuminating power, and of the absence of control relative to its practical purity, it happened—

1. That every day the company were condemned to 1000 francs fine for insufficiency of illuminating power.

2. That every week the Municipal Council received complaints from the consumers, which denounced the gas as having "blackened or darkened plate or brass in the silversmiths shops, or the steel or iron goods, or the plates and dishes, or the crystals in the glass and china shops, and the white lead painting in apartments, as having discoloured or faded the shades of stuffs in the silk shops, as having inconvenienced or made ill the actors or the singers in the *cafés chantants* and the theatres in which the footlights were lighted with gas, the first of these effects being attributable to the sulphuretted hydrogen, and the second to the sulphurous acid produced by its combustion.

In order to end all these disorders, I have asked that a complete verification of the illuminating power of the gas should be effected, and that measures should be instituted in order to ensure its practical purity in a permanent manner.

It is not now the time to explain how these trials, which took more than a year, were conducted and were carried out in a little experimental works for the preparation of the gas, as well as at my laboratory at the Sorbonne, for the verification of its illuminating power and its purity. It will be sufficient to state that the system adopted by the Municipal Administration upon my report having been in operation since the year 1861 did not give rise to any criticism; it notably caused the disappearance of all complaints relative to the insufficiency of the illuminating power, the presence of sulphuretted hydrogen, and of the production of sulphuric acid.

The examiners of the illuminating power only found the gas once, by accident, below its limit; the jewellers and steel and metal dealers, the crystal and crockery merchants, and private individuals having painted panellings in white lead, the magazines of embroidery or of *nouveautés*, the artists of the theatres, never came to complain of the damage or inconvenience which the old gas made them experience.

Therefore it seems certain that, taking simply the practical point of view of the matter, the harmony between the company producing the gas, the authorities which watched over its good quality, and the consumers who used it, seemed to be solidly established; nobody makes complaints.

I leave on one side the economical and financial question, which, however, is full of interest, but which does not touch the sanitary side of the question, nor the control of the fabrication. I restrict myself to state that which concerns this latter aspect of the question.

There were present on the one side the company charged to manufacture the gas, and on the other side the City of Paris, the latter intervening under various titles—

1. As proprietors, possessing the soil in which the company established their canalization.
2. As customers, consuming the necessary gas for the lighting of the streets.
3. As partners, taking part of the profits of the company.
4. As the Municipality, charged to watch, in the public interests, over the strict execution of the clauses of the contract incumbent upon the company.

In order to simplify this situation, and to avoid all interpretations of a nature to be inconvenient to the contracting parties in their respective movements, it seemed to me to be necessary on the one part to leave to the company the most complete liberty for its means of production, and its procedure for purification; on the other part to constitute a sort of tribunal, charged to state legally the purity of the gas which has been distributed for consumption, just as one states the title of moneys put into circulation.

In consequence it was agreed that M. Regnault, representing the company, and I, representing the City of Paris, should establish, in concert, a system of control, and prepare apparatus to realize this system, the company and the city accepting in advance our mutual results.

In the name of the city, I considered it indispensable to guarantee—

1. A very definite illuminating power.
2. The absence of sulphuretted hydrogen.

I only state, as a passing remark, that the procedure which we proposed in order to control the illuminating power is adopted to-day in a very great number of towns in France and abroad, and that there has been constructed at least 157 apparatus of verification for the purpose.

As to the absence of sulphuretted hydrogen, we thought that the inconvenience of its presence having been rendered sensible by its action upon the compounds of lead, it was sufficient to exact that the gas should remain without appreciable action on paper impregnated with a salt of lead during an exposure of a quarter of an hour.

The question was discussed between M. Regnault and myself, in order to know if it was right or not to exact that the gas should be free from ammonia, and that it should not have any alkaline reaction. Our opinion was that the pressure of some traces of ammoniacal gas was not inconvenient at all for the consumer, that it would ensure the disappearance of the sulphide of carbon entirely or nearly so, and that in consequence it avoided the formation of sulphurous acid at the moment when the gas was burning. As to fearing the presence of an excess of ammonia, there was no occasion to trouble about it, its price engaging the company to gather it out.

Thus we were led to establish that the gas supplied by the company should be coal gas endowed with a definite illuminating power, and without action upon the acetate of lead paper. We knew that the gas was alkaline.

For all the rest the company are free to produce their gas just as they think proper, and to purify it in a manner conformed to their interests, or to do it at their convenience, the town reserving to itself only the right of observation, like a partner, in case, by the use of onerous or badly conceived processes, one should happen to bring trouble into its finances, or compromise the profits of the operation. By the wise direction of the company, every remark on that subject, on the part of the engineers of the city, has become useless.

Conformably with these principles, M. Regnault and I have instituted a series of various and prolonged experiments, which are re-quoted in the practical instructions for the use of the examiners charged with the daily verification of the gas delivered to the public.

These practical instructions have been accepted by the two contracting parties, and have been incorporated in Article II. of the treaty before mentioned, page 11 of the edition of 1871, lines 12 to 20 inclusive, and have been annexed to this treaty, in which they will be found on pages 23 and following.

The stipulations relative to the purity and illuminating power of the gas delivered to the public are found in Article II. of the treaty, page 7, edition of 1871.

This article provides that the gas shall be extracted from coal, that it shall be perfectly purified, that its illuminating power shall be that of a burner consuming 105 litres of gas, giving a light equal to that of a Carcel lamp consuming 42 grammes of purified colza oil.

The experiments established by means of this report embraced the production of gas from all varieties of coal, from whatever source the company could obtain them to ensure their service—French, Belgian, English, and German; for the burner, all varieties of burners known.

M. Regnault and I were constantly assisted, during the long and troublesome work, by two distinguished chemists, M. Paul Audouin, engineer of the gas company, and M. Paul Bérard, secretary of the Consulting Committee of Arts and Manufactures attached to the Ministry of Commerce, who were authorized by us to publish the details.

From these numerous and varied experiments, we have deduced two principles on that which concerns the verification of the illuminating power. The first is, that the gas-burner ought to approach as much as possible in form and flame to that of the Carcel lamp taken for a type—conditions which were found realized in a porcelain burner of the Bengel system.

Second, that the photometric apparatus should be so arranged that the examiner would have only the variable point to determine, all others remaining constant in each trial.

The Carcel lamp and the gas burned which have to be compared having been lighted, the examiner assures himself that the lights have the same intensity, being placed at the same distance from the photometric disc. This equality being established and maintained, the gas-meter is placed at zero, while the Carcel lamp, placed upon the plate of the balance, is kept in equilibrium by a weight of 10 grammes. When it has burned 10 grammes of oil this equilibrium is broken, a bell informs the examiner, who stops the pointer, and who has only to read the figure indicated by the meter to ascertain the consumption. He notes how many litres of gas have been burned in order to produce a light equal to that which 10 grammes of purified colza oil supplied, and, therefore, how much it requires to correspond with the consumption of 42 grammes of oil per hour.

In order to ascertain the state of purity of the gas, we have had recourse, as has been already seen, to the employment of a band of unstarched paper dipped in a solution of acetate of lead, formed of one of salt for 100 of distilled water, suspended in a tubulated bell-glass placed upon a tray. The cock which communicates the current of gas to the bell-glass is opened, the gas passes into this bell-glass, and circulates there under a pressure of from 2 to 3 millimetres of water during 14 or 15 minutes—i.e., during the time necessary for an experiment to ascertain the illuminating power. After having passed through the bell-glass the gas is burnt.

If after this period of time the paper band has remained white, the gas is considered exempt from all sulphurous impurity of a nature to be injurious to the public—practically it is considered to be purified gas.

Every contravention concerning the presence of sulphuretted hydrogen is the subject of a *procès verbal* followed by a fine.

When the illuminating power is regularly obtained, the obligations of the company towards the city and the public are regarded as having been satisfied. In a contrary case, and after a certain number of re-occurrences, the company are exposed to the prescribed penalties, which not being any longer excessive, as they were before, would be applied with rigour. But their intervention has not been found to be necessary but once in what concerns the minimum of the illuminating power, and one might have believed that in the long run the verification of the gas was useless, because there were so few contraventions.

It cannot, however, be doubted that this verification is indispensable; it has precisely for consequence the prevention of all relaxation in the important service of the lighting of Paris; it has contributed in the highest degree to maintain the company in the excellent line of conduct which they have adopted from the commencement, and have persevered in hitherto.

During more than ten years as President of the Municipal Council, it was my duty to state officially the results obtained by the application of these measures taken altogether. Since I have ceased to fulfil these duties in 1870, I have been enabled, by official communications, to keep myself informed of everything which is of interest in a service, at the creation of which I had taken so important a part, that it was not possible for me to lose all interest in it. I have, therefore, the right to affirm that the treaty, in the preparation of which my public duties and my special studies had furnished me with the occasion to participate, under various titles, and had the happy fortune to consecrate the liberty of action of the company to supply each year an important contribution to the finances of the city, to guarantee in all points of view the public interest, to increase

the proportions of light placed at the service of the public ways, to decrease the price of gas, and to make disappear all appreciable damage to the consumer.

(Mr. ALBERT verified the copy handed in as being a true translation of the original.)

Cross-examined by Mr. CRIPPS: The paper bands dipped into a lead solution are used for the purpose of ascertaining whether the gas is free both from sulphuretted hydrogen and from ammonia. The only difference between the French and the English systems is that the paper is saturated with moisture in order to absorb more upon the paper, to make the paper more sensitive to it.

Mr. CRIPPS: But all that difference between the English and the French systems is still only directed to the test for sulphuretted hydrogen?

Witness: For all materials which attack or make an impression upon the lead solution.

Have you made any experiments to determine the quantity of sulphur compounds in 100 feet of coal gas in Paris?—No; such an experiment I should consider a weak one.

You know nothing at all of the quantity of sulphur compounds contained in the Paris coal?—I do not study that question; my duties are simply to see that the conditions stipulated for in the treaty are strictly observed.

So long as the conditions of that treaty are performed, you have nothing further to do with the matter at all?—I have other duties to perform, certainly, but nothing more as to the purifying process.

The CHAIRMAN: I am certainly rather fresh in chemical combinations, and I am not sure whether I follow the evidence. Am I right in thinking that in Paris they are allowed a certain amount of ammonia in their gas, with a view to neutralizing the effect of the sulphur compounds—is that so?

Mr. MICHAEL: What he absolutely said was this: We do not so much care about taking out the whole of the ammonia, because, retaining a small amount of ammonia in the manufacturing process would not prevent the fixture of a certain quantity of sulphide of carbon in the process of purification. (To witness:) Is there any limit to the ammonia allowed in the gas in Paris?

Witness: That is not expressed in the treaty, but I can state that I have discovered, in my examinations, it was about the tenth part of a milligramme per litre, which is the same thing as a decigramme to a cubic metre; there are 1000 litres in a cubic metre.

The CHAIRMAN: That is 5 grains in 100 cubic feet?

Mr. KEATES: About 4½ grains.

Mr. MICHAEL: One grain and a half in 35 cubic feet.

The CHAIRMAN: All you are allowed in London is 1½ grain.

Mr. RICHARDS: At the present moment it is 2½ grains.

The CHAIRMAN: Then it is nearly twice as much in Paris.

Mr. RICHARDS: If only half the quantity of ammonia which is in the Paris gas were to be allowed in that gas, would it have any effect upon the sulphur compounds?

Witness: My own opinion, and also that of M. Dumas, is, that the presence of ammonia has an effect, which is to retain the sulphur compounds, or, perhaps, the other sulphurous compounds, or matters not well known. We are not under any fear that the company would give a supply of gas so much impregnated with ammonia, because it is a source of profit to them to retain, or to separate as much as possible, the ammonia, which is a source of profit to them.

By the COMMITTEE: There are two things to be considered—first of all, whether the ammonia should be in sufficient quantities to prevent the acidity of the gas before it is lighted. When the lighting takes place, then the ammonia itself is decomposed, and, even if there could result from it, a trace of nitric acid; and for this reason it would be inconvenient to increase the quantity of ammonia.

Mr. MICHAEL: The witness has not stated whether the presence of ammonia has any influence in preventing any of the bad influences when sulphur is present during the combustion.

The CHAIRMAN: I will put the question in this way. It has been proved to us, or we have had evidence, that in the combustion of the London gas, the sulphur compounds produce sulphuric acid, and this sulphuric acid has an injurious effect upon furniture, gilding, and the binding of books. Supposing that is so, do you think that the presence of the amount of ammonia allowed in the Paris gas would prevent that, or neutralize it in any way?

Witness: No; the ammonia disappears in the combustion, and cannot afterwards give any alkaline produce. The presence of ammonia has been considered useful in the passage of gas through the purifiers to retain the sulphurous compounds, which otherwise would escape. I think that the English chemists who are interested in this question have occupied their minds a great deal with the sulphuric acid question consequent upon combustion. I think there is something very much more pernicious, or hurtful, or injurious, and that is the presence of a very small quantity of sulphuretted hydrogen in the gas; and this is the reason why we keep strictly to an absolute purifying process.

Mr. CRIPPS: I asked the witness whether he had made any experiments by which he could determine how many grains of sulphur compounds there would be in the Paris coal in 100 feet of gas. He said that he had not made any experiments, but I am told that I did not make it quite clear; and I want to know whether he knows that matter from his own experiments or from any other source?

Mr. MICHAEL: We are going to call Mr. Ellissen.

The CHAIRMAN: In the report, he refers to the stipulation in the English private Act forbidding more than 20 grains, so that he is conscious of the thing.

Mr. MICHAEL: When the gas is perfectly free by purification from sulphuretted hydrogen, do you attach any importance to the sulphur compounds, other than sulphuretted hydrogen, which may be in the gas when it is burnt?

Witness: It is evident, if there are notable quantities of these compounds in it, that the combustion, giving sulphurous acid—which oxidizes itself, to give afterwards sulphuric acid—must have some inconveniences; and on that subject there would be complaints in the shops where there are coloured stuffs, which would be affected by the sulphuric acid; and those complaints have not been made. I must observe, however, that I have not studied the London gas, nor the coal from which it is made. I know the French procedure of making gas, and I come to explain and to justify that which is done in Paris.

By the COMMITTEE: The Paris Gas Company buy coal of very different kinds. There is in connexion with the largest gas-works in Paris an experimental work where every quality of coal is examined, and also the products therefrom, and the different kinds of purification. The company know beforehand the kind of gas that will result, and, therefore, they care as little as possible to employ pyrites coal, which produces those sulphurous compounds.

As a matter of fact, the coal which is used for the production of this Paris gas is wholly free from the ingredient which makes the sulphurous compounds?—That would be impossible. I am not admitted to the management of the Parisian Company; but the control of what is supplied by them is in my hands, and as long as I see that the conditions of the

treaty are obeyed, then the manufacture of the gas, and the coal, or any ingredient, does not concern me at all.

You have said that there is an experimental work where they try the coal before they use it, in order to ascertain whether it is the kind of coal which would produce much sulphur. Can you suggest any reason why, after so trying them, they should select the coal which would produce the least sulphur?—Their interest is that the purification process should not be made too difficult.

Is the check upon the company using a very sulphurous coal that they would apprehend complaints being made of the sulphurous compound after it had been supplied to the consumers?—This consideration would be rather too limited. In the purchase of coal and other materials the company have different points in view.

What are those points of view?—The nature of the manufacture, the illuminating power of the gas, the accessory produce, the quality of the coke—in fact, everything which makes the manufacture advantageous with the materials given for it. However, of all this I am not a judge; but the engineers of the company are, who pronounce thereon.

M. Albert Ellissen, examined by Mr. MICHAEL.

I am a Chevalier of the Legion of Honour, and a chemical engineer. I was formerly engineer of the Paris Gaslight Company, and also chief of the experimental works, which were erected in the ordinary works at Villette, to ascertain the value of the coals, and to make certain experiments in the processes of the manufacture of gas. I am at present practising in Paris independently as a consulting gas engineer. I am also a director of the Madrid and some other gas companies. I was the chief engineer of the experimental works for about 10 years, and quitted the service of the Paris Gaslight Company in 1871. I am thoroughly well acquainted with the theory and practice of gas-making, as performed both in France and England, and also with the mode of purification adopted in both countries. I am also well acquainted with the treaty which was entered into between the City of Paris and the Paris Gas Company, referred to at length by the last witness. There is no other test adopted in Paris as to the other sulphur compounds in the gas after it is free from sulphuretted hydrogen.

Mr. MICHAEL: Have you yourself made any tests as to the quantity of sulphur remaining in the Paris gas after purification from sulphuretted hydrogen had been carried to its full extent?

Witness: I made some experiments in 1864. I was asked by the English companies to come over and make some experiments on the London gas, and when I then back to Paris I made some experiments, not on the Paris gas, but on a special gas at the experimental works. What I intended to do was, not to have the absolute quantity of sulphur, but only to see how the several products would act on the sulphur; so that it was not to make a test of the Paris gas, but only to make a test of a special gas made at these experimental works. The coals employed by the Paris Company are of all sorts—English, French, German, and Belgian. It is certain that Belgian coals are much more free from pyrites than the general English coal. Before the war, the Paris Gas Company used a great quantity of English coal—sometimes one-half—in their works. They have still contracts for English coals, and I think that they have now is for Pelaw Main and other coals which are used for gas manufacture in England.

Mr. MICHAEL: In the experimental works was it a point with you to ascertain specially the freedom from sulphur in the gas?

Witness: That was not at all my occupation, and the Paris Gas Company never did make experiments on this point. The only thing done at the experimental works was to know the value of the coal—which is one of the great points—to see what was the production of gas and coke, and then to see if the Paris gas corresponded to the products obtained.

As far as you know in Paris, has there ever been any question except freedom from sulphuretted hydrogen in the gas?—No; there has never been any other question.

Has there ever been any trouble from the presence of sulphur compounds in the gas, after the gas has been purified from sulphuretted hydrogen?—I never heard of any trouble.

Supposing that any bad effects had resulted from any sulphur compounds left in the gas after the purification from sulphuretted hydrogen, would you have been likely, as the engineer of the gas company, at once to have heard of such complaints?—The directors of the company would have sent to the experimental works to make experiments about it; but no such experiments were made.

Have you ever yourself seen any bad effect resulting from the use of the Paris gas, owing to sulphur compounds other than sulphuretted hydrogen?—I have never seen any effects. I know all the places in Paris, and I never heard of any bad effects.

Examination continued: The quantity of gas used in the Paris shops is so immense, and also where the pictures are, and the Opera House, and so on, that there would be a complaint if there were any compounds from sulphuric or sulphurous acid deposited. In the Louvre they burn something like 70,000 cubic mètres in a night, and Beaumarchais about the same quantity. There is no test at all in Madrid, nor, as far as I know, in any town on the Continent, except the one that is in use at Paris, for sulphuretted hydrogen. I know all the contracts made between the towns and the companies, and, excepting England, there is not one stipulation about sulphur compounds other than sulphuretted hydrogen. In Madrid they use a great part of English coals; in Italy they use English coals—there are sometimes stipulations made about that—and the last treaty of Bordeaux, made this year, does not contain any stipulation of that sort. Oxide of iron is the only thing which has been employed in Paris for some 20 years to get rid of sulphuretted hydrogen. Lime was previously used to take out all the sulphur of the gas; but since oxide of iron has been known in the manufacture of gas, all the gas-works that I am aware of use only oxide of iron. I have seen the works at Pimlico, at Shoreditch, and at Beckton, and I am sure they would not in Paris allow working lime on that scale; it would immediately be stopped by the Prefect of Police. I have here some tables of experiments I made with respect to the quantity of sulphur in gas.

The following tables were delivered in:—

Hornu (Belgium) Coal, containing 15·05 lbs. of Sulphur per Ton distilled at a Low Temperature.

Length of Time of Distillation.	Yield of Gas per Ton of Coal.	Rate at which the Gas was consumed.	Sulphur in 100 Feet.
6 hours. . .	8,610 feet. . .	1·010 feet. . .	6·07 grains.
6 " " " "	8,610 " " " "	1·010 " " " "	6·28 " "
6 " " " "	8,300 " " " "	9·734 " " " "	6·29 " "
6 " " " "	8,300 " " " "	0·734 " " " "	6·54 " "
7 " " " "	7,800 " " " "	0·819 " " " "	5·91 " "
7 " " " "	7,800 " " " "	0·819 " " " "	6·10 " "
7 " " " "	7,200 " " " "	0·833 " " " "	7·65 " "
7 " " " "	7,200 " " " "	1·416 " " " "	2·762 " "
7 " " " "	7,820 " " " "	0·988 " " " "	5·567 " "
7 " " " "	8,190 " " " "	0·865 " " " "	6·247 " "
7 " " " "	7,920 " " " "	0·812 " " " "	4·675 " "

Denain (French) Coal, containing 31·10 lbs. of Sulphur per Ton, distilled at a Low Temperature.

Length of Time of Distillation.	Yield of Gas per Ton of Coal.	Rate at which the Gas was consumed.	Sulphur in 100 Feet.
7 hours. . .	8,610 feet. . .	0·688 feet. . .	5·227 grains.
7 " " " "	8,610 " " " "	0·589 " " " "	4·037 " "
6 " " " "	8,290 " " " "	0·861 " " " "	1·742 " "
6 " " " "	8,030 " " " "	0·593 " " " "	2·720 " "

Same Coal at a High Temperature.

Length of Time of Distillation.	Yield of Gas per Ton of Coal.	Rate at which the Gas was consumed.	Sulphur in 100 Feet.
4 hours. . .	9,770 feet. . .	1·329 feet. . .	1·360 grains.
4 " " " "	9,770 " " " "	1·589 " " " "	1·232 " "
4 " " " "	9,850 " " " "	0·727 " " " "	5·525 " "
4 " " " "	" " " "	0·882 " " " "	6·332 " "
4 " " " "	10,410 " " " "	0·893 " " " "	7·480 " "
4 " " " "	" " " "	0·575 " " " "	4·420 " "

Escouffiaux (French) Coal, containing 18·80 lbs. of Sulphur per Ton, distilled for Four Hours at a High Temperature.

Length of Time of Distillation.	Yield of Gas per Ton of Coal.	Rate at which the Gas was consumed.	Sulphur in 100 Feet.
11,320 feet. {	3,390 feet 1st hour. . .	Products lost.	
	1,624 " 2nd " " "	12·937 grains.	
	2,082 " 3rd " " "	11·021 " "	
	3,072 " 4th " " "	13·068 " "	

Average 12·342 grains.

Length of Time of Distillation.	Yield of Gas per Ton of Coal.	Rate at which the Gas was consumed.	Sulphur in 100 Feet.
11,270 feet. {	2,360 feet 1st hour. . .	7·362 grains.	
	3,001 " 2nd " " "	5,968 " "	
	3,001 " 3rd " " "	6·229 " "	
	3,425 " 4th " " "	5·881 " "	

Average 6·335 grains.

Length of Time of Distillation.	Yield of Gas per Ton of Coal.	Rate at which the Gas was consumed.	Sulphur in 100 Feet.
11,550 feet. {	2,076 feet 1st hour and 45 min.	7·666 grains.	
	1,907 " 2nd " " "	53 " "	6·273 " "

Average 6·969 grains.

Mr. MICHAEL: Will you explain to the committee what was the test you made use of with respect to sulphur?

Witness: I made experiments in London, to see what was the real quantity of sulphur in the gas at that time, and to see if there was a practical way to take the sulphur out, or to reduce it. I tried it in a laboratory by all the tests that are used at this moment, and I did not find that there was any practical way to take the sulphur out. What was proposed at that time was lime, as it is now, but I did not think that lime could be used on a large scale in a city like London. The other process, I think, was that of Mr. Bowditch, who seeks to heat the gas to get out the sulphur compounds which are not sulphuretted hydrogen, and afterwards to take the sulphuretted hydrogen out, but I do not think it is possible to do that on a large scale. It is quite impossible, in manufacturing gas, to raise it to a regular heat without destroying the illuminating power.

Is there anything whatever done in the process of the manufactures of gas in London that would make a larger quantity of sulphur compounds in the gas, other than sulphuretted hydrogen, as differing from the mode adopted in Paris?—I think just the contrary. When I was in London, in 1864, they were heating at a much lower temperature than we were in Paris; and the experiments show that, if you produce gas at a higher temperature, you have more sulphur in the gas than if you produce it at a lower temperature; so that I think all the conditions of London ought to produce less sulphur than if we distilled the same coal in Paris.

Owing to greater heat employed in the distilling process in Paris, there would be likely to be, all things being equal, a larger amount of sulphur compounds there?—I think so. It is not only the question of ammonia; but there never was any test made in Paris about the effect of ammonia kept in a sufficient proportion in gas.

Cross-examined by Mr. CRIPPS: The Paris Company are always increasing the consumption of gas in Paris, and they do as much as they can to make the most perfect gas, even if it is not asked for by the Municipality.

Mr. CRIPPS: You know that the rule here is the same as in Paris, that of entirely prohibiting the presence of any sulphuretted hydrogen in the gas; but in London, over and above that, we do not allow more than a certain quantity of the sulphur compounds to be present in the gas when it is burnt?

Witness: Yes.

Your treaty in Paris has been kept faithfully by the companies, has it not?—Yes, it has. I think during the 17 years which it has been in work there have only been three cases of action against the company for not having purified their gas sufficiently.

With reference to the same question, you stated that the coals used for the manufacture of gas in Paris are more free from sulphur than the English coals?—I did not properly say what I meant to say. There are different sorts of coal used in Paris, which are bought simply for the price; the company do not at all care about the sulphur in the coals when they buy them. Of course, they would not buy coals containing a great deal of pyrites, because the purification from the sulphuretted hydrogen would be more difficult; and if they could have pure coal, of course they would buy it. The French coals they use generally come from the Pas de Calais; they do not use much Denain, and not much Belgian coal now, because they use a great quantity of English coal and German coal, which they get from Ruhr, near Dusseldorf, and partly Sahr coal. The absolute quantity of sulphur in those coals is about the same, but the way the sulphur is contained is different. In the English coals there are more pyrites than in the French coals, and these Sahr coals have more pyrites still than the English coals; but those are not tested in an experimental way by the company. It is only a sort of science that we make a study of in the company; but when we buy coal, we do not test for sulphur at all.

Though you do not test when you buy the coal, have you not performed experiments and tested to find the quantity of sulphur in 100 cubic feet of gas from French coal?—Not generally. I only once made an experiment in Paris, and that was in 1864, and was done for a special purpose.

The late Mr. Barlow, of London, was associated with you, was he not?—He asked the Paris Company for an engineer or director of the Paris Company, and I was asked to come over to make these experiments in London, and a special report to Mr. Barlow, and Mr. Barlow made afterwards a report to the company. I found that the Hornu coal, which was used at that time in Paris, gave about 6 grains in 100 feet. It was a test made by Dr. Letheby's apparatus, but the test has been changed, and there is now a test in London that gives 40 per cent. more than the Letheby test, so that if these tests had been made by the new test, I suppose I should have found 40 per cent. more than I did then, which would have been 10 grains.

How long is it since you have taken to mix English coal for gas-making at Paris with your own coal?—It is a very long time ago. I know that

when I was here in 1864 I made a contract myself with Mr. Elliot for a great quantity of English coal; and it was in use at that time, so I do not know when it began.

Can you tell us about what proportion of English coal is used to French coal now?—I am no longer engineer of the Paris Gas Company, therefore I do not know what are the coals they buy and in what proportion they buy them. I know they use different coals, but I do not know at this moment the proportion. They are using a great quantity of German coal at present, because it is very cheap.

Cross-examination continued: Another French coal I experimented upon was the Densin coal, and the quantity of sulphur compounds contained in that coal was less than 5 grains, I think, with Dr. Letheby's apparatus. I do not know how it is now, but with that apparatus you got very irregular tests.

Mr. CRIPPS: Are you able, at the present time, to give us any information as to the quantity of grains of sulphur in 100 feet of gas made from French coal?

Witness: Nobody makes experiments at Paris about that; I do not think there is even an apparatus for testing it. I could do it by comparison, as we use about the same coal that you do, and we purify with oxide of iron; I think that we must have about the same quantity as you have.

I suppose, during the war, you did not get any German coal at all?—No; we have only had this German coal since the war.

Your shops in Paris are very much more open, are they not, and better ventilated, than ours?—Some shops are well ventilated, and others are very badly ventilated. I think the new shops in the Louvre are very badly ventilated.

The COMMITTEE: Is the result of your evidence that, supposing the Paris gas was tested for the sulphurous compounds in the same way in all respects as the London gas is tested, you have no reason to suppose that a smaller amount of sulphurous compound would be found in the Paris gas than in the London.

Witness: I think that if you use Belgian and French coals in certain proportions, you would have less sulphur than in the English coals, but as there is a mixture, perhaps we should find 15 grains. I could not say at all what would be the quantity, but I think it ought to be something between the results which I found with these French coals and the results of the English coals. Our gas is manufactured at a much higher heat, and, therefore, there would be very much difference, but it is difficult to say the exact quantity.

You could not, in fact, make a sufficiently exact comparison in order to form an opinion?—I do not think so; we do not find it at Paris of any interest to get these proportions. The quantity of sulphurous products depends not only upon the quantity of sulphur in the gas, but also upon the quantity of gas burnt in a room; and, of course, in Paris we burn a much greater quantity of gas in the same space, for pictures, and things like that, than is generally done in London. At the Paris Opera, if there is a ball there, they burn in the night 12,000 cubic metres—that is more than 400,000 cubic feet—of gas; and if there was a great deal less, even half the sulphur in the London gas, they would have found that with the pictures there it would be a very great danger to have such a great quantity of gas burnt, but that was never so. There was no injury at all found in any place in Paris, in the theatres and in these great shops where they burn an immense quantity of gas, so that the Municipality have never asked us to test even for the quantity of sulphur.

Do you attribute the difference mainly to the difference of the coal?—I think, as a theory, it ought to be that if you have more pyrites in the coal, you have more sulphur compounds which are taken out of the pyrites.

Dr. Charles Meymott Tidy, examined by Mr. MICHAEL.

I am a Bachelor of Medicine, a Fellow of the Chemical Society, Professor of Chemistry and Medical Jurisprudence and Public Health at the London Hospital, and Medical Officer of Health for Islington. I was for many years the colleague, and am now the successor, of the late Dr. Letheby, in the chair of chemistry at the London Hospital. I have paid considerable attention to the gas question, and am scientifically acquainted with the manufacture and supply of gas. I have considered this matter, not only chemically, but from a medical point of view. I know of the present regulations in force as to the sulphur compounds in gas, and I certainly think that there is no need for such restriction as 15 or 20 grains per 100 cubic feet. So far as free sulphuric acid is concerned, if there is any produced, by the combustion of gas, it is in the very smallest possible quantity—infinitesimal, I may say. I am convinced of this, that, if the sulphur present in gas was oxidized to sulphuric acid, the amount of damage that would be produced would be so enormous that there could be no doubt whatever as to its presence.

Mr. MICHAEL: Going from sulphuric acid to sulphurous acid, is there any such amount of that acid, or would there be any such amount of sulphurous acid formed, if the maximum were increased, say, to an average of 33 grains—which we understand to be the average, when oxide of iron is used as the purifier—would 33 grains, or even up to 40, cause such a formation of sulphurous acid as would be injurious to property?

Witness: I do not think it would.

I think you have samples of books and various materials in the very first inquiry which was instituted at the instance of the Athenæum Club?—Yes, I have [producing the same]; these were the original samples upon which all this inquiry was instituted. That was, I believe, the original book upon which the whole of this sulphur question arose [handing a book to the chairman], and here I have samples of the covers of books at the Athenæum which are supposed to have been injured by the sulphuric acid that was formed by the gas. I have a great many samples.

I will not trouble you to go over the whole of the samples; but do any of them furnish evidence of sulphuric acid being the agent of destruction in any individual case?—I think not; there is quite sufficient cause to account for the action which has taken place from the carbonic acid produced, and the large amount of heat evolved as the result of the combustion of gas.

Do you agree with Dr. Odling, that the disagreeable effect complained of in the burning of gas proceeds partly from the carbon products, and also from the dryness and heat of air produced by the combustion of the gas?—Yes; I think so. I can honestly say that I have done my best to find free sulphuric acid produced as the result of the combustion in a somewhat large number of gaslights in my own dining-room, and I have failed.

I think your process at the present time for detecting sulphur is rather better than that established by the late Dr. Letheby?—Yes. I would say, with respect to the history of the sulphur test—it is right I should refer to it, as it has been already mentioned, and I know something of the history of it—when that sulphur test was originally suggested by Dr. Letheby, he used large cylinders. Somewhere about the year 1860—it might have been 1859, but I believe it was 1860—those large cylinders were abandoned, because Dr. Letheby found that by the use of small cylinders he obtained a larger quantity of sulphur. It certainly was not because he obtained a smaller quantity of sulphur.

Tell me the quantity; if it were 20 grains produced by a large cylinder, what would that equal if a small cylinder were employed?—I am speaking of the cylinders of Dr. Letheby. I can scarcely give the actual propor-

tions of those two. But with the cylinder used by the Gas Referees, which is a very much smaller one, I have made some very careful experiments, and I find that the difference is as near as possible 6 grains between Dr. Letheby's small cylinder, and the apparatus now used by the Gas Referees.

That is to say, that the apparatus which was competent to discover 20 grains, would, if now employed, discover 26 grains?—Yes; as nearly as possible.

Do you believe that there are any sulphur compounds evolved in the combustion of gas which are injurious to health?—I mean after the purification by oxide of iron, even up to a maximum of 40 grains per 100 feet?—I am strongly of opinion that sulphurous acid is not injurious to health. I may say it is a matter upon which I have had occasion to make a great many experiments, and though, in the first instance, in breathing sulphurous acid there is a slight irritation produced as the result, I quite admit that directly that irritation wears away, the action of sulphurous acid is somewhat antiseptic rather than otherwise. I am quite convinced, as the result of large numbers of experiments, that sulphurous acid is not a gas which, in moderate quantity, is injurious to health.

What would you put as the quantity which would have been necessary, before even this sensation which you have described would be produced?—I do not know. I should scarcely like to fix the exact quantity. I have not a sufficiently accurate account of that, but it is nothing like the amount produced by any ordinary amount of sulphur in the gas in an ordinary room.

I will put to you an average of 33, and a maximum of 40. Would that produce it?—Oh dear, no.

Do you know, to put it generally, any results which could occur either to persons or to property, of a disadvantageous kind, by the burning of gas with 40 grains of sulphur contained in it?—I do not. I think it is right I should say, as had been said before by a witness, that if gas was offered with a small amount of sulphur at 8s. 8d., and with 40 grains at 3s. 6d., I should choose the 3s. 8d. gas; but, at the same time, having said that, I should say it with one proviso, and that is, that I did not live in the immediate neighbourhood of the gas-works where that sulphur was removed.

I am not putting it to you as a question of expense, neither do we present it as a question of expense to the committee. I am putting it to you as a question absolutely whether you know or believe that any injurious effect could be produced, by the burning of that gas, either upon health or property?—No, I do not.

Having devoted attention to the matter, do you agree with the other witnesses, that where oxide of iron is employed at the works, and a small quantity of lime is used to take out the carbonic acid, the maximum would be 40 grains, and the average might be taken as 33 grains of sulphur in 100 cubic feet?—It is somewhere from 33 to 35.

Examination continued: I do not know any other mode which can be adopted, if the sulphur compounds, other than sulphuretted hydrogen, are to be taken out, than the adoption of lime as the purifier; and I do not believe that it can be so employed as not to create a nuisance. Sulphuretted hydrogen, even in small quantities, cannot be inhaled without producing bad effects upon health. I can only say that, in the course of my lectures on toxicology at the hospital—this was before the Vivisection Act came into force—I was always accustomed to show the effects of an atmosphere containing one per cent. of sulphuretted hydrogen by putting a sparrow into it, and the sparrow dropped down dead immediately. I showed it at one part in a hundred; but I could have reduced it very much indeed. There have been a large series of experiments made upon the action of sulphuretted hydrogen; the earlier experiments were made by Parron de Chatillet, then Barker, and then Dr. Letheby; and I believe they all agreed very nearly in one fact, that small birds died after a time when there was one part of sulphuretted hydrogen in, according to Parron de Chatillet, 1500 of air; according to Barker, 1800 of air; and according to Dr. Letheby, 2000—that one part in 2000 would be fatal to birds; and then, when we come to dogs, it has been found that one part in 200 will destroy the life of a dog.

Mr. MICHAEL: Putting it not as a matter of destroying life, but as to injurious effects upon health, do you believe that a comparatively small quantity of sulphuretted hydrogen in atmospheric air, employed as the ordinary medium of breathing, will produce injurious effects to a person in an ordinary state of health?—Most assuredly.

Such an amount as would be likely to arise after the process of emptying the purifiers?—I should think so, most assuredly.

Have you seen instances of injury to health from sulphuretted hydrogen?—I have, in the case of sewer gases, very frequently.

Is there any particular difference between the sulphuretted hydrogen evolved in a sewer or from decomposing organic matter, and the sulphuretted hydrogen given off from the opening of the lime purifiers?—No; I am convinced of this, that the active agent in the case of sewers is sulphuretted hydrogen, and I think that is agreed on all hands.

Generally, do you consider—according to the evidence we have had before us, it is inevitable that some amount of nuisance must be created by the use of lime as a purifier—there is any corresponding advantage in the abstraction of the 10 or 15 grains of sulphur which the lime would take out of the gas?—No; my own feeling in the matter is, that I should be very glad to have no sulphur at all, but the objections arising from the process of the removal of the sulphur seem to me to be infinitely greater than any harm it can possibly do by remaining in the gas. As a matter of fact, putting it in another way, the difference between 20 and 35 grains of sulphur in the gas really amounts to this: Say the difference between 20 and 35 is 15 grains, and say there are two burners in a room, burning three cubic feet each an hour for four hours—that would be 24 feet. Every sulphur match has in it about one grain of sulphur, and the whole discussion between 20 and 35 grains is really as to whether three sulphur matches may be lighted during the evening.

The COMMITTEE: Do you mean to say that the ignition of three sulphur matches in a room would produce as much sulphuric acid eventually as the combustion of the amount of gas you have mentioned?

Witness: Yes; taking the actual facts. It is not an opinion in any way. But even that is not an accurate comparison, because in the case of gas there is some ammonia present, which neutralizes any fumes that are produced, whilst in the case of sulphur matches there is no ammonia present; that is the actual fact of the case.

We did not hear from the French witness that the ammonia neutralized the sulphurous compounds after combustion, but it was only before combustion that it was held in suspense, as it were. On the contrary, the witness said positively it would not have any effect after combustion. The question you were asked was this: Do you mean to say that burning an ordinary sulphur match, or four of them, would produce as much of the injurious sulphurous compounds as the burning of two gas lights?—Yes. I have made a large number of experiments as to the amount of sulphur on those matches, and I can say that as a rule it is over one grain, but ordinarily one grain may be taken as a very low average.

Can you say that on striking a lucifer match the fumes it gives off contain a grain of sulphur, which would be spread through the room in the same way as the sulphurous compounds come from gas?—Yes;

wherever sulphur is found, it is no matter whether it is in combination or not, the facts are the same.

Mr. MICHAEL: The rule is, in a sulphuric acid combination, or in any other combination, that when sulphur combines with oxygen, it will combine in definite proportions, whether you have it in the solid form, or in the vapour of gas?

Witness: Yes.

You have given a homely illustration. If we could collect the products of combustion in a bell-glass we should have precisely the same, whether four matches were burnt, or we had the same quantity in gas; and therefore one thing would be that you burn the four matches altogether, and in the other case you have four hours during which the whole quantity is diffused?—Yes.

Is there any other difference?—No.

Looking at the triviality of such a quantity, and the possible effects of it, is it worth while to run the risk of all this complicated process, and the nuisance which is almost inevitable from its use, to get rid of such a thing?—I should prefer not to have four sulphur matches lighted; but, knowing the injury that results from the process of taking away the sulphur from gas, I think it is infinitely worse than the presence of the sulphur.

You know of no other means, neither has any chemist suggested any other means, which practically are effective, without the use of lime, for getting rid of the sulphur compounds?—I do not know of any.

Cross-examined by Mr. O'HARA: I have not seen the process of purification in operation at the works, because the purifiers have been shut on my visits to the works. I am not a practical gas-maker, and what I say is theoretical; but, of course, it is regarding the matter from a purely scientific point of view. I say that in a sulphur match there is, on an average, one grain of sulphur; and when you burn that match, the sulphur becomes sulphurous acid as the result of burning it. The amount of sulphurous acid produced is actually fixed and definite.

Mr. O'HARA: Are you referring to some antiquated cast-off kind of match?

Witness: I am referring to a sulphur match. I am not saying whether it is old or new. I am not referring to Messrs. Bryant and May's matches, because they use paraffin.

Did you ever weigh the sulphur on one of these old matches?—Yes; I have, upon more than one occasion, very accurately weighed the amount of sulphur. It became a great question once as to how far that sulphur could be kept down, and upon that occasion I weighed the wood very carefully. It was then dipped in sulphur, and I took the weight after, in order to determine the amount of sulphur present.

You said the ammonia in the gas neutralizes a certain quantity of sulphur in the gas?—It is not the ammonia in the gas that neutralizes it, but there is ammonia in the air neutralizing it.

Then with the two ammonias combined?—I cannot say at all.

Can you go anywhere near it?—No; I think that is a matter which varies so much that it would be impossible to give you an opinion.

You agree with Mr. Vernon Harcourt, that if you could get gas at 8s. 6d. per 1000, in which there was an increase of sulphur compounds, and if you could get gas for 8s. 8d. without the sulphur compounds, you would prefer to pay the 8s. 8d.?—I should.

Let me take you from a question of chemistry to a question of honesty. Supposing you agreed to give a man gas at 8s. 8d., free from sulphur compounds, and it cost you 2d. to purify it, and then you proposed to give him gas with sulphur compounds, and not alter his price—would you think that fair?—No. I think that this question of the purification of gas ought not to be a money question. If I could see my way to suggest that the gas company should keep their sulphur down to 10 grains, even if it cost them an enormous sum, I do not think that I would venture to give evidence here to-day upon this subject. I feel very strongly that, if the sulphur can be removed, it is not a question of expense at all that ought to influence it; and I will even go further on your side by stating that I do not quite advocate making the sulphur an open question.

Supposing—we will assume a more violent supposition—supposing this committee were to relax the test for the impurity of sulphur, would you think that it would be fair that they should diminish the price as well?—That really is a question I must not enter into; I do not know the question of price. Regarding the consumer on the one hand, and the manufacturer on the other, I think that the limit of sulphur—it is only my opinion, of course—might be fixed at 35 grains, and I hold that view very strongly. I also hope that even that amount will not be permanent, because I trust that as science progresses means will be shown by which the sulphur can be removed. I should be very glad to have no sulphur in the gas at all; but, as science is at present, I feel that Parliament might very fairly, in the interests of the public, and in the interests of the gas companies, reduce that sulphur to 35 grains.

But, beyond that, you think it is very dangerous?—No; I did not say it was very dangerous. I said I desired to reduce any impurity—and I admit sulphur to be an impurity—to such a quantity as that it should be removed without causing in any way a nuisance to the public.

The COMMITTEE: Which do you mean, an average of 35 grains, or a maximum?

Witness: I mean that a matter of that kind should be taken on an average of three days—that if the sulphur was more than 35 grains on an average of three days, the gas company ought to have to pay for that sulphur being in.

Mr. O'HARA: The present penalties (I do not know whether you are aware of this) are only levied on the average of three days?

Witness: I believe that is the case, and I think that is very fair. Of course, you are always obliged to trust a certain amount in an average of three days—that is to say, even taking 20 grains, they may have 40 on one day, and none the next, and, therefore, your average of two days would still be 20 grains.

You know, of course, you could fix a small maximum, such as 20 grains, and prevent this excessive average?—Yes, but the difficulty of that is the use of this lime process of purifying, where the undoubted existence of a nuisance is so clear.

Supposing it were demonstrated to your satisfaction that this process of purification could be carried on without a nuisance, would you then be for 20 grains always as the smallest amount of sulphur?—I go in for none at all—that is to say, if the sulphur could be reduced to none at all, I should be very glad to have it; but I am convinced, in the present state of science, that there are no means whatever, without producing a nuisance, of its being reduced to that.

Have you ever made any experiments as to purifying in gas-works?—I have tried laboratory experiments, but only those by the Bowditch system. I have heard from others of their trials, and I know very well the smell of a purifier when it is opened, but I am obliged to accept in some degree other people's tests for these matters.

To make any experiment valuable, ought it, in your opinion, to be derived from practical experience in gas-works?—I consider that you must try every experiment on a large scale before you can form a proper and true estimate of the results of that experiment.

You yourself have not tried them on a large scale?—No, I have not.

The COMMITTEE: With regard to your evidence as to the injury caused by the presence of this sulphur in the gas, do you think there is any injury except the irritation of the throat?

Witness: No. I can give you an illustration on a large scale of that. One of the first cases I happened to be engaged in professionally was the atmosphere of the Underground Railway, and I made, in conjunction with Dr. Letheby, in 1861, I think, a very large number of experiments on that question of sulphur, and the result of our experiments was, that, though undoubtedly there was a slight irritation set up at first, that irritation never had any injurious effect. I will tell you another thing with respect to that sulphur. At the time of the inquiry all the railway men on the Underground Railway subscribed to a club, and they had applied to that club to have the weekly sum they paid in reduced, because so very few cases of illness occurred among the men. It is perfectly wonderful the amount of sulphurous acid you may have in the atmosphere. As regards the injury to books, furniture, and so on, I am quite convinced that the excessive heat and the relative dryness of the air which we have heard so much about, is sufficient to cause most of the injury, or nearly all. There may be, in my opinion, a little acid sulphate of ammonia formed.

You say it is of enormous importance that ultimately these sulphur compounds should be entirely got rid of. Is there any substantial injury that you consider is done to any living person or to any object around us except the irritation to the throat which you have spoken of?—No, I am quite convinced there is not—not by such a quantity as the difference between 20 and 35 or 40 grains.

Mr. MICHAEL said that was the case on behalf of the promoters.

WEDNESDAY, MAY 16.

The CHAIRMAN said as the case of the promoters was closed, he thought it might simplify and shorten the proceedings if he stated what the view of the committee was at that time. The promoters by their Bill asked that the 30th and 51st sections of The Gaslight and Coke Company's Act (their last Act) should be repealed; that was to say, the section which established the authority of the Gas Referees for the purpose of controlling the company, and in order to obtain a certain degree of purity in the gas. It was objected by the Metropolitan Board of Works, by the 6th clause of their petition, "That, as your petitioners are advised, it is of the utmost importance that a proper limitation should be placed upon the amount of impurity in gas, such impurity being highly detrimental to the sanitary condition of the Metropolis, whereas, if the Bill is passed into law, it will be in the absolute discretion of the company to supply gas with any amount of impurity, either of sulphur and ammonia and of the compounds thereof." The Corporation of London, also, in their petition, said that if those clauses should be repealed, "they would be left to the mercy of the said company to supply them with gas charged with any amount of impurity they pleased; and it has undoubtedly been proved, before more than one committee of your honourable House, that the impurity contained in the gas is most injurious and detrimental to health, and causes vast injury to all descriptions of goods and merchandise." If the case rested there, the committee thought that no other course would be open to them than to declare the preamble not proved. But, a suggestion had been thrown out by Mr. Pope, to the effect that if the committee came to the conclusion that there ought to be some restriction, then justice would be done between the company and the public, by restricting the power of the Referees to the maintenance of a test, the minimum of which should be of such an amount as, in the words of the Act of Parliament, would render it possible to maintain a reasonable amount of purity. The committee were desirous, if they could so arrange it to the satisfaction of both sides, to adopt Mr. Pope's suggestion in a modified form, but, of course, they were quite ready to hear what might be said by the petitioners if they should not agree with that suggestion. The terms the committee were disposed to offer to the promoters of the Bill were that the limit of impurity as to sulphurous compounds (as regards the other impurities they did not propose to make any change at all) should be fixed, experimentally, at all events, at such a limit as would make it possible to avoid what was called the lime process of purification. At the same time they would require that the line so fixed in the Bill should not be reduced, unless by direct order from the Board of Trade.

Sir E. BECKETT: When you say that it should not be reduced, does that mean, supposing we start with 40 grains, it should not be reduced below 40 grains.

The CHAIRMAN: Yes; that is to say, that the Gas Referees, in the exercise of the discretion vested in them by the 30th section, shall not reduce the limit below 40 or 35 grains, or whatever we arrive at, as the lowest limit which can be attained without the use of the lime process, unless by direct order from the Board of Trade.

Sir E. BECKETT: To put it in a cognate form, it comes pretty much to this: Supposing we agree that 40 grains is the limit that can be reached without lime, then you would take 40 grains, assuming it to be so—as the maximum, in short.

The CHAIRMAN: As the maximum.

Sir E. BECKETT: And also as the minimum, unless the Board of Trade otherwise order?

The CHAIRMAN: Yes.

Sir E. BECKETT: That is a matter that requires a little consideration.

The CHAIRMAN: I am not sure that you understand about the minimum. What we mean is that the average that would be obtained in that way, as I understand the evidence, would be an average of about 33 grains.

Sir E. BECKETT: The average seems rather doubtful in this case.

The CHAIRMAN: Therefore we say the maximum. We say that the Gas Referees are not to reduce it, and in that sense you are quite right, it would be the minimum. The Referees ought not to oblige the company to keep the impurity arising from sulphurous compounds below a limit of 40 grains in 100 cubic feet.

Sir E. BECKETT: As you have just now mentioned 33 grains as an average, would you put 33 grains at once into the Bill, do you mean?

The CHAIRMAN: No, because that I believe is not so convenient a method of doing it. There is also another question upon which we should like to hear what you have to say—namely, whether we might not fix the maximum 35 grains, and give an average of a week instead of three days. I likewise think there is another condition we should have to impose upon the company if they are disposed to agree to these terms, and that is that they should, from time to time, make such reasonable experiments as the Board of Trade might require.

Mr. RICHARDS: Most certainly; we have it as much at heart as anybody can have.

The CHAIRMAN said there was another question which would afterwards have to be considered. Mr. Pope had put the case as between the company and the public, but the committee were not disposed to make any concession to the company in their interest alone, under the circumstances of the case, they having last year obtained their Act, and having agreed to the principle upon which that impurity was at present restricted. The committee did not think that the company, as such, had any *locus standi* to complain at all, but they certainly had made a case on behalf of a certain portion of the public, and the question was one between the consuming portion of the public and that portion who were suffering

injuriously from the nuisance arising out of the purifying process at present adopted; and, therefore, after they have agreed upon that part of the case, they would be glad to hear anything that might be said by those representing the public—the Corporation and the Metropolitan Board of Works—as to the financial question; that was to say, as to whether any terms should be imposed upon the company with reference to the price at which the gas should be sold to the public. It was quite plain that if no such provision were made, there would be a very considerable economy for the company, and that would represent a considerable advantage financially, as well as in convenience and other ways. He (the chairman) was not quite sure that he was right, but he thought, as far as he understood the case, that that advantage would be only partly shared by the public under the system of the sliding scale; the alteration of the system at present adopted would go to reduce the cost of the gas, and part of it would go into the pockets of the company. If those views were accepted, the committee would require further evidence on the question, whether the quantity should be 40 grains, taking the average ascertained on three days, or 35 grains on the average of a week.

The parties retired to consult, and, upon their return.

Sir E. BECKETT said: I am sorry we cannot save any time. We think that we ought to go on, and also that, with a view to proceedings hereafter, it is not expedient to withdraw any of the evidence.

Mr. George Anderson, examined by Sir E. BECKETT.

I have been engaged for about thirty years in managing gas-works, and am lessee of several now. I have considered the subject of purification, and have read several papers upon it, one of which obtained the premium from the British Association. I manage gas-works at Dover, Waterford, and three or four other towns that I need not name. I am engineer to the Cork Gas-Works, and to a number of other gas-works. In no case am I under any restrictions as to sulphur, excepting sulphuretted hydrogen. Although not under restrictions, I have managed to get my sulphur down to about 15 grains. I have always considered, as a lessee, that it was my interest to have as much gas consumed as possible; and as I thought that the purer the gas the more would be burned, I have paid a great deal of attention to the subject, and I have my gas as pure and salubrious as possible for that reason. I use precisely the same coal that is used in London—Ravensworth Pelaw and Pelaw Main. I do not know anything about the Paris gas, or the coals they use there. I have used the same tests as they do in London. I had my offices fitted first with Letheby's test; afterwards with the Referees test; and more subsequently, being a more facile arrangement, I have used Mr. Harcourt's test. The result I have obtained is from 10 to 16 or 18 grains.

Sir E. BECKETT: Of course the important question comes, what means do you use for arriving at those results?

Witness: In that sense I use means a little different from what they do in London. I am very particular, first, in the cooling of the gas; next, in the washing of it; and next, in the scrubbing of it, so as to remove a very large proportion of the impurities before the gas enters the purifier at all. My objection, and I have stated it before, is to the fact of finding so much sulphur in the gas in London, which is due to the previous processes. They have not, in my opinion, been so scientifically attended to as I think they should be. More stress is laid upon the purifiers, and consequently there are more impurities to be removed by them, and more difficulty in doing it. I use both lime and oxide. I have not had any complaints of nuisance for several years. About eight years ago I had one at Dover; but then it was because our works were incomplete. We had only two purifiers there at that time, and we could not work upon the system as we ought to do, and we did certainly have some nuisance; but since we have completed our works we have not had any complaints for many years. I have heard of some people complaining at Cork, but nothing ever came of it; there was never any action, or anything of that sort.

—You are confident, are you not, that, by taking means that are known to practical people it is possible to reduce the quantity of sulphur below 20 grains without incurring any nuisance?—Yes, with improved apparatus.

Is it very expensive, that is another thing to ask?—No, it is not any more expensive than the apparatus now employed, but they require more of it. I would even go beyond that, and say that if investigation upon this subject is not opposed by legislation which will not require purity, my opinion is that we shall go on making gas, and arrive at even lower than that—perhaps to eight or ten grains.

Mr. M'Ninn said that science was never to advance in that direction. Do you think so?—I think the very opposite of that; I think it is advancing very rapidly.

You think that if people are kept under a little decent pressure, they will soon find means of reducing the sulphur to 10 grains?—I think it would be to the interest of the companies to do so, because the purer they make their gas the more of it will be burned, especially in a place where a good deal is burned in the daytime.

You seem to think that there is something in the sulphur after all; that is not a desirable thing?—I do not go so far as some people talk, as to its being injurious to health; but I believe it is injurious in this way, that it is unpleasant, and I am not quite sure that the products that come off when the gas is burnt are merely sulphurous acid. If it was sulphurous acid, I do not think it would be so unpleasant as it is; but I have had personal experience of headaches when I have been burning gas in my office in London, and I do not think that sulphurous acid alone would have done it.

Do you find the same result—headache, or whatever it may be—at the places where you have your own gas?—I have not had the same means of trying it, and therefore I should not like to make that comparison.

Examination continued: My plan is to keep the gas in contact with ammoniacal liquor, instead of draining off the liquor from the gas, as is often the case. The ammoniacal liquor has an alkaline action, and it absorbs a large quantity of carbonic acid from the foul gas. I have done this for a number of years without really thoroughly understanding the chemical reason why I have got the benefit; but Mr. Patterson, about three or four years ago, discovered that while the carbonic acid remained in the gas, it was difficult to cause it to deliver up the bisulphide of carbon that causes the mischief. If, however, the carbonic acid was removed from the gas, and brought in contact with an alkali, there being less acid to neutralize the alkali, the acid sulphide of carbon would be attacked by the alkali—lime—which would therefore remove it. It so happened that my process was just following exactly in this line. I have always taken out as much carbonic acid as I could before bringing the gas to the purifiers at all. The consequence is, that all the gas engineers have expressed to me their wonder how I purified my gas with so little lime. I have stated the quantity of lime I use, and in comparing it with their cases, they have always said that I did not use above half the lime they did, and they did not understand it. I have explained to them that it was because I did not give the lime so much to do as they gave it. I do not know that I need go any further. I should also say that the doing of this renders the lime almost innocuous. If you thoroughly carbonate the lime—that is, allow the foul gas to go through it for a long period of time—you send the sulphur out of the lime, and you leave the lime a hard substance, like a porous stone, which has really no smell; you may put your nose over a purifier, and scarcely smell it. I have a piece of lime

here [producing a sample], taken out of the last purifier we cleared, which was on Tuesday or Wednesday.

Sir E. BECKETT: With regard to taking the lime away from the works, do you think that they manage that rightly in these London works?

Witness: Granting that they have a smell, I think they use a considerable amount of caution; but I consider they might do it even in a better way than they do. In the first place I must state, from what I have read recently, that when the lime is being taken out it is in a dusty state, and the dust of the lime blows about and causes the smell. I think that is exceedingly likely, but I contend that, by the proper use of lime, when it is taken out of the purifiers it should never be in a dusty state. You may pass foul gas through dry lime, and it will come out foul gas; but put some water in that lime, and then it is impossible for the gas to come out foul. You want the water to have contact, and then the lime comes out in a lump, and the pieces produced are those that come out.

The COMMITTEE: Those are dusty?

Witness: That is because they have been rubbed together in coming here. My lime is in lumps, and it has to be taken out with a pick. Another mode that I would adopt—and which I do not know that they have done—would be, before opening a purifier, to leave it, say for 24 hours, to cool, because when the stuff has cooled it has much less chance of delivering noxious gases than when it is warm, which it is when the purifier is shut off from making gas. I would also inject steam into the purifier after it was shut off, for the purpose of causing the lime to collapse and shut up the pores. When the lime is porous the oxygen of the atmosphere gets in through it, and delivers any smell that can be got from it. If you were to keep it in a state of pulp, partially pulped, it closes up the pores, and you might remove it, even if it had noxious ingredients in it, with much less smell than in a state of dust. Again, I should have a thoroughly closed barge that could be locked up—covered over with simply man-hole doors, the same as the hold of a vessel, so as to leave the chance of the air acting upon it as little as possible.

Can the sulphur be got out again, and the lime utilized?—If it were absolutely necessary that you must remove the sulphur compounds, and must not take away the lime, even then I say that I could take the sulphur out of the lime in the works, and use the lime over and over again for purifying the gas, the same as they take the sulphur out of the oxide and use it over and over again, and get the sulphur as a saleable article to sulphuric acid makers.

Have you ever done that?—I have not done it with the lime, but I have with oxide of iron. I mean to say that I have taken the whole of the sulphur from the oxide of iron which the companies now sell as useless, and I have used the oxide of iron for years and years without selling it, or taking it off the works at all.

Why have you not done it with the lime?—Because the lime in our case was cheap, and we did not consider it worth while.

They talk so much here about their being encumbered with a great quantity of lime—if they were so encumbered with it they might treat it in that way?—Yes, they might do so, and there are some people who do do it, I believe. It makes the lime caustic again—makes it ready for putting into the purifiers. It takes away the carbonic acid and all the impurities.

Cross-examined by Mr. RICHARDS: My gas is not tested for sulphur compounds by any public officer, and the results I arrived at were merely for my own edification. My works at Dover are small as compared with London, but they are larger than many others; you must have things in proportion. I have never taken out a patent for my scheme of dealing with the lime. Mr. Patterson took out a patent for his discovery, but the novelty of it was disputed in Chancery, and he had one decision for him and one against him, but I have heard he is now applying to have another in his favour if he can get it, as he is going to appeal to the House of Lords. His process was disputed upon the ground of novelty, not of utility; for since the companies have used it they have been able to reduce the sulphur compounds to 8 or 10 grains. I was examined before the Revision Commissioners in 1874, when the company applied for an increase of price.

Mr. RICHARDS: Did Dr. Odling, who was one of the commissioners, ask you this:

If all your lime coming out consists mainly of carbonate, I want to know in what form you take out your sulphur from the gas. If none goes into the purifying material, where does it go to?—Most in the scrubbers and washers.

I think you said your lime was sulphuretted to some extent?—Yes.

But not when you take it out?—Not when I take it out.

Sulphur is not a thing you can squeeze into nothing; you cannot squeeze anything into nothing. I want to know, in purifying gas in that way, what is the form in which you take the sulphur out?—I should very much like, if you could, during the bathing season, come down and visit it for yourself; the fact is, as I state, that we work our purifiers a long time.

You drive your sulphur from one purifier into another; you never take it out?—That is the something that takes place. At Beckett they have oxide of iron purifiers for the purpose of taking out the sulphuretted hydrogen at the last. I take out the sulphuretted hydrogen without doing so.

I cannot understand your taking out nothing but carbonate of lime, and yet removing the sulphur of the gas?—The same thing has gone through my mind that it will get by-and-by into that condition that it will be choke full, but it is not so; the gas is tested, and it would not do to have sulphuretted hydrogen in it.

You do not seem to me to give any satisfactory answer to Dr. Odling's question of what becomes of the sulphur?

Witness: As I have heard you read it, it appears that Dr. Odling was arguing from premises which I do not admit—namely, that I took the lime out pure carbonate.

I only ask you what Dr. Odling asked you, and that is, where is the sulphur? If it goes through the lime, where is the sulphur? You say it is taken out of the gas; where is it?—It exists in the lime in a state in which it does not give off so much smell, in consequence of the large quantity of carbonic acid in the lime.

Have you analyzed that lime to ascertain whether sulphur is in it?—I have not; but I have given samples of it to chemists, and I dare say it is possible that during this inquiry you may have an analysis.

You yourself are no chemist, I presume. You set yourself up as a gas engineer?—I do not profess to be a chemist, but I know more about the purification of gas than some chemists do.

Cross-examination continued: At Dover we have six purifiers, two filled with lime and four with oxide, and the gas is passed through the lime first, and then through the oxide. Our old works were situated under the cliffs, but they have been abolished, and new works erected a little way outside the town, about 40 feet above the lowest part of the town. The old works were complained of by the people in Marine Parade, but it was more on account of the smoke than anything else, and they were never serious. In those old works we had not the means of purification which we have in the new ones. We worked with the old purifiers, and the arrangements of 20 or 30 years before that; and the reason for removing, I may say, was twofold—one was that the works were in the town, and another was because the place was altogether too cramped—in fact, we had no room to do anything.

Mr. RICHARDS: You say it is not difficult to deal with lime with proper apparatus. Is that an apparatus that you have invented?

Witness: No, it is not; but I would invent it if I had this thing to do.

You mean to say that if this problem was submitted to you, you could deal with it very easily?—I do not doubt it at all.

Have you got what you describe as proper apparatus in action anywhere?—I have not required it.

You have not had any practical experience of this proper apparatus?—Yes; I have had experience of a proper apparatus, but not for carrying out the necessity that exists here of taking away these smells. I should like to give my reason for this. Taking that little box represented there as being the thing to put some oxide of iron into, and the exhaustor for drawing air up from the large purifier into it and through it, I think any person would expect to get a smell under such circumstances; that box should be six times as large as it is. The gas coming from the purifier through that very small thing would be passed through it at a very considerable velocity, and I believe that it would come through only partially purified. There would be some impurities that would go through, but if that vessel had been six times as large as it is, and the gas were allowed to go very slowly through the material, you would have a far better combination, and you might not have any smell from the surface of the vessel.

You know that the operation proved a failure. Have you ever tried a large vessel?—I have tried this, which is the same thing.

Will you answer the question, and then explain afterwards?—In the first place, I say no; then I give this explanation. When you have a small purifier in proportion to the gas made, you require double or treble the amount of material for doing the same amount of work. If you enlarge your purifying surface and the gas goes through slowly, so that the products of the gas and the lime come slower in contact and hug each other more slowly, you get a combination to take place which does not take place if the gas is rushing past the material. If that is the case with your large purifier, what is the small purifier but purifying the gas a second time?

You would, under the circumstances, not multiply?—Not multiply, but magnify. Magnifying is better than multiplying, because if you multiply you must send through each vessel in succession, and at the same velocity; but if you magnify you get a lower rate of speed from what you otherwise would do.

What are the limitations as to sulphuretted hydrogen and sulphur compounds in the Dover Act of 1860. Is it not that you shall be free, as far as possible, from sulphuretted hydrogen and other compounds deteriorating its purity?—It is in those exact words; but I may state that we have an inspector of gas who is daily testing the gas, both for ammonia and for sulphuretted hydrogen, and really I should have no objection if he were to test it for sulphur compounds.

Re-examined by Sir E. BECKETT: It is not requisite at large works to have any different mode of purifying to that in use in small ones; only larger apparatus. What answers for 400,000 or 500,000 feet will answer for 17,000,000 feet if of larger dimensions.

Mr. Clarence William Raymond, examined by Sir E. BECKETT.

I am Inspector of Chemical Factories to the Poplar District Board, and know generally the process by which the gas at the Bow Common works (which are in my district) is purified. It is by lime and oxide. At the present time that process does not cause any nuisance. I have often been present when the purifiers have been opened, and have seen the lime turned out. When the lime purifier is turned off, the lids are raised, and the air is drawn through from 18 to 24 hours before the lid of the purifier is lifted off—that is, passed through the oxide of iron, and anything that escapes from the oxide of iron passes away into the flue. We experience no nuisance from it now, neither have we had any complaints with reference to the works since October, 1875; before that we used to have a great number of complaints. Acetate of lead paper is not at the present time blackened by the effluvia. The lime is employed twice over. There used formerly to be a great nuisance, especially through the emptying of the purifiers, and after the lime was lying there; but they were threatened with an action for nuisance, and since they adopted the mode they now employ there have been no complaints of nuisance since. The gas-works are surrounded by houses, some within 30 yards. As to the use of lime, the farmers cart it away; in short, I am perfectly satisfied with the present condition of things.

Cross-examined by Mr. RICHARDS: The Bow Common station is one of The Gaslight and Coke Company's works.

Mr. RICHARDS: Do you think it intelligible that they should conduct their works in this way in one place, and neglect the best course of proceeding at another station?

Witness: I speak as I find those works; I cannot say what they carry out at others.

The particular neighbourhood in which the Bow works are situate is not what you would call a very savoury neighbourhood?—No; at times it is rather bad.

A stink or two, more or less, does not make much difference?—No.

You speak of houses near. What sort of houses are they—factories or chemical works?—No; dwellings of from six to seven rooms, I suppose.

Sir E. BECKETT said before he called the next witness, he would ask the committee whether they thought it desirable to have more evidence upon the question of the injuriousness of the sulphur itself. He rather understood they wanted to have evidence upon the question of getting rid of the nuisance of the lime.

The CHAIRMAN said the view the committee took was that, of course, it would be a great advantage, if it were possible, to get rid of the sulphurous compounds altogether; but that as a balance of convenience between the degree of the increased amount of sulphur, as between 20 grains and 40 grains in the 100 cubic feet, and the nuisance of the lime process of purification, they were disposed to have the experiment tried. The clause he had suggested would enable the Board of Trade at any time, in the first place, to have such an experiment as they had just heard of tried at the works of the company in London; and in the second place, if they thought a case was made out for such an alteration, to reduce the sulphur maximum.

Sir E. BECKETT said he did not think it necessary to argue that point at present.

(To be continued.)

ASHBOURNE GAS COMPANY AND THE LOCAL BOARD.—At the meeting of the Ashbourne Local Board on the 11th inst., the clerk reported that, as directed at the previous meeting, he had written to the gas company, inquiring upon what terms they would sell their property to the board, and he had received the following reply:—"Ashbourne, June 7, 1877. Dear Sir,—In reply to your letter relative to the purchase of the gas-works by the local board, I am requested by the directors of the gas company to inform you that they have not the slightest intention of entering into any negotiations as to the transfer of their property.—(Signed) Edwin Bradley." The clerk explained that the board had no compulsory power of purchase, and that in case of a treaty being entered into, the sanction of the Local Government Board, and the assent of three-fourths in number and value of the shareholders present, or represented at a special meeting, would be necessary.

BRITISH ASSOCIATION OF GAS MANAGERS.

The Fourteenth Annual General Meeting of the Members of this Association was held on Tuesday, the 12th, and Wednesday, the 13th inst., at the Lecture Theatre of the Bristol Museum, Queen's Road, Bristol—ROBERT PAULSON SPICE, Esq., Memb. Inst. C.E., the President, occupying the chair.

TUESDAY, JUNE 12.

The PRESIDENT took the chair at ten o'clock this morning.

The minutes of the last general meeting, and the financial statement for the past year, having been previously printed and circulated amongst the members, were taken as read, and, on the motion of the PRESIDENT, were approved.

NEW MEMBERS.

The PRESIDENT stated that three gentlemen had applied for admission to the Association as extra-ordinary members. The rule on this point hitherto had been that, in addition to the usual annual subscription, extra-ordinary members should pay an admission fee of £5. It appeared to the committee, however, that in reference to future elections, including those which might take place on the present occasion, the annual subscription should be two guineas. The matter had been well considered, and the change proposed was thought by the committee to be desirable. He moved a resolution to that effect.

Mr. MAGNUS OHREN suggested that it would not be a proper course to alter a rule without due notice.

The PRESIDENT admitted that it would not, unless there was a general agreement in the meeting.

Mr. WARNER said the gentlemen whose names were to be proposed on this occasion had applied for extra-ordinary membership on the conditions laid down in the existing rules, and he thought they should be admitted on the usual terms.

The PRESIDENT said the proposition might be considered as withdrawn at present, and a motion to give effect to the change he had intimated could be subsequently made.

The list of applications for ordinary and extra-ordinary membership, with the customary introductions and recommendations, was then read. The names are as follows:—

ORDINARY MEMBERS.

Ayris, J.	Norwich.
Barratt, S.	Gaythorne.
Bickford, J. M.	Carshalton.
Blott, E. B.	Richmond, Surrey.
Bower, T.	Lytham.
Brace, T.	Monmouth.
Bridge, W.	Cleckheaton.
Burgess, F.	Huddersfield.
Carr, J.	Todmorden.
Cotton, E.	Uxbridge.
Daniel, A. V.	Portishead.
Davison, W.	Crewe.
Dawes, S.	Clevedon.
Donaldson, G.	London.
Dougall, J.	Aberystwith.
Evans, T.	St. Mary Church.
Fetté, W. E.	Boston, U.S.A.
Freeman, H. S.	Wandsworth.
Gil, Claudio	Barcelona.
Green, R. A.	Carriekfergus.
Hammond, W.	Bognor.
Hammond, W.	Hampton.
Harper, H.	London.
Hastings, C. W.	London.
Henry, T.	Ebbw Vale.
Hudson, G.	Santiago.
Ker, A. P.	Birmingham.
Lane, G.	Aylesbury.
Leach, W. T.	Ventnor.
Littlewood, W.	Old Trafford.
M'Minn, F. J.	Fulham.
Mearns, J.	Banbridge.
Monnier, D.	Paris.
Moore, T.	Macclesfield.
Murray, M.	Bungay.
Oldfield, F. W.	Hull.
Redman, J.	Haworth.
Roberts, W. H.	Newton Abbott.
Sidle, R. J.	Hythe.
Stevenson, S. E.	Bournemouth.
Stiven, D.	St. Thomas, D.W.I.
Tait, W.	Portadown.
Walker, T.	Wrexham.
Webb, T.	Egham.
White, C.	Blaenavon.
Whyte, P.	Cardiff.

EXTRA-ORDINARY MEMBERS.

Calvert, J.	Pontypridd.
Corbett, W.	Stourbridge.
Dempster, J.	Elland.
Dempster, R., jun.	Elland.
Hallsworth, S.	Armley.
Lockwood, T.	Stalybridge.
Wright, J.	Birmingham.
Wrigley, E. G.	Ashton-under-Lyne.

The above names having been submitted to the vote, it was resolved—"That the gentlemen whose names have been read be elected members of the Association."

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I thank you sincerely and heartily for the honour you conferred upon me at your last annual meeting in the Metropolis, by electing me to occupy the presidential chair on the occasion of your coming this year to this ancient and important seat of commercial and manufacturing industry, to discuss those objects which claim our special attention as a scientific institution.

ADVANCE IN THE SCIENCE AND PRACTICE OF GAS LIGHTING.

In the year which has passed since we last met, there has been no flagging in the exertions which the active spirits among our members have of late years been accustomed to make in the constant pursuit of improved methods of gas manufacture; the objects at all times kept in view being, the reduction of cost, and the improvement of the quality, of the manufactured article, the scientific and the practical being thus directed to secure the best possible commercial results.

It does not always happen that these exertions are estimated at their full value by the general public, or by those who, in large towns and cities, are entrusted with the direction of public affairs; but that does not furnish

a sufficient reason for any relaxation of our efforts. It is our duty to be "instant in season and out of season," and, sooner or later, devotion to duty will be crowned with success.

The nature of the case is such, that a gas company occupy of necessity a position which, of all others, is calculated to beget in men's minds, suspicion and distrust. The supply of gas to a town or city being unavoidably a monopoly, any one requiring a supply, and having at any time a grievance, either fancied or real, against the company, cannot obtain relief by going to a shop over the way, or round the corner, and this too frequently gives rise to a feeling of antagonism which is difficult to remove, and has often resulted in furnishing employment to unscrupulous agitators, ready to promise anything, but competent to do nothing, but mischief.

The true remedy for this state of things lies mainly with yourselves, and I beg you will bear with me, while I endeavour to point out the course to be steered, to avoid exciting the public mind prejudicially, and secure that spirit of satisfaction and goodwill which contributes, where it exists, so largely to the prosperity of gas companies.

THE EDUCATION OF A GAS MANAGER.

The first step in this direction is for a manager to obtain a critically accurate knowledge of his art; I say art, advisedly and intentionally, for gas manufacture has really become an art, whereas it was formerly, and long within my own recollection, merely a rough-and-ready, and too often slovenly conducted, business. As a rule, all that was thought requisite, not very many years since, was to charge a retort with coal, keep up such a heat as would suffice to drive out all the gas in six hours or so, and then draw the resulting coke, the gas having been driven through an apology for a condenser, and so much lime as would prevent its blackening test-paper or a bit of silver, and sent into the gasholder, measured or unmeasured. As to any accurate knowledge of exact results, it was out of the question, not dreamed of in the philosophy of the gas managers of those easy-going times.

But a change has come o'er the spirit of the dream. The times are altered, men's wits have been sharpened, the voice of popular opinion has been heard and felt; what may be called gas literature has become widely spread; every session of Parliament has produced important additions to the vast amount of evidence placed on record as to what can be, and is, done in cheapening and improving the supply of artificial light; and thus is made clear the fact, that the gas manager of to-day must, if he is to hold his own, be an intelligent and painstaking man, well informed on all matters relating in any degree to the one subject, above all others, claiming his attention in a business point of view—namely, LIGHT.

The subject itself is vast, and should be regarded comprehensively; and, although it may appear to be an extreme view, I cannot shrink from the expression of my opinion, that a gas manager should aspire to a scientific knowledge of the material structure of the globe, its place and its path in the universe, and attain to such a degree of familiarity with the sciences of chemistry, geology, and astronomy, as may enable him to bring to the practical and every-day labours of his life, the aid of those great principles which are involved in, and underlie, the solution of the problems which naturally arise, and require his skill in the determination of the right direction to be given in his dealings with the various forces of nature, intimately connected, as they undoubtedly are, with his common avocations, demanding the economical adaptation of the means to the end to be accomplished.

And these being the primary objects of his professional life, I would suggest that he would do well to have on his book-shelves Kingsley's "Town Geology," an elementary and popular work, treating of the soil of the field, the pebbles in the street, the stones in the wall, the coal in the fire, the lime in the mortar, and the slates on the roof; the works of Hugh Miller, entitled "My Schools and Schoolmasters," "The Testimony of the Rocks," and the "Old Red Sandstone;" Faraday's popular lectures "On the Various Forces of Nature," and the "Chemical History of a Candle;" "Notes of a Course of Nine Lectures on Light," delivered at the Royal Institution in 1869; and "Six Lectures on Light," delivered in America, in 1872-73, by Tyndall; and Herschel's "Outlines of Astronomy."

These several works contain almost inexhaustible and measureless mines of intellectual wealth, calculated to raise the conceptions, expand the intellect, and enlarge the resources of the gas manager, place him above the common level of his fellow-townsmen, and make his power felt by them, to a degree, and in a way, in which it could not otherwise be, quite as much to their advantage as his; and thus it would, in his own experience, prove the truth of Lord Bacon's aphorism, that "knowledge is power," always assuming that the knowledge is accompanied by the twin virtues, discretion and courtesy.

The chemist, the geologist, and the astronomer, each furnishes all-important aids to the gas manufacturer and manager, enabling him to trace effects to causes, make the best use of materials, direct his choice in their selection, and produce the best attainable results; unfolding the treasures of the material world which we inhabit, throwing light upon its progress towards what it now is, from what it once was, many millions of years ago, before the dry land appeared, and before the command went forth from the Great Architect of the Universe, "Let there be light."

The astronomer, opening to our wondrous gaze not only the position and courses of those planets, which, like our earth, perform, each in its own appointed time, the circuit of the central luminary which gives us light and heat by day, but teach us that outside our planetary system, there are countless myriads of worlds in the infinite space which we call the heavens; those which we can see, but whose distance we cannot measure, and which we call fixed stars, being, in all probability, suns and centres of life and light to systems of worlds, the light from which has not yet reached us, although travelling at the rate of 186,000 miles a second. All such knowledge must tend to furnish our minds with food for reflection, and inspire us with thoughts, concerning not only the finite, but the infinite, while we are dealing with created matter, and disinterring from the bowels of the earth, those carboniferous treasures which represent the buried vegetation of a period so remote, that the geologist can only estimate, but entirely fail to measure or determine, its age.

THE DISSEMINATION OF INFORMATION AMONGST GAS CONSUMERS.

The next desirable state of things to the possession of an extensive and accurate acquaintance with scientific knowledge, is the acquisition of a faculty for communicating and spreading that knowledge among one's fellow-men in our individual spheres. The peculiar demand of the times is, as Hugh Miller states in his "Testimony of the Rocks," that "what a man knows of science and art, he should freely communicate to his neighbours;" and the faculty of doing this may be acquired by practice, if it be not an inherent power.

In regard to this principle of action, we have in our own Association many pleasing and encouraging examples, the evidences of which I am proud to point to, in the many valuable papers which have been contributed, from time to time, and which are already enrolled in the records of our Transactions; and this list, I am happy to find, will receive important additions, at this our fourteenth annual meeting. It has been customary to refer to these papers from the chair, at the commencement of the meeting; but as I do not see the necessity for such a notice, inasmuch as

each member has been furnished with a list of them, I shall so far depart from the custom, by honouring it in the breach, instead of the observance, and merely say, that I feel grateful to each of those gentlemen who have prepared a paper, which is, in fact, in each instance, evidence of devotion to the interests of the Association, proof of which I hope will never be wanting.

But, over and above all that has thus been done among ourselves, it is pleasing to see the instances, of very praiseworthy efforts made in this direction, by one or other of our members, in their own localities. To my mind, it is a refreshing sight to see a gas manager occupy the platform in the Lecture Hall, or Assembly Room, of his own town, as a lecturer on the recondite mysteries of light, and heat, and fuel, gas-burners, and gas-cooking, and the endless variety of matters connected with coal and its formation, character, and uses, its distillation and products, the tar and its dyes, the ammoniacal liquor and its salts. And while desiring, above all things, to avoid being invidious, I cannot refrain from mentioning, as cases in point, the names of Mr. Wood, of Hastings, whose lectures I have read with pleasure and profit; Mr. Macrae, of Dundee, and Mr. West, of Maidstone, whose recent appearances as lecturers in their own towns, explaining in a forcible way to their fellow-townsmen, without telling them so in so many words, what fools people are to use burners which will not allow the light-giving matter which the gas contains, to be made available for its purpose, and who, while grumbling at the price of gas, voluntarily or in ignorance, pay twice as much for their light as they need do, by wasting one-half of what they buy. And lastly, as the most recent instance of the kind, the brilliant example set by the South Shields Gas Company, in getting up, at no small cost, such an exhibition of gas cooking and heating apparatus, as has never before been witnessed or attempted, and which I attended as your representative, and gave to it the stamp of your approbation, in my official capacity, feeling certain of your approval. This important and practical exhibition was conceived by our excellent friend, Warner, who was most ably, and with far-seeing wisdom, seconded by the chairman and directors of his company; and we may well hope the good example will be followed by other companies, for the information thus spread cannot but bear good fruit.

RECENT GAS LEGISLATION.

And now let us direct our attention to recent gas legislation. In the last session, Parliament, for the first time, granted a corporation compulsory powers for the purchase of a statutory undertaking, the case being that of the Stockton and Middlesbrough Water Company, the terms fixed by the committee of the House of Commons being, 25 years purchase of the statutory dividend, with the usual addition for the sale being compulsory, and in addition thereto, the prospective improved value of the undertaking; the total sum to be paid to the company for the forced surrender of their property, and their interest in it, having to be determined by arbitration, which has not yet been done.

In the present session, compulsory powers have been sought to be obtained by local authorities, for the purchase of both gas and water undertakings in vain, the applications having been refused in each instance; but we have had to witness a strange and arbitrary innovation upon long-established usage, in the shape of a new "Standing Order," forced upon all companies applying for the first time for special Acts, and upon companies having statutory authority applying for further powers for raising additional capital—disturbing the accustomed course of parliamentary practice after the session had commenced, at the instance it is said of an under-secretary of a Government department; thus affording an instance of the inconvenience of that centralization, which threatens an injurious amount of interference with, that private enterprise which has raised this country to its proud pre-eminence among the nations; and this demands more than a passing remark.

The new "Standing Order" repeals, in fact, a provision contained in the Companies Act of 1863, for the allotment of new shares in the additional capital of a company, *pro rata*, among the existing shareholders, and compels the sale of such shares by public auction; the premiums (if any) realized by such sales being applied as capital bearing no dividend. And as a set-off to the deprivation of the privilege of allotment, hitherto enjoyed by shareholders, except in special cases, a standard price of gas is to be fixed, in lieu of a maximum price as hitherto; and a sliding scale is applied, by which the dividends may rise or fall, above or below, the prescribed rates of 10 or 7 per cent., in proportion as the price charged for gas is below or above the standard price fixed by the Act; and thus it may happen that if gas can be, and is, sold at, say, 4d. per 1000 feet below the standard price, the dividend may be 11 per cent. instead of 10, or 8 per cent. instead of 7; the rule, as now established, being, that for every penny charged below the standard price, 5s. per cent. may be added to the dividend, and contrariwise, for each penny charged in excess of the standard, the dividend must be 5s. per cent. less than the prescribed rate.

In the present session the companies promoting Bills, whether opposed or unopposed, have had no cause of complaint in regard to the application of this new Standing Order, a fair margin having been allowed, in fixing the standard price, upon which, indeed, the whole question turns, and if those who have obtained liberal terms exercise their newly acquired powers with a wise discretion, the results of the application of the new theory may prove to be generally beneficial to the companies and consumers alike.

It is important, however, to bear in mind, and the fact cannot be too forcibly impressed upon the directors and managers of gas companies, that the main cause of all the modern warfare, between local authorities and themselves, has been the unquestioned prosperity of our special branch of industry, and that this of itself has excited, in some cases, the cupidity, and in others, the suspicions, of the governing bodies of towns and cities; illustrating again the truth of the proverb, "Where the carcase is, there will the eagles be gathered together."

THE STATE OF COMMERCE AND THE RELATIONS OF CAPITAL AND LABOUR.

But while gas companies have been thriving, commerce generally has been languishing; the high tide of prosperity, which, for several years past, has enabled Chancellors of the Exchequer to lighten taxation, seems to have been seriously checked, if indeed it be not turned, and on the ebb. The great demand for our national staples, coal and iron, has slackened very seriously, and a time of general depression appears to be imminent.

It is painful, under these circumstances, to witness the infuriated struggles going on here and there between employers and employed, the one urging the necessity for a reduction in the rate of wages, and the other demanding a rise, with a shortening of the hours of labour. The dispute on these points, between masters and men on the Clyde, has brought about the serious result of the enforced idleness of about 30,000 men in that district, the cessation of the means of earning sustenance for their families, and paralyzing the trade of the district. The same cause, and the like effects, have also led to serious derangement in the colliery districts of Northumberland, where one declared object of the men was, to diminish the output of coals, with the view of forcing up the price; some 12,000 hands are said to be idle there, instead of being busy, as they might be, earning, by honest labour, fair wages for the maintenance and comfort of their families.

We are thus painfully reminded of the time when the shipbuilding

trade was, by such suicidal folly, driven from the Thames, and the miserable spectacle was seen, of empty shipyards and workshops, with all the attendant miseries, of starving families, and deserted homes. And we can but ask—Is all such experience useless? Will men still go on under the influence and control of trade unionism dictation—ceasing to judge for themselves, surrendering private judgment, and act as they may be ordered by those who rule the trade union societies, instead of disposing of their labour and skill in the open market, on terms satisfactory to themselves, and those who obtain the orders for ships, for willing hands to build, and machinery for skilled artisans to produce?

It does not appear to occur to those multitudes of working men who are under such guidance, that, just as an important branch of industry may be, and often has been, driven by "strikes" from one locality to another, to the ruin of many, so it may be driven from this country, never to come back; but this is the issue now at stake on the Clyde. Those who want to buy ships cannot get supplied on that river, because the masters have been compelled to close their yards, so the buyers must seek what they want in another market; and thus the trade may be driven from the country, and possibly return no more, the change involving a national disaster, through the operation of what may be truly called the *curse of this country*—namely, trade unionism.

These, however, are not the only considerations connected with the labour market demanding our attention, and by which the interests of gas companies may be seriously affected. The fact is patent to the world, that the purchasing power of money is less than it was a few years since. The logical consequence of this is, that more money must be given for whatever we have to buy, whether it be labour or materials, or manufactured articles; and in this way the value of a gas undertaking, like any other real property, is enhanced, and in all recent sales of gas property, by companies to corporations, this has been felt, even where it has, perhaps, not been seen or understood, the general increase in the value of such property being practically equal to the diminished value of gold, which has been estimated by competent authorities at about 20 per cent., the increased production of gold having had this effect.

PURIFICATION OF GAS FROM SULPHUR COMPOUNDS.

Within the last few days, a decision has been given by a committee of the House of Commons, on "the sulphur question," which has recently been again debated, and voluminous evidence given thereon, before that tribunal, two Bills having been brought before it, one by the Crystal Palace District Gas Company, and the other by The Gaslight and Coke Company, the object of each company being, to obtain relief, from the expense and inconvenience, of complying with the requirement to eliminate, what are called the sulphur compounds from the gas, to such a degree, that not more than 20 grains shall be found in 100 feet, and both Bills have been rejected, thus leaving the companies as they were.

The question has been, whether the public suffer more, from the nuisance arising from the use of lime, or from the sulphur compounds, when lime is not used as a purifying material.

When oxide of iron alone is used as a purifying agent, the only sulphur compound removed is H_2S (sulphuretted hydrogen), a most offensive smelling and injurious gas; but every one of you well knows that there are other sulphur-holding compounds which are present in gas, the principal, and the only one, the existence of which has been completely demonstrated, is bisulphide of carbon, CS_2 . It is conjectured, and we have very strong reason to believe, that sulphuretted hydrocarbons are also present in coal gas. Now, the removal of the CS_2 , or, at all events, a large proportion of that which exists in ordinary coal gas, is a comparatively easy matter. But, so far as we know at present, there are no chemical means of taking out the sulphuretted hydrocarbons.

CS_2 is what chemists call a weak acid, and it has the power of combining, with other sulphuretted compounds, such, for example, as sulphides of calcium and ammonium. Now, when it is desired to remove as completely as possible this CS_2 , the gas manufacturer has, as a preliminary step, to get a purifier charged with sulphide of calcium. Then, the gas being carefully purified from carbonic acid, the CS_2 it contains, enters into combination with the sulphide of calcium, and is detained. This process is arrived at with the greatest success, at the Bow Common and Beckton works of the Chartered Company.

The same thing may be done, to an almost equal extent, by the use of strongly sulphuretted ammoniacal liquor, care being again taken to remove the carbonic acid in an early stage of the process, as practised successfully at the South Metropolitan works by Mr. George Livesey.

The objection recently raised before Parliament is, that it inevitably occasions a nuisance in the neighbourhood of the works, by the removal of the lime. The purification of gas in close vessels involves a nuisance in a much less degree, and it is highly desirable, that the process of purification should be so conducted, as at all times to avoid, if possible, giving cause of offence to those who are fastidious, respecting perfumery; but the great object of a gas manager should be, so to distil his coal, as to create, or set free, and send forward in his gas, as small a quantity of these obnoxious products as may be possible, or practicable, and here, in my opinion, there is room for improvement in our common practice.

Formerly, say 25 years ago, when iron retorts were in common use, the practice was to distil coals at much lower heats than have been common since that period, with the use of clay retorts.

I need not trouble you with any remarks or reasons to show how, and why, the use of clay retorts involves the necessity of what may be called the high-heat system, because, as practical men, you can hardly fail to know that the two—that is, clay retorts and high heats—are inseparable; but I may take this opportunity of putting forward a theory which I believe will be proved to be perfectly sound and reliable; hence I give it as my well-considered opinion, that our common practice of charging clay retorts on the scoop system, is the source and main cause of all the difficulty involved in the "sulphur compound" agitation.

The coal being laid in a thick mass, the outside is over-cooked before the interior has been sufficiently acted on by the heat of the oven, and this is productive of mischief, not known in the days of iron retorts, by the expulsion of the obnoxious compounds which formerly were left in the coke; hence I state it, as my belief, that the way to overcome the difficulty of not being able, by any known purifying process, to take them out of the gas, is by not, in the first instance, putting them in. And I have been led to this conclusion, by observing that this is done, in common practice, by West's system of charging, the coal being deposited in a thin stratum, and worked off in four hours instead of six, the heats and the quantity being the same as, on the scoop system, would require six hours.

THE ELECTRIC CANDLE.

As regards the electric light, the public have recently been led to expect great things, and cheap things, from a Russian inventor, M. Paul Jablochhoff, who has devised a candle which is to give the light of at least 100 other candles, and cost less than gas, thus casting our poor gas-burners, the pride of our hearts, into the shade, in more ways than one. And, full of hope that it might be my happy lot to be able to communicate to you, some pleasing information respecting this wonderful invention, I applied, in my official capacity as your President, for permission to attend a private exhibition of it, and an invitation was very

courteously sent me by the agent of the proprietors of the patent, Mr. R. Applegarth.

But, unfortunately, what was intended did not come to pass. Some 200 gentlemen, interested in scientific matters, attended at the appointed time and place—namely, at nine o'clock in the evening of the 5th inst., at the West India Docks, and after waiting till half-past ten, were obliged to leave to catch the last train to the City, without seeing that for which they had put themselves to no small inconvenience. The cause, as we were informed, was the break-down of a steam-engine, without which, the electric generator could not be worked.

Assuming, however, that the thing had been a success, its superiority over other electrical lights would have been but a matter of degree. The inconvenience of a light too powerful for the human eye would still remain, and the light of 100 candles from one burner would require to be reduced, by shading, to about one-fifth of its power, to render it admissible for the ordinary purposes of life, thus reducing its value, while the cost of production would remain the same. It is thus obvious, that if the light of 100 candles be produced, and 20 only are available, the 80 are obscured and wasted. And there would also remain the fatal objection, of its not being diffusible, besides all which, its cost must be such, as to put out of the question its becoming a rival to coal gas, until some means be devised for collecting electricity, instead of having to employ steam power for its generation.

Nevertheless, such lights are undoubtedly highly desirable and valuable for certain purposes, such as lighthouses, large spaces, submarine work, and a variety of other possible uses, and we should hail with pleasure the improvement of the electric light, as we should any other addition to the comfort, profit, and advantage of the human family. But I think I may safely say, that there is not the slightest probability of property invested in gas undertakings being affected in value by any kind of electric light; and that the fear of any such result can only be seriously entertained by the ignorant.

I cannot, however, leave the electric light without mentioning the fact, that Dr. Siemens has successfully grappled with the difficulty previously felt in connexion with the carbon points being kept at the proper distance apart, and which, till recently, was effected only by a clockwork arrangement.

I had occasion, a short time since, to visit the extensive iron-works of Messrs. Head, Wrightson, and Co., at Stockton-on-Tees, and saw there a lamp, invented by Dr. Siemens, by which the carbon points were kept in their proper position automatically, and was informed by a member of the firm that they had found it very useful in the construction of an iron girder bridge, 250 feet long, the girders being 26 feet deep, upon their works, whereas without such an appliance they could not have kept their men at work upon the structure by night as well as by day last winter.

DEATHS OF MEMBERS DURING THE PAST YEAR.*

We have to regret the loss by death, since we last met, of Joseph Bradock, of Fairfield, near Manchester; John Chester, of Swinton; C. B. Darwin, of Ulverstone; J. T. B. Porter, of Lincoln; and William Fraser, of Inverkeithing.

I had not the pleasure of a personal acquaintance with the first four gentlemen in this mournful list of five, whose loss we have to lament, but I had the happiness of knowing our departed friend Fraser, of Inverkeithing, whom to know was a pleasure and privilege, and it was with a feeling of profound regret that I heard of his removal from among us. We can all well remember his familiar countenance, marked by intelligence and inspired by good will, his manly, common-sense, and kind-hearted tone of mind, generous sentiments involuntarily escaping from his tongue; and of him it may truly be said that "The law of kindness was on his lips."

POSITION OF THE ASSOCIATION.

Five members have withdrawn, from various causes, leaving 594 on our list this morning; we have now added 55, making our number now 649.

I beg now to invite your attention to the fact, that the expenditure of the Association has somewhat exceeded the income for the past two years, which I am confident has only to be mentioned to be corrected, and the balance made to appear on the right side of the account; simply by some of those of our number who have been in the habit of subscribing half a guinea a year instead of a guinea—from a feeling of delicacy, and the avoidance of anything like ostentation towards those who can only afford half a guinea—just doubling their annual subscriptions.

And in reference to the expense of our members leaving their homes to attend the annual meetings, I venture to think it will not be out of place for me to refer to the excellent letter of our friend Hartley, which appeared in the JOURNAL OF GAS LIGHTING three weeks since, reminding those directors of companies who have not hitherto considered the matter, that the oftentimes valuable information picked up by their managers through attending these meetings, is an addition to their previous stock, which is available for the benefit of shareholders and consumers alike, and thus would fully justify the payment of such expenses out of the revenue account of the company, and it is my earnest hope that we shall not again hear of any managers having to attend the annual meetings at their own cost.

NEW WORKS IN PROGRESS.

It only remains for me to mention, as illustrating the progress which is being made in the designing and construction of vessels and apparatus required for the manufacture and storage of gas, that a gasholder to contain 3,100,000 feet, to work in a brick tank—the largest in the world—has been designed by our friend Mr. Woodall, of London, for the Phoenix Gas Company, a description of which I hope we may, in due time, be furnished with, if, indeed, we may not have the pleasure of holding one of our annual meetings in the tank. The contract for this monster holder has been entrusted to Messrs. Cutler and Son, of Millwall, the construction of the tank having been undertaken by Messrs. John Aird and Sons, of London. Also the fact of a station-meter being in course of construction for the London Company, by the Gas-Meter Company, on what is called the Reliance principle, to pass 250,000 feet per hour; and another, by Mr. Sugg, for the Fulham station of The Gaslight and Coke Company, to pass 200,000 feet per hour.

And while on the subject of meters, it is pleasing to find that the inventive faculties of our members are directed towards the attainment of absolute perfection in registering the consumption of gas under varying circumstances as to speed, pressure, and water-level. The Reliance meter has been designed with this view, and Mr. Hunt, of Birmingham, has also come to the front with a new arrangement for producing the same result.

THE SUNDAY LABOUR QUESTION.

I am pleased to hear that the movement set on foot by Mr. Morton, to diminish Sunday labour in retort-houses, has been continued with growing success, the management of many works having been conducted with zealous regard to this object.

* A letter from the President, which appears in our "Correspondence" columns, points out an omission in this record of deceased members.

ESTABLISHMENT OF A BENEVOLENT-FUND.

I cordially congratulate the Association upon the support accorded to the scheme for establishing the Benevolent-Fund, the principle having been adopted, and above £800 subscribed, the particulars of which will be reported to you by our secretary, when you will be asked to adopt the rules, which have already been circulated among the members.

And now, gentlemen, hoping I have not trespassed too much on your patience, I invite your attention to the business of the meeting.

PREMIUMS FOR PAPERS.

The President: Gentlemen, I have now to inform you what premiums have been awarded by the adjudicators, for papers read at the last annual meeting. Three of the four premiums only have been allotted. The first, of £10, was awarded to Mr. Richards, for his paper on "Retort-Settings;" the second, of £7, to Mr. Hunt, for his paper on "Washers or Scrubbers;" and the third, of £3, to Mr. Fison, for his paper on "A New Self-Regulating Exhausting Apparatus."

APPOINTMENT OF SCRUTINEERS.

Mr. A. LASS and Mr. F. W. HARTLEY, having volunteered their services, were elected scrutineers of the ballot papers for the election of officers and committee of the Association for the ensuing year.

READING OF PAPERS.

The reading of papers was then proceeded with. They are enumerated here in the order in which they were read, and we reserve their publication and our report of the discussions thereon, as usual, for succeeding numbers.

The first paper read was by

Mr. R. O. PATERSON, of Cheltenham, on "Experience of Körting-Cleland's Steam-Jet Gas-Exhauster, with Notes on its Adaptability and Economy."

Mr. E. W. BRETT, of Hertford, read a paper on "The Supply of Gas to Public Lamps."

Mr. PEARSON, on behalf of Mr. W. Sugg, who was unable to be present, read a paper on "Railway Carriage Lighting."

Mr. A. F. WILSON read a paper on "Lighting and Extinguishing Automatically."

In the evening, a lecture was delivered before the members by Mr. THOMAS CARGILL, C.E., B.A., T.C.D., President of the Society of Engineers, on "The Strains upon Girders, Trusses, and Braced Structures, and the Mode of Ascertaining and Calculating them."

WEDNESDAY, JUNE 13.

The President took the chair at ten o'clock this morning.

PROPOSED ALTERATION OF RULES.

The President: I think this may be an opportune time to consider whether the proposition I made yesterday as to the amount of annual subscription required from extra-ordinary members should be carried into effect. The committee think the subscription for that class of members should be fixed at two guineas, and now that no gentleman is before us for election, there is nothing personal in the way if you also think it desirable to make the change.

Mr. ELDRIDGE: The rule, as altered, would not apply to existing members of that class.

Some members appearing to think it better that notice should be given of a motion to be submitted to the next annual meeting on the subject,

The President said he saw no objection to that course. It could then be discussed under the notice now given, without appearing to reflect in any way upon the gentlemen proposed at that time for election.

Mr. HODGSON JONES, however, moved that the original proposition made by the President be adopted.

Mr. MORTON seconded the motion.

Mr. WILKINSON moved as an amendment that notice of the proposed alteration be given for consideration at the next meeting.

The amendment was seconded, but, on being put to a show of hands, was negatived.

The motion was carried by a considerable majority.

Mr. CARR, of Halifax, wished to propose another alteration. He had not been favoured with a copy of the rules, but at the present time, as he understood, the committee nominated all the officers of the Association, and he believed it had been already felt that it was not exactly a fair thing that they should be allowed, or, rather, according to the constitution, be compelled to choose their successors.

The Secretary said Mr. Carr was under a misapprehension in the statement he had made. He had no doubt received a copy of last year's proceedings, as all other members had, and appended to that report were the whole of the rules.

Mr. CARR apologized for the oversight; he had not noticed that the rules were attached to the report.

Mr. HODGSON JONES thought the balloting papers used by this Association were the same as those employed by other societies of a similar kind, and every member had the opportunity of altering the list as he might desire.

The President said he was a member of several associations, and in all the rule was exactly the same as in this.

Mr. HARTLEY remarked that, as one of the acting scrutineers, he had had the opportunity of seeing to what an extent the members did exercise their judgment in selecting names for the various offices to be filled. As far as he knew, the practice prevailing in this Association was the same as in all others, and he was afraid that if any other arrangement were introduced, the scrutineers might be occupied for a week instead of a day.

The conversation upon this point then dropped, it being understood that it would be revived at a subsequent period of the proceedings.

The President: Now that we are upon the question of a proposed alteration of rules, I should like to call attention to rule No. 3, which says, "Ordinary members shall be either engineers, managers, or secretaries of gas-works." Now, in the early history of the Association, that rule was not rigidly adhered to, but lately it has been interpreted in strict accordance with its true meaning, and both last year and the year before cases came up, and applications for membership were made, which the committee could not entertain. Two similar cases have presented themselves this year, and, acting according to the strict interpretation of our regulations, we were obliged to decline them, although according to our judgments both gentlemen should be members of the Association. They are, however, neither "engineers," "managers," nor "secretaries." They are both gentlemen engaged with large gas companies as outdoor superintendents, having most important control over the administration of affairs. One is a gentleman in the City of London, a man with a large fund of information, and a great amount of practical knowledge, who would be without doubt a valuable acquisition to the Association. Now the way we propose to get over the difficulty is this—that there should be a discretionary power vested in the committee, and we, therefore, propose to add these words to the rule, "except in special cases in which the committee may deem it necessary that the rule should be relaxed."

A MEMBER said he thought there might be a discretionary power given

to the committee, not to elect such a person, but to submit his name to the meeting.

Mr. C. WOODALL said instances had occurred in which practically what the President proposed had been done, and now it was sought to legalize the practice where its exercise seemed desirable.

Mr. FRITH, of Runcorn, moved that such an alteration be effected in the rule as would give the committee power to submit names to the general meeting of members for approval.

Mr. WARNER, of South Shields, thought, instead of making alterations here and there, it would be better to have a sub-committee to revise the constitution of the Association altogether. It was evident to him that some changes were required. He proposed a resolution to that effect.

Mr. SIMPSON, of Rugby, seconded the motion with much pleasure. He thought it would be found that according to the original rules, it was intended that not only engineers, managers, and secretaries were eligible for ordinary membership, but others who were interested in the manufacture of gas. His old friend, Mr. Broadhead, however, objected to this proposal, and wished it confined to gas managers only.

Mr. CARR thought the impression ought not to be entertained, that because a gentleman was an outdoor superintendent, therefore he could not be considered as a gas engineer.

Mr. BARRETT, of Grantham, said he remembered having a conversation with one of the founders of the Association, the late Mr. Adamson, who, in reference to this point, remarked that there were some men outside who were far more qualified for membership, and would prove of far more value to the Association, than mere secretaries of gas companies. He (Mr. Barrett) thought, if the rules were altered, it would be well to exclude secretaries pure and simple, who had no knowledge at all of the manufacture of gas.

Mr. BALL, of Wortley, said, if the question now was whether secretaries should belong to the Association, it would be better to discuss it in a committee of two or three members, as proposed by Mr. Warner, and not in the general meeting.

The President: In stating what the views of the committee are, I have not come forward with any "cut and dried" proposition. We simply feel somewhat of a difficulty, because the gentlemen who desire to become members do not answer the description in the rule, and we have no discretionary power in the matter. It was, therefore, left for me to mention the point. It is a question which should be looked at calmly, and need create no division of feeling amongst us as a body.

The motion was then submitted to a show of hands, and was declared to be carried.

The President: This discretionary power having been given to the committee, I have now to ask the secretary to read the propositions for membership which the committee recommend you to accept.

The Secretary read the names of Mr. J. Johnson, London, and Mr. Thomas C. Hersey, London, who were unanimously elected ordinary members of the Association.

READING OF PAPERS.

The reading of papers was then resumed.

Mr. C. WOODALL, of London, read a paper on "Some Experiments upon the Power and Fuel Expended in Exhausting Gas."

Mr. J. ELDRIDGE, of Richmond, read a paper on "Evidences of Economy in Carbonization by the Use of West's System."

Mr. W. J. WARNER, of South Shields, read a paper on "Periodical District Pressure Taking."

Mr. A. LASS, of London, read a paper on the question: "Is the Adoption of the Form of Accounts, as scheduled in the Gas-Works Clauses Act, 1871, by all Gas Companies and Corporations, desirable?"

Mr. W. H. BENNETT, of London, read a paper on "Means of Extending the Use of Gas and Coke, and How their Consumption may be Increased."

PROPOSED ALTERATION OF RULES.

The President said he had now to ask for an expression of the opinion of the meeting on a proposal of the committee to alter the time for making up the annual accounts. Hitherto they had been made up to the 30th of April in each year, but the Finance Committee, in a report which they had made to the General Committee, strongly recommended that for the future the accounts should be made up to the 31st of December, and they stated several very good reasons for the proposed alteration, which the General Committee entirely endorsed.

On a motion made for the purpose, the alteration was unanimously agreed to.

Mr. G. ANDERSON, of London, thought it would be an improvement if the published list of subscriptions was arranged alphabetically, so that, without difficulty, members might find out whether their subscriptions were paid or not.

Mr. WARNER remarked that the several propositions for alterations which had been brought forward clearly indicated to his mind the desirableness of a revision of the rules. He would therefore move—"That a sub-committee be appointed, consisting of the President and six other members, to examine and revise, if necessary, the rules of the Association, and report thereon to the next annual meeting."

Mr. CARR seconded the motion, reiterating the observations which he made on the subject on the previous day about the inconsistency and anomaly of the committee nominating their own successors.

Mr. TALLENTIRE remarked that, of the names nominated in the committee's list, there were nine resident in the southern districts of England, and not one Scotch or Irish member.

The President said it seemed to him that the motion involved the appointment of two committees to do the work of one. The General Committee of the Association when elected, would be quite competent to undertake the revision if that were thought to be desirable, and it would be a reflection upon their judgment and impartiality if a second committee were appointed for the purpose. With regard to Mr. Carr's observations, he would only say that when the lists were sent out, members were at liberty to strike out any names and insert others, and, if they failed to do so, they ought not to blame a system of nomination which had been found to work well in other associations. He (the President) thought that there were practical difficulties in such a change as was proposed, which those who advocated it did not at present realize.

Mr. R. O. PATERSON did not see how the meeting could well take out of the hands of the General Committee the duty which clearly belonged to them, and he should move as an amendment that the selection of names be left in the hands of the committee, as before.

Mr. SYMS, of Rochester, seconded the amendment, which, on a show of hands, was declared carried by a large majority.

BENEVOLENT-FUND.

The Secretary was called upon by the President to report the progress of the Benevolent-Fund. He said: It will be remembered that at the last annual meeting the Benevolent-Fund was established, and the question was remitted to the General Committee to devise a scheme and set of rules for the government of that fund. A set of rules was prepared, and a copy sent to each member for review and criticism. These were then returned and corrected, and a second copy sent to each member, and he (the

secretary) had not received notice of a single dissentient from the rules as finally settled. The members now assembled were asked formally to adopt those rules. A list of the subscriptions had been sent out, but since then there had been considerable additions. The total amount of subscriptions and donations was now £838 8s. This sum had been contributed by 125 subscribers and 31 donors, and he proposed in the course of a few weeks to circulate a list of the contributors, with the amount subscribed or given attached.

On the motion of the PRESIDENT, it was then agreed to adopt the rules as printed, save and except that which related to the financial year, which, according to the resolution previously passed, was made to terminate on the 31st of December.

SUGGESTED EXTENSION OF THE ASSOCIATION.

Mr. TRAVERS, of Cork, said he was desirous of submitting to the meeting the feasibility of admitting water engineers as members of the Association. As the meeting was aware, there were several of the leading members of the Association at the present time who were both gas and water engineers, and he believed that if the limits were extended so as to include water engineers, as such, as well as gas engineers, it would tend very much to increase the value of the institution. It might be thought by some that water questions would not possess sufficient interest for gas engineers to justify his proposition, but he did not share in that feeling himself; but, on the contrary, he felt sure that the admission of water engineers, as such, to membership would lead to considerable advantage.

The PRESIDENT said he quite agreed in what had fallen from Mr. Travers. It seemed to him a self-evident proposition that it must be for the advantage of the Association to admit these gentlemen. It had been his pleasure on the present occasion to introduce a gentleman as a member who was much more a water engineer than a gas engineer—he referred to Mr. Ayris—a gentleman second to none in his profession, and one who would do honour to the Association. If the meeting, therefore, would accept Mr. Travers's suggestion as a motion, he (the President) would be happy to second it.

Mr. IRONS and Mr. WARNER raised objections to the adoption of such a motion without notice.

Mr. MORTON said it was not because he objected to the introduction of these gentlemen into the Association that he should oppose the motion, but because alterations would be involved in the constitution of the Association, which ought not to be undertaken without due notice.

Mr. H. P. STEPHENSON said it involved not only an alteration in constitution, but in name also. He did not say whether, as an individual, he should object to the scheme or not, if it were properly before the meeting; but it did seem somewhat absurd to object to the introduction of gentlemen into the Association, because, though they might be superintendents of large gas-works, they were not "engineers," by which step the society would be largely extended, and yet, at the same time, propose to enlarge it by the introduction of a class of gentlemen who had no connexion with gas manufacture in any way whatever.

Mr. HEPWORTH, of Carlisle, moved, and Mr. MAGNUS OHREN seconded, that the matter be referred to the committee for consideration, so as to relieve the meeting from the necessity of accepting or rejecting the proposal of Mr. Travers at the present moment.

The amendment was agreed to.

MEMBERS IN ARREAR.

The SECRETARY read a list of the names of members whose subscriptions had fallen into arrear for two consecutive years, and who, under Rule 37, *ipso facto* cease to be members from the time.

TIME AND PLACE OF NEXT MEETING.

Mr. MORTON moved that the next annual general meeting be held in London on the second Tuesday in June, 1878.

Mr. GODDARD seconded the motion.

Mr. HELPS, of Bath, moved that the next general meeting be held in Paris.

Mr. MAGNUS OHREN said it was not a rule, but it was a custom for some time observed, that the alternate meeting of the Association should be held in the Metropolis. Next year, however, was the year of the Paris Exhibition, and no doubt many members would be glad of the opportunity of visiting France on that occasion. For his own part, he did not know why they should not go to both places—meet in London for the transaction of business, and make their annual excursion afterwards to Paris.

Mr. BALL seconded the proposition.

The PRESIDENT said he cordially concurred in Mr. Ohren's suggestion; it was a very sensible one, and, he thought, quite feasible. It would not do to attempt to hold the business meeting in Paris; it would not be consistent on many grounds; but a visit there afterwards could be very nicely arranged. The *Société Technique de l'Industrie du Gaz* corresponded almost entirely with the British Association, and he was sure would be pleased to welcome them. Having held their business meeting in London, there was no reason why the members should not make an excursion to Paris instead of down the river to "spend a happy day" at Rosherville. He had just had a telegram put into his hands from Mr. Sugg, who was now in France, in which he said, "By all means come to Paris; you will see some new works at Clichy, and M. Ellissen and I will act as interpreters."

The motion for holding the next meeting in London and having an excursion to Paris was put and carried unanimously.

ELECTION OF HONORARY MEMBERS.

On the motion of the PRESIDENT, seconded by Mr. GODDARD, it was unanimously resolved—"That Mr. James Glaisher, F.R.S., and Mr. W. Richardson be and are hereby elected honorary members of the Association."

ELECTION OF COMMITTEE AND OFFICERS.

The SECRETARY read the report of the scrutineers as to the result of their examination of the ballot papers, from which it appeared that the following gentlemen had been elected for the ensuing year:—

President.—Mr. Corbet Woodall.

Vice-Presidents.—Mr. John Douglas, Mr. Charles Hunt, and Mr. W. J. Warner.

Treasurer.—Mr. Henry Newall.

Secretary.—Mr. W. H. Bennett.

Committee (new members to replace those going off by rotation).—Mr. R. Harris, Mr. J. Hepworth, Mr. A. H. Wood.

Finance Committee.—Mr. G. Livesey, Mr. G. W. Stevenson, Mr. J. Eldridge.

Auditors.—Mr. A. Hersee and Mr. A. Lass.

Benevolent-Fund Committee.—Mr. R. P. Spice, Mr. W. J. Warner, Mr. E. Goddard, Mr. J. Hepworth, Mr. J. R. Frith, and Mr. J. Storer.

Mr. C. WOODALL said: Gentlemen, I feel that it would be impossible for me to let the meeting separate without acknowledging my sense of the honour you have conferred upon me by electing me to the office of President. I can only assure you that, so far as it lies in my power, I will do my utmost to maintain, during the year of my office, the usefulness and credit of the Association to which I am very proud to belong.

VOTES OF THANKS.

Mr. CUTLER: I rise to propose a resolution, which I am sure will be received with much pleasure, and that is a vote of thanks to the writers of the papers on the present occasion. It would be invidious for me to mention any one in particular, for they were all good, and it has been a great satisfaction to listen to them.

The motion was put, and carried unanimously.

Mr. HARTLEY: It is my pleasure to move a vote of thanks to the committee. I think they have shown themselves thoroughly deserving of our approbation for the manner in which they have conducted the affairs of the Association in the past year.

Mr. IRONS seconded the motion, which was put and carried.

On the motion of Mr. STORER, seconded by Mr. FRITH, thanks were then voted to the treasurer.

Mr. LONGWORTH moved, and Mr. STOUT seconded, a vote of thanks to the scrutineers.

The PRESIDENT remarked that the scrutineers were well deserving of this compliment, as their labours involved a large amount of self-denial and sacrifice.

The motion was put and carried unanimously.

Mr. GODDARD: Now, gentlemen, I have to propose a motion which is not of a formal character, but is one in which I am sure you will most cordially concur. The very valuable Inaugural Address of the President, in which he departed from the usual course adopted by his predecessors, in directing our minds to the pursuit of more enlarged scientific requirements, the very admirable administrative skill which he has shown in conducting the business of this Association, the instructive manner in which he has epitomized the papers and discussions during these meetings, and the natural courtesy which he always manifests, have entitled him, I am sure you will feel, to our very warmest thanks. It is, therefore, with much satisfaction I propose—"That the best thanks of the Association be given to Mr. Spice for the great ability with which he has presided over the meetings of this Association."

Mr. MAGNUS OHREN seconded the motion, which was put, and carried unanimously, and, amidst loud cheers,

The PRESIDENT, who was fairly overcome by the heartiness with which the vote was responded to, said: Gentlemen, I cannot give expression to my feelings in words; I can only say I thank you for your kindness. (After a pause, the President again rose and said:) There is one pleasing duty I have yet to perform, and that is to ask you to give a vote of thanks to Mr. Bennett, our secretary, for the manner in which he has conducted the business of the Association, not only to-day and yesterday, but during the whole year since we last met together. We who work with him know how to appreciate his valuable services, and the more we see of him the more we value the help he is able to render us. Let us give him a hearty vote, and express the hope that he may long be spared to fill an office the duties of which he so well discharges.

The motion was put, and cordially adopted.

The SECRETARY: Allow me to acknowledge the kind expressions which have fallen from our worthy President, and to thank the meeting for the vote of thanks just given to me.

On the motion of Mr. CARR, thanks were voted to the auditors for their services.

The PRESIDENT, in closing the proceedings said: There is one pleasing bit of news I am able to give before we separate, and I especially mention it, because in my opening address I referred to the subject. I am happy to state that there is an end to the Northumberland dispute—a dispute which threatened to issue in disastrous consequences.

The annual dinner of the members took place in the evening at the Grand Hotel, Broad Street, and on the following day an excursion was made to Chepstow and the ruins of Tintern Abbey.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

- 2128.—BURT, P., Glasgow, "Improvements in the arrangement or construction of double-acting steam-pumps." June 1, 1877.
- 2132.—POPE, J., Folkestone, Kent, "Constructing a receiver for conveying and for adjusting the flow of water to the pans of water-closets." June 1, 1877.
- 2135.—PARKES, J., Birmingham, "Certain improvements in taps or cocks for steam, water, and other similar purposes." June 1, 1877.
- 2177.—CROSSLEY, F. W., and CROSSLEY, W. J., Manchester, "Improvements in gas motor engines." Partly a communication. June 4, 1877.
- 2231.—BAGSHAW, J. and W., Batley, York, "An improved equilibrium valve for water and other fluids." June 8, 1877.
- 2238.—NEWMAN, J., Litchurch, Derby, "Improvements in apparatus for transmitting gas from the retorts to the hydraulic main." (Complete specification.) June 8, 1877.
- 2249.—STRONG, M. H., New York, U.S.A., "Improvements in the manufacture of gas for illuminating and other purposes." June 9, 1877.
- 2269.—EELLS, A. F., and LOUB, S. C., Boston, U.S.A., "Improvements in pumps." (Complete specification.) June 11, 1877.
- 2281.—PITT, S., Sutton, Surrey, "Improvements in machines for charging and discharging gas or other similar retorts, and for measuring the coal which is to be deposited in such retorts, and in arrangements for operating these contrivances." A communication. (Complete specification.) June 12, 1877.
- 2291.—LAKE, W. R., Southampton Buildings, London, "Improvements in apparatus to be arranged in connexion with gas pipes or burners for opening and closing the cocks thereof by electro-magnetism." A communication. June 12, 1877.
- 2295.—HAMILTON, F. A., Southwark, and HAMILTON, F., Hackney, London, "Improvements in reflectors, diffusers, and concentrators of light, and motions or actions for moving or regulating the whole or part of the same." June 13, 1877.
- 2330.—PARSONS, Hon. R. C., Connaught Place, London, "Improvements in pumps." June 14, 1877.
- 2334.—ROBSON, J., North Shields, Northumberland, "Improvements in engines operated by the combustion of gas or vapour." June 14, 1877.

PATENTS WHICH HAVE BECOME VOID

- BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.
- 1929.—SCHANZER, L. I. L., "A new or improved instrument or apparatus for drilling and tapping or screwing mains under pressure, and attaching pipes, cocks, or connexions thereto." June 3, 1874.
- 1973.—MATTHEWS, H., "Improvements in apparatus for preventing the return or back flow of gas, water, and other fluids in sewers, drains, and other similar situations." June 6, 1874.

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TO CORRESPONDENTS.

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 26, 1877.

Circular to Gas Companies.

ONE of the penalties a man pays for having achieved a great reputation, is the liability to be bored by correspondents; and, perhaps, no statesman or author, living or dead, has ever suffered more from this source than Mr. Gladstone. Gushing young ladies want an autograph to paste in an album; sucking politicians want opinions on crude theories; and older ones want hobbies backed up; and so the torment incessantly goes on.

It is not to be wondered at, that when one correspondent has asked and obtained Mr. Gladstone's opinion as to whether or not it is desirable for Local Authorities to become possessed of commercial undertakings such as gas-works, another should interrogate him as to the principle on which such undertakings should be conducted, supposing they belonged to a representative body. The reply to Mr. Silverthorne, which we published in our last issue, was somewhat enigmatical, and the same may be said of the answer we print to-day. No one, however, can be surprised at this, for a great statesman cannot be

expected to bind himself by expressing a decided opinion, on a rather intricate question, to any casual correspondent who may address him.

Our own opinions are, of course, well known to our readers. We regard the supply of gas and water as legitimate commercial enterprises, which it is beyond the province of Local Authorities to enter upon—at all events, with a view to profit to be applied to purposes other than those appertaining to the undertakings. We consider all the net profits of gas undertakings in the hands of Local Authorities as so much additional taxation of the gas consumers; and we feel confident that if Mr. Gladstone had leisure to give a little attention to the subject, he would agree with us. As it is, he admits that the axiom of the late Mr. J. S. Mill, quoted by our correspondent, is undoubtedly sound. A rate levied by a Local Authority for a particular service should be calculated so as to produce as nearly as possible the exact sum required to defray the expenses of rendering such service. It is clear, then, that the opinion of the great political economist is, that the only legitimate principle on which a corporate gas undertaking can be managed is the Scottish plan, the adoption of which we advocate.

Mr. Gladstone may be perfectly right, from his own point of view, in stating that particular cases might require separate consideration; but we must confess that we can imagine no case in which this law ought not to be followed. It would, in our opinion, to mention a supposititious case which affords the closest analogy, be just as legitimate for an authority to levy a three-penny lighting rate when only a penny was necessary, and devote the excess to general purposes, as to charge gas consumers more for gas than was necessary to defray all the expenses of production and distribution. No local authority would, of course, dream of inflicting the treble taxation here supposed, and yet it is the desire of many to acquire gas undertakings, in order that they may make a quite analogous infliction. In this Metropolis we feel certain that the intelligence of the population would effectually prevent any such misuse of the gas undertakings. But we need not speculate. The day is very distant when the metropolitan undertakings will pass into the hands of any corporate authority. It may be further delayed, or its arrival may be altogether prevented by the adoption of the system of economic management advocated by Mr. Gladstone, which can easily be effected by the general amalgamation of the Metropolitan Gas Companies.

We have at the present moment—unfortunately for us—no gas dispute agitating the Metropolis. The vexed "sulphur" question has, we understand, been relegated to what we must call the legal tribunal—the Referees—who, with the evidence taken at the late inquiry before them, will, no doubt, consent to a relaxation of their recent orders, at all events in the winter months. It seems clear that the Metropolitan Board of Works, who rule over by far the larger part of the metropolitan area, would be perfectly satisfied if a maximum of thirty-five or forty grains of sulphur per 100 cubic feet were allowed. With this the Companies might be able to comply, by making use of modes of purification which would not involve the production of a nuisance; and we regard the limit suggested by Mr. Keates, and evidently approved of by the Metropolitan Board, as fair to the Gas Companies, and not prejudicial to the consumers.

We print, to-day, two of the communications made at the meeting of the British Association of Gas Managers, and all our readers will agree that they possess great practical value. The account given by Mr. Paterson of his experience with the Körting-Cleland Steam-Jet Exhauster thoroughly supports the opinion we have more than once expressed as to the adaptability and economy of this instrument. The chief point raised in the discussion was the situation in which the exhauster should be placed. Mr. Paterson, and we believe Mr. Cleland at his own works, has put it at the outlet of the scrubber; but it was urged by some members that a better situation was at the end of the main leading from the hydraulic. The President correctly remarked that when put in the former position it involved doing the same work twice over. We shall not stop to discuss details which all our readers will peruse, but we may allude to one point which appears to us of much interest. It has always been claimed in Germany, where this exhauster is more employed than in this country, that its use improves the illuminating power of the gas. The reason for this we confess we did not see, until it was explained the other day by Mr. Paterson. He has found that the heat of the steam in contact with half-condensed gas effects a partial distillation of the tar—does, in fact, exactly what the process of Messrs. Aitken and Young is intended to accomplish. The more volatile constituents of the tar are converted into vapours which dissolve in the gas, and serve to enrich it. This, as we have said, is a point of much interest, and we hope it will receive further attention.

The paper read by Mr. Brett, "On the Supply of Gas to Public Lamps," was eminently practical, and his treatment of the subject was exhaustive. Few things have occasioned more worry to Gas Managers than the incessant disputes of their companies with the Local Authorities as to the public lights. We fully agree with the author in his opinion that where a company supply the gas, all the plant should belong to, and be under the control of, the company. The Local Authority may have their inspectors if they please, but they should not be allowed to touch or disturb anything except in the presence of an officer of the Company. With the practical suggestions which follow, as to the plans to be adopted for the preservation of service-pipes, their size, and that of the stand-pipe, we fully agree, and also as to the choice of burners and the careful fixing of them. We may pass to Mr. Brett's remarks on the meter system. To us, who have for many years advocated the general adoption of that system, it is extremely gratifying to find that managers in general are becoming convinced of its advantages. We do not regard the average system as doing complete and perfect justice to Gas Companies. There are, of course, but two plans which would effect this—the separate main advocated by Mr. Wilson, which would be impossible over a large area; or a meter to every lamp, which would lead to inconveniences. The best course is the average meter system, which, when approved of by a man of so much experience in connexion with public lighting in the Metropolis, as Mr. Johnson, must commend itself to all. We do not despair of seeing Mr. George Anderson on the stool of repentance before long. Passing by, for want of a special knowledge of the facts, the disastrous results at Watchet, we may once more contend that the system offers the easiest means of establishing peace and contentment between the supplying Company and the Authority supplied. This, by itself, is no mean gain; but we were pleased to hear a generally-expressed belief that no loss resulted to the Company. All that is required for their protection is vigilant supervision. The question as to whether public lamps should be supplied at a lower rate than that charged to private consumers was ably dealt with by the President, who pointed out that cheap public lighting meant dearer gas to private consumers, and, in the long run, must be detrimental to their interest.

An exhibition of M. Jablochkoff's "Electric candle" was successfully made, last Friday week, at the West India Docks, at which we were not present, but we have no hesitation in congratulating the inventor on the results, for it demonstrated more clearly than ever that gas has nothing to fear from competition with the "candle." That the electric light will enable people to distinguish shades of colour accurately, we all know; but these are early closing days, and evening shopping gets less and less. That it might be possible to light the deck of a ship, and even the hold, was certain; but then ships do not use gas, and, in order to be lighted with an electric candle, they must carry a steam-engine and a magneto-electric machine. We notice that none of the experiments detailed lasted longer than about twenty minutes, and we understand that the "kaolin" points require to be changed about every half hour, involving the extinction of all the "candles" actuated by the same machine. The change, we are told, is very expeditiously made, but a total eclipse of the light for only a minute or two would produce grave inconvenience under many circumstances. As yet, we have no more complete information as to the cost of the light than we gave from our French contemporary last week.

Nothing daunted by a crushing defeat in the House of Commons, the Hanley Town Council have again endeavoured to open negotiations with the British Gas Company for the Potteries Works. The reply is as before—the Company absolutely refuse to sell; there the matter rests, and will rest, we believe, for a long time.

Water and Sanitary Notes.

THE Public Health (Metropolis) Bill, surreptitiously, we may say, introduced into the House of Commons, and carried to a second reading before it was printed, has, as we expected would be the case, occasioned a good deal of excitement among the Vestries and District Boards in the Metropolis. It is not that they object to the measure, so far as it is simply a consolidating Bill; but they, very naturally, take alarm at the large powers it would confer on the Local Government Board. For these powers, we, with a wide knowledge of the operation of the sanitary laws, as administered by the Metropolitan Local Authorities, feel bound to say there is no necessity. Although we are not prepared to deny occasional defaults on the part of Vestries, to take proceedings when well-founded complaints are made, we cannot see that the

interference of the Local Government Board is at all required in such cases. A much simpler mode of proceeding would suffice. There is one thing that may be urged in favour of the Bill. All the provisions it contains, or very nearly all—for we have not time to go through the several Acts which are here consolidated—are already in force all over the country, except within the limits of the Metropolis. We could never conceive a reason why an Act applicable to Little Peddlington or Eatonswill should not be applied to London. We fail to recognize in a Metropolitan Vestry any special virtue or talent which entitles them to be exempted from the control which is exercised over Provincial Boards. Our objection to this Bill goes to the root of the matter. We object to centralization altogether, within or without the Metropolis. At the same time, we may say that most of the alarm, and even indignation, expressed, is perfectly uncalled for. If we take the most obnoxious provisions—sections 85 to 88—it will be seen that most of them have been in the statute-book for several years; but no case has ever occurred in which they were put in force, nor, in our judgment, is any likely to occur. Public opinion in a district will always be sufficient to compel even a vestryman to do his duty. At this day, almost every metropolitan district has its local print—some two or more—and a local paper wields a power far greater than the Central Authority could exercise. We regard, then, the powers of compulsion, which the sections we have enumerated would confer, as altogether unnecessary, and, moreover, we doubt whether they could be enforced against a Vestry or District Board determinedly recalcitrant.

We imagine that, with the powerful opposition already organized, the Bill has no chance of success this year, and must be greatly modified to succeed at all. Some of our contemporaries remark on the slipshod manner in which the measure has been drawn; but we do not see much to complain of in this respect. We notice one section, however (the 30th), which will render a dealer liable to a fine of twenty pounds for "*every animal, carcase, fish, or piece of meat flesh or fish,*" found in his possession, unfit for human food. Will any one calculate for us what amount an unfortunate fishmonger would be liable to if he were caught with a bushel of stinking sprats on his premises? Our Government departments, we fear, are failing in some of their functions, not the least important being the drafting of Bills.

Under the title of the "Public Health Act (1875) Amendment Bill," a measure has been introduced to the House of Commons, which, we rather think, will create some dismay among many Rural Sanitary Authorities. It bears on the back, among others, the name of Mr. Cowen, M.P. for Newcastle, and, therefore, it would not, at first sight, be expected to aim at any centralization of authority. It will be found, however, that the promoters have adopted the 299th section of the Public Health Act, 1875, which is the same as the 85th section of the Public Health (Metropolis) Bill, against which the London Boards are now so strongly protesting. The object of the Bill, we notice, is clearly set forth in the second section, which is as follows:—"It shall be the duty of every Rural Sanitary Authority to see that every occupied house within their district has, within a reasonable distance, a supply of pure water sufficient for the consumption and use, for domestic purposes, of the occupiers of the house." Accordingly, they are to have power to compel every house owner to find such a supply, and they are not to allow any new houses to be built, or old ones to be rebuilt, before such a supply is provided. If the Rural Authority fail in this, their duty, the Medical Officer of Health may bring the Local Government Board upon them, with what consequences it is impossible to foresee. The county landlord interest is much too well represented in Parliament to allow of this measure passing into law, and we need not further refer to its provisions.

Contrary to our expectation, the Metropolitan Board of Works have decided to withdraw the Metropolis Floods Prevention Bill, rather than accept the amendments of the Committee of the House of Commons. The Committee have reported the Bill to the House, technically, without amendment; but their decision is certain to receive the attention of the Government, who will, probably, take up the measure, and proceed with it according to the terms of the Committee's report. Our own views upon this question have been repeatedly expressed, and we can only regret that a small majority of the Metropolitan Board have taken such a narrow view of a wide and important question.

THE COAL PRODUCTION OF THE WORLD.—The coal production of the world is now estimated at 273 million tons. In this total Great Britain figures for 133 million tons; the United States for 46,500,000 tons; Germany for 45,645,000 tons; France for 16,950,000 tons; Belgium for 14,400,000 tons; and Austria and Hungary for 10,400,000 tons. The production of other countries is comparatively trifling.

CONTRIBUTIONS TO THE THEORY OF LUMINOUS FLAMES.

By Dr. KARL HEUMANN.
[Translated from the *Journal für Gasbeleuchtung*.]
PART I.
(Continued from page 491.)

Aided by the experience already gained, we now proceed to consider the disilluminating influence of the refrigerating burner, and of the following stream of cold gas.

It will at once be admitted that as a metal rod touching the flame, say, of a slit-burner, very near the burner-head, causes a rather considerable dark space within the flame, the head of the burner itself will also, by its refrigerating action, contribute to produce the non-luminous portion of the flame, which always exists, to a greater or less extent, immediately above it. But a second element—namely, the continued stream of cold gas—is also concerned in this result.

The disilluminating effect of the burner is naturally more conspicuous in small flames, for if the effect extends in a circle of, say, 0.5 centimètre radius, the proportionate loss will be greater in a small flame than in a larger and brighter one; moreover, in a small flame the diminution of light will extend over a greater space, because the actual temperature will not reach that of a larger flame, on account of conduction and radiation of heat, and also of excessive influx of air. The diminution of light may be carried to complete disillumination, if the flame of the slit-burner is reduced by nearly closing the tap. The refrigeration, too, is considerable, if the burner presents a large surface to the flame, and is made of thick metal, as in gas-stars, cooking apparatus, or gas-stoves, in which a number of small flames issue from a thick iron plate, perforated with very small holes. If the influx supply of gas is only small, all the flames are quite blue, and the lighting effect, so to speak, *nil*. I think it may, for the same reasons, be predicted that the heat of these cooking and stove burners, especially with small flames, must bear an unfavourable proportion to the gas consumed. If the supply of gas is increased with these burner arrangements, the tips of the little flames first become luminous; opening the tap wider, the light envelope of the much enlarged flame extends further downwards, but it never quite touches the head of the burner, the lowest portion of the flame always remaining blue.

If, then, the burner causes a diminution of light by its refrigerating action, it may, *a priori*, be asserted that this diminution will be greater with metal burners than with burners made of some bad conductor of heat. But an assumption hitherto made, that burners of porcelain or steatite possess advantages over metal burners, has been contradicted, and a competent practical authority informs me that in practice the only disadvantage of metal burners consists in their speedier oxidation.

This would lead to the conclusion that the greater diminution of light with a good conductor of heat, if perceptible at all, would certainly not be considerable. Only experiment could decide this. As it was evidently a question of very small differences in brilliancy, especial care was requisite in the choice of the burners, and I soon found that the ordinary burners sold in the shops would not fulfil my requirements. Two precisely similar burners were required, one made of steatite and one of iron, which should consume the same quantity of gas with equal openings of the tap; for, even with an equal consumption of gas, a larger hollow in the burner, or a different position of the tap might have a sufficient effect on the intensity of the light to entirely obscure that due to the material of the burner. I therefore had two special burners made, with heads of precisely the same size, and a circular hole in each, bored with the same instrument. These burners were luted on to glass tubes of equal diameter, and tested by the photometer under quite identical conditions.

The position of the tap remaining the same, the first observation showed that the iron burner consumed rather more gas than the steatite burner, but the excess was so slight that it did not prevent the greater brilliancy of light from the steatite burner being plainly perceptible:—

	Degree of Light in Wax Candles.	Consumption of Gas in Litres.
Steatite burner	0.90	36
Iron burner	0.85	37

It must, however, be remarked that the observation of the iron burner in this case, apart from the not inconsiderable errors due to the ordinary methods of photometry, were rendered much more difficult by the very perceptible variations, both of the intensity of the light and of the gas consumption, during the first minutes of combustion. This was evidently owing to the heating of the burner; the consequent alteration in the size of the aperture, and reduced rapidity with which the gas issued, were variable elements, which, it is true, would gradually attain an equilibrium, but would still differ in every case where the mode of consumption varied.

To obviate these disturbing influences, the iron burner was cooled down to 15° Cent. = 57° Fahr.—that is, retained at its initial temperature by a constantly renewed body of water, which was readily effected by passing the glass tube that carried the burner through a cork inserted in the top of a small bell-shaped glass, inverted till the orifice of the burner was on an exact level with the lip of the bell. This funnel-shaped vessel was then filled to the brim with water, so that the iron burner was surrounded by water. A funnel tube above the vessel, and an exit-pipe, allowed the upper layer of water to be constantly renewed as fast as it grew warm.

The experiments, of which the result is given in the following table, were carried out by causing the gas* first to pass through a

meter, the index of which read per minute showed the consumption in litres per hour. The readings of the gas consumed in the flame to be tested were taken by setting a seconds teller in motion at the moment when the index of the meter pointed to a division; the position of the index was again noted when the timekeeper showed that one or more minutes had elapsed. For protection against errors or unforeseen chances, I always took several readings both before and after using the photometer. The standard was the light of a stearine candle, according to which the gas-flame was regulated in the moveable disc-box; here, too, I always, after the measurement, tested whether the gas-flame still equalled the candle, and in each case I took several observations on the photometer with the flame under examination. The gas pressure was in every case 3 inches of water.

All the photometric observations, including those given further below, were carried out in this manner. Of course, only those figures admit of comparison which resulted from experiments immediately following each other; for the quality of the gas, as was proved by direct experiment, varied a good deal at different times.

STEATITE BURNER.				IRON BURNER.			
Light in Candles.		Gas Consumption in Litres.		Light in Candles.		Gas Consumption in Litres.	
Average.		Average.		Average.		Average.	
0.12	0.12	14.5	14.6	0.16	0.17	19.5	19.5
0.12		14.7		0.18		20.0	
0.12				0.17		19.0	
						19.5	
0.30	0.30	22.0	21.3	0.30	0.30	25.5	25.7
0.30		21.0		0.30		26.0	
0.30		21.0		0.30		25.5	
0.90	0.96	39.0	39.0	0.90	0.87	41.0	41.7
1.00		39.0		0.80		42.0	
0.98		39.0		0.90		42.0	

It was not advisable to increase the flow of gas any further, as the different portions of the flame, in consequence of its length, would no longer have been equi-distant from the diaphragm, and any consequent error would have been the more serious, because the weak light of the flame necessitated its being pretty close to the diaphragm.

The second and third groups of figures in the above table show at a glance that the steatite burner had a decided advantage, as for equal intensity of light less gas was required than with the iron burner. In the first group this is not so evident, and, in fact, if from the 14.6 litres and 0.12 light the proportion were calculated for 19.5 litres consumption for the steatite burner, the result would be rather against it as compared with the iron burner; but if the figures obtained in the experiment with one burner are tested against each other, it will be found that they are not at all proportional, but that the light of very small flames is much below the figures that would be arrived at from a proportion based on the result of experiments with a larger gas consumption. This probably arises, in the first instance, from the refrigerating action of the burner, but the loss of heat by conduction, radiation, and excess of air is greater in a small flame than in a larger one.

The results of the above table are more clearly shown if the intensities of light are considered as ordinates, and the corresponding gas consumption as abscissæ in a system of co-ordinates, the appearance with increased gas consumption being represented by a curve. The curve of the iron burner is much below that of the steatite burner.

It cannot now, therefore, be asserted, that the advantages of a slow-conducting material for burners are "altogether imaginary." In the above case the advantage was not inconsiderable, chiefly, it is true, because the iron burner was kept at its original cold temperature by artificial means. Of course, a burner acting without such a cooling apparatus would heat very quickly, and attain a pretty high temperature. That the disadvantage of an iron burner is thus much lessened, and that especially with a very bright flame, it might not exercise any very perceptible influence on the intensity of the light, is easily understood; but I think my experiments have established the fact that there is a greater diminution of light with metal burners.

The refrigerating influence of a metal burner may be shown in other very instructive ways. If a cooking burner, or metal single-hole burner, is closely observed immediately after lighting, it will be seen that a wet spot is formed close round the aperture. In small flames, after burning for a short time, the condensed water becomes mixed with tarry matter, which rapidly increases to a considerable quantity if the burner is kept cool by artificial means. A thick drop of tarry liquid soon collected round the aperture of the well-cooled burner used in the above experiments, and threatened to stop it up. But if the burner is not cooled it gradually heats, and the condensed water is again evaporated; a brown residuum from the dried tar remains, however, on the upper surface of the burner, as a visible proof of the great abstraction of heat effected at first by the burner.

It has been already shown that a wire inserted in a flame disilluminates it to a considerable extent, but that if the wire be glowing hot, no such disillumination takes place. By the same rule, the diminution of light occasioned by the refrigerating effect of a cold burner will cease when the latter is heated to glowing.

Unfortunately, in this experiment, it is impossible to prevent the gas-stream from becoming heated also; so that the result, which entirely confirms what is said above, cannot be exclusively referred to the cessation of heat-abstraction by the burner.

The refrigerating effect of the cold gas-stream on the already

* The gas-works here furnish a mixture of wood and coal gas.

glowing gases—i. e., the flame—has been already noticed in speaking of the space between the flame and the burner when compressed gas is used. As it is now also established that the light is diminished by cooling the flame, the same effect must also be produced by the freshly-inflowing gas-stream.

If we suppose that the flame could exist for a moment without the continual influx of fresh gas, it would not, even in this case, be of the same temperature throughout; as the impenetration of air, as well as conduction and radiation, would cause the outer portions of the flame to lose most heat; the hottest part would, therefore, be somewhere about the centre of the flame. If we now suppose cold gas suddenly to enter at the bottom of the flame, it is clear that the greatest diminution of heat will take place in the lower interior portion of the flame; the hottest part is, therefore, no longer in the centre, but must have moved further up, nearer the tip of the flame.

But the different portions of the flame have all to participate in this reduction of heat, and those parts the temperature of which was previously only a little above what was absolutely necessary for the separation of carbon would be cooled below this point—i. e., entirely disilluminated by the refrigerating effect of the gas-jet, while intrinsically hotter portions of the flame would only suffer a diminution of light. The colder the intruding gas is, the more will the entire light of the flame be weakened, consequent upon the joint action of all these causes, while it will be very greatly increased, and even reach the intensity of the above hypothetical flame existing without the influx of gas, if the heat-abstracting effect of the issuing gas-stream is obviated by heating it to the flame temperature before it is allowed to enter.

(To be continued.)

COMMON SENSE FOR GAS USERS.*

Notwithstanding that this is an interesting and highly useful work in many respects, the exercise by the author of a modicum of the common sense which he has endeavoured to instil into the minds of gas users would have led him to omit, or to have treated in a different manner, several matters that do not by any means improve the quality of the book.

For instance, the often refuted statement of the formation of sulphuric acid in the combustion of coal gas is reproduced with a good deal of dogmatic assertion, which, considering that Mr. Wilson is an engineer, and not a chemist, is scarcely becoming.

A great amount of attention and inquiry have again recently been devoted to the sulphur question, and he can scarcely be other than prejudiced, who, after carefully perusing the evidence for and against, arrives at any other conclusion than that it is entirely a question of ventilation; and that the destruction of certain textures, the canvas of pictures and their frames, and the bindings of books, is due not to the formation of sulphuric acid, but to the desiccating effects of heat in the upper stratum of the air of badly ventilated rooms lighted with gas.

Again, in speaking of the desirability of consumers being able to read their own meters, the author gives an absurd example of the "carelessness, or worse, on the part of the gas company's servants," caused by the consumer not keeping a record of his consumption. "In a large manufacturing town, the owner of an extensive warehouse formerly had his place lighted with gas, but, in consequence of a dispute with the gas company, had the gas shut off at the main. To his surprise the gas account was rendered the following quarter as usual, and for about the same amount as had hitherto been the rule. On remonstrating with the gas company about the absurdity of the charge, they asked him to pay what he considered fair. Had this consumer been able to read his own meter, he would have been able to check the quarterly account regularly, and would not have run the risk of being imposed upon. In this case the gas company had erroneously assumed the meter had been passing gas without registering, and acted accordingly."

We fail entirely to see the relevancy of the example adduced; besides, its puerility should have ensured its rejection. Such stories in derogation of gas suppliers may be collected by the bushel, but we never knew an instance of a single one of them being verified on investigation. Statements like this are better spared. Both companies and local authorities supplying gas have to contend against sufficient prejudice without a writer of note furnishing up the gamut of grievances retailed against them by unjust or unreasonable consumers.

Then, as to the "simple means of testing a meter," recommended on pp. 44 and 45, what do our readers think of this? "Obtain a large jar, of glass, if possible, of which the exact cubic contents in feet and in inches is easily calculated. As there are $6\frac{1}{4}$ gallons, or 25 quarts, in a cubic foot, a gallon jar filled 25 times, or a quart jar filled 100 times, will represent 4 cubic feet. Fill the jar with water, and cover it with a flat plate of glass or other material. It can now easily be reversed without spilling its contents, and placed mouth downwards in a flat pan or trough containing 2 or 3 cubic inches of water. So placed, the atmospheric pressure will keep the water in the jar. Having unscrewed and severed the connexion between the house supply-pipe and the meter, attach a piece of india-rubber pipe to the meter, having a stop tap at the end with an elbow to it. Turn on the gas till this pipe is filled, and note the position of the small hand on small index on the meter. Carefully place the pipe under the jar without allowing the water to escape, and turn on the gas, which will bubble up and displace the water. As soon as all the water is forced out and the jar is full of gas, turn off the gas at the

tap. Repeat the experiment again and again until the number of fillings, multiplied by the contents of the jar, equal, say, 4 or 8 feet of gas. On comparing this with the consumption indicated on the meter, its accuracy or otherwise will be seen. It is advisable to allow a slight margin in favour of the meter index, to compensate for any inaccuracy on the part of the tester.

"Another and simpler mode of testing a meter is to use a cask or other water-tight vessel, having a capacity of several feet, which can be accurately ascertained by measuring or weighing the water required to fill the vessel. The outlet-pipe from the meter being connected with the top of the vessel when filled with water, and the gas being allowed to enter the vessel as the water flows out at the bottom, at the moment the water ceases to flow the vessel will be filled with gas, the amount of which being known, can be compared with the quantity registered during the test by the meter." The author might well prefix the remark that "some skill in manipulating the simple apparatus, and considerable patience, is necessary."

Such a mode of amateur testing, with all its inevitable inaccuracies, could only lead to bickerings between user and supplier, and possibly also to accidents of a serious kind. But even if such a system of testing could be relied on, *cui bono*, so long as practical meter testers are accessible, whose certificate may be accepted without hesitation? Such a method of experimenting should not be recommended, or even mentioned, in a work proposing to teach common sense to its readers. No sensible man would attempt any such folly in the way of experimenting, and a reckless or foolish person should not be encouraged to risk either his own or his neighbour's property and life.

There is surely an inconsistency in the statement on pp. 47 and 48 with reference to the comparative merits of wet and dry meters. The question is asked, "What advantages has the dry meter over the wet meter?" and the reply is given under a series of heads, laudatory of the dry meter, with some of which we do not agree. After this comes the further question, with its answer: "Then why are dry meters not always used?" "Because, until recently, there has been a strong prejudice on the part of the gas companies against their use. It was considered that they were too delicate to answer well or last long, that they could not be easily tested, and that, as a rule, they told against the gas company—that is, they registered less than the actual quantity of gas that passed through them. The prejudice is now rapidly dying out, and as the stocks of wet meters held by the gas companies disappear, they are largely replaced by dry meters."

"Is the dry meter as trustworthy as the wet meter?" "No; it is too delicate in its construction, and as the flexible leather inside is liable to stiffen in course of time, the dry meter cannot be depended on to register accurately for more than from two to five years. Hence it is considered necessary by gas companies to re-test the dry meters every few years."

If the description as to the untrustworthy character of the dry meter, after a few years use, be correct, the objections on the part of the gas companies to its employment can scarcely be described as mere *prejudices*. If a meter cannot be depended on to register correctly for more than two years, the objections to its employment are perfectly natural and just. It is well known, too, that dry meters, like wet meters, notwithstanding Mr. Wilson's assertion to the contrary, are liable to stoppage by frost, owing to the moisture present in them after working for a time; and it is certainly not correct to say that wet meters are being gradually supplanted by the dry. We have reason to know that dry meters are less in favour now than they were ten or a dozen years ago.

Speaking of service-pipes, the author states that in this country wrought iron alone is used for service-pipes. This is a mistake. Lead pipes are used almost exclusively in some of our large towns, and in many places, particularly in Scotland, cast-iron service-pipes are employed.

We have been thus careful to point out what we consider defects in a work that will probably command a wide circulation, from the well-known ability of the author, and the repute of the publishers for producing works of a scientific character. In future editions some of the matters referred to should be eliminated, and the others corrected. We despair, however, of consumers in the bulk availing themselves of the excellent advice offered on nearly every page of the book. They will, as a rule, be content to go on in the old groove, and have their grumble against the gas and the company as before.

Of trustworthy information on the subject of gas lighting there is no lack; the difficulty is to get consumers to acquire it, and act upon it. There are many useful manuals, written in a popular style, by gas engineers and others, dealing with the question; and some of them have been placed under the very noses of those concerned; but, in spite of this, there is no subject on which so much ignorance prevails, and in regard to which there is greater carelessness or indifference manifested.

The truth is, a certain measure of scientific knowledge, physical and chemical, is required in a consumer, to induce him to enter heartily into the matter with a view to introducing the remedies necessary; and this the average householder does not possess, and scarcely cares to acquire. The effort to understand the conditions under which gas is most economically consumed would give him too much trouble. The bulk of mankind have no taste for practical science; it is only the actual student, or the curious in such matters, who avails himself of the advice so freely offered. For the many, martyrdom, in short, is pleasanter to contemplate, and easier to bear, than the thought of penetrating the mysteries of gas illumination, or even of registration.

A school for the education of gas-fitters in the theory of gas lighting is needed in every large town; and if that class could be brought under the influence of such teaching as could readily be

* "Common Sense for Gas Users. A Catechism of Gas Lighting." By Robert Wilson, C.E., author of a "Treatise on Steam-Boilers." London: Crosby, Lockwood, and Co., 1877.

supplied to them, more would be done in the way of improved gas consumption than will ever be accomplished by any treatise, however popularly written and accessible in point of price. Consumers are greatly at the mercy of gas-fitters, as Mr. Wilson shows; and till these are educated into their duties, or until the gas suppliers themselves take the fitting into their own hands, the grievances of consumers will continue to exist.

The book, Mr. Wilson says, is not written for gas-works engineers, but for gas-fitters, consumers, and others, the exercise of whose skill should begin where the work of the gas company's servants usually ends. Had it been the practice of gas companies to continue their work to the burners, the book might never have been written. Nevertheless, there are managers of gas-works who may profit by a careful perusal and study of the facts and advice it contains.

Given an adequate supply of good gas, at a cheap rate, how can it best be utilized for lighting purposes? This is the problem the author has endeavoured to solve in a popular manner, and with very considerable success. The work is written in the form of a catechism, and is divided into eleven chapters, and an appendix on gas-engines, the illustrations accompanying them being numerous and neatly executed. The subjects treated of are the nature and qualities of gas, the advantages and disadvantages attending its use, gas-fitters, meters, gas-pipes, burners, gaseliers, globes, regulators, and carburizers. In each chapter there is much valuable information, and some originality; and the treatment of the subjects throughout is clear and concise.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE VALUATION OF GAS LIQUOR.

SIR,—The communication from a correspondent upon the above subject, published in this day's JOURNAL, is somewhat late in the day. It is now some twelve months since the little apparatus described was fitted up for the Phoenix Company, with a view to meet a special difficulty. As your correspondent truly says, there is little novelty in it; none was ever claimed, but in one or two matters of detail it fulfils its purpose more satisfactorily than most other forms of apparatus fitted up for the same application. I have not had the pleasure of seeing, or hearing of, Mr. Hartley's recent pamphlet.

Royal Naval College, Greenwich, June 19, 1877.

THOS. WILLS.

MR. GLADSTONE ON THE TRANSFER OF GAS AND WATER WORKS TO CORPORATIONS.

The following correspondence has been forwarded to us for publication:—

The Right Hon. W. E. Gladstone, M.P., &c.

SIR,—I must apologize for the liberty I take in asking you a question which arises out of your reply to Mr. Silverthorne. It relates to the appropriation of the net profits of gas undertakings in the hands of local authorities. Mr. Silverthorne has correctly told you that since the gas undertakings have been in the hands of the Corporation of Birmingham, £25,000 of net profits have been paid over to the borough improvement-fund. The question I would ask you shortly is, whether or not such an appropriation of the profits must not be regarded as an addition to the taxation of gas consumers? Bearing in mind (1) that all ratepayers are not gas consumers, (2) that the largest ratepayers are sometimes very small gas consumers, and (3) that large ratepayers are often large consumers of gas, I think you will see that in two cases gas profits applied to public purposes go to relieve rates at the expense of the gas consumers, and, in the third case, involve a direct injustice in the shape of a double taxation.

You will, of course, know that in the cases of most Scottish Burghs possessing gas undertakings these are conducted on what I may call the "self-supporting system;" that is, that the charges for gas are fixed so as to exactly balance the expenditure. To this system, I take it, no objection can be raised; but I contend that the English system of making profits (enormous in the case of Manchester) to be applied to public improvements constitutes a double taxation of the consumers of gas.

And here, but that I do not wish to take up more of your valuable time, I might refer you to a statement of the late Mr. J. S. Mill ("Principles of Political Economy," Book V., chap. v., §4) in which he lays it down as an important principle that a rate (and people always regard the charges made for gas and water as rates) levied by a local authority for a special service should never exceed the expense incurred in rendering such service.

Since the matter I venture to bring before you is of great importance to the ratepayers in many of our large corporate towns, and is likely to become of more importance as the transference of undertakings progresses, I have ventured to ask your opinion as to the appropriation of profits from the point of view above mentioned, and am, with much respect,

Your obedient servant,

W. T. FEWTRELL.

13A, Great George Street, Westminster, June 21, 1877.

W. T. Fewtrell, Esq.

SIR,—In my note of the 13th, I certainly had in view the economy of production through consolidation of undertakings, and did not at all refer to the transfer of profits from one local purpose to bear the charge of another.

Mr. Mill's principle is undoubtedly, in my view, sound. It would not, however, follow that the rule is to be absolutely without exception. The presumption would, of course, be against the exception, but it would be unwarrantable in me to attempt to determine any case without an exact consideration of the circumstances, such, as I fear, I could not undertake.

I remain, Sir, your faithful servant,

73, Harley Street, June 22, 1877.

W. E. GLADSTONE.

DOUBLE OR SINGLE STAND-PIPES.

SIR,—Gasholders are, without exception, provided with two stand-pipes; but I venture to ask if a single pipe—the outlet—would not be sufficient, if the inlet were connected to it before its entering the stand-pipe well, fixing, of course, the slide valves before the junction.

By omitting the second pipe the well may be reduced in diameter, and the difficult fixing, and the chance of leakage and breakage which exist, though they seldom occur, are reduced by half.

It is true that, compared with the enormous capital often spent in gas-works, the saving would be a trifle; but why throw away even a single pound if no advantage whatever is derived from it? It may be the two pipes are of some service in small works which have to use cannel, as they promote, in some degree, the mixing of the gas made in the evening with the contents of the holder; but for large works, where at sunset a number of them are filled and ready for delivery, I cannot see the two pipes are of any use whatever.

Is there, however, a valid reason for their employ of which I am ignorant? I shall be glad to be informed of it in the columns of your valuable JOURNAL, of which I am a constant reader.

A DUTCH MANAGER.

BRITISH ASSOCIATION OF GAS MANAGERS.

SIR,—Permit me to correct an error which appears in the otherwise very excellent report of the meeting of the British Association of Gas Managers, held in Bristol last week. At p. 1007, Mr. Johnson, of London, is represented as having been elected consequent upon the discretionary power given to the committee. This is not so. Mr. T. C. Hersey, of London, was the only gentleman so elected; but as Mr. Johnson was the proposer of Mr. Hersey, and his name was read to the meeting, I can quite understand such a mistake creeping in. Mr. Johnson joined the Association in 1868.

W. H. BENNETT,

Secretary of the British Association of Gas Managers.

22, Great George Street, Westminster, S.W.,

June 23, 1877.

STANDARD PRICE OF GAS.

SIR,—A man with a grievance is generally considered to be a bore; I hope, however, I may not be so considered by yourself or your readers, now that I have a grievance to ventilate.

On a very recent public occasion I stated, when reviewing the gas legislation of the present session, that the companies promoting Bills, whether opposed or unopposed, have had no cause of complaint in regard to the application of the new "Standing Order," a fair margin having been allowed in fixing the "standard price." This was true up to the early part of last week.

Since then, however, my experience has not been so pleasant; one unopposed Bill, of which I had charge, having passed satisfactorily through a committee of one House, with a margin of 4d. per 1000 feet allowed between the present price and the "standard price" granted by the committee, when it came before the committee of the other House, the "standard" was cut down, without rhyme or reason, and in the teeth of sound argument, to the price charged by the company at the time they came to Parliament for statutory powers, thus leaving the company no margin whatever, depriving the shareholders of the old and accustomed privilege of a *pro rata* allotment of new shares among themselves, and giving them nothing in its place, which was one of the proposed objects of the sliding scale.

The effect of such decisions as this, if they should become common, will be to deter companies from lowering the price of gas on the eve of going to Parliament, and so inflict injury on the consumers of gas instead of conferring a benefit upon them.

All companies in such a position will do well to reflect that "to be forewarned is to be forearmed."

R. P. SPICE.

21, Parliament Street, Westminster, S.W., June 25, 1877.

Miscellaneous News.

PLYMOUTH AND STONEHOUSE GAS COMPANY.

The Annual Meeting of Shareholders was held on Thursday, the 21st inst.—Mr. P. ADAMS in the chair.

The SECRETARY (Mr. G. Henderson) read the following report of the directors:—

The directors, in presenting a statement of accounts for the year ending March 31, 1877, have the satisfaction to assure the shareholders of the continued prosperity of the company.

After providing for outstanding liabilities, and payment (in January last) of the authorized half-yearly dividend, there remains a disposable balance of £6408 13s. 1d. Your directors, therefore, recommend the payment of a further dividend of 10s. per share on the original shares, 7s. 6d. per share on the additional shares, and 3s. 9d. per share on the new additional shares, and that the balance of £2908 13s. 1d. be carried forward to the credit of next year's account.

It has always been the policy of your directors to reduce the charge for gas as early as, in their judgment, circumstances would justify such a step. In anticipation of the financial results of the year, they determined, in February last, notwithstanding the reduction made last year, to announce a further reduction of 2d. per 1000 feet to private consumers, and 4s. per lamp per annum for public lamps, to commence at Lady-day; and it is satisfactory to find their expectations have been fully realized.

The retort-house and coal stores, referred to in the last report as then in course of reconstruction, were completed in time for use during the past winter. The new purifiers are nearly completed, and will be available for the coming winter. After being in action for several years, the gasholders Nos. 2 and 3 are found to be in a defective condition, and it is necessary that the crowns be renewed forthwith. To meet this outlay, the directors have carried the sum of £2000 to a contingent-fund.

The directors have to regret, since they last met the shareholders, the loss of one of their oldest colleagues in the person of the late Mr. William Burnell, whose sound judgment rendered him at all times welcome amongst them, and his place at the board has been filled by the appointment of Mr. Samuel Jackson.

The retiring directors are Mr. James Payne, Mr. Richard Rundle, Mr. Isaac Watts, and Mr. John May; the three former, being eligible, offer themselves for re-election. In consequence of severe affliction Mr. May does not seek re-election, and the directors regret they are thus deprived of the able services of one who has been a member of the board from the formation of the company. The retiring auditor, Mr. John Turner, is eligible, and offers himself for re-election.

The CHAIRMAN moved the adoption of the report, and congratulated the shareholders on the flourishing position of the company. Of course, they got a little blame occasionally; it was incidental to the working of such a large business; but he did not know any town in England where gas was so cheap as at Plymouth. The quality of the gas was very good, and often-times, when complaints were made, the fault was not in the gas, but in the fittings. During the last year there had been a great deal done on the

premises. The old retort-house had been pulled down, and a new one had been erected, and worked very well. Whilst the old house had 12 benches, the new one had only 10, and, therefore, it was not an extension but a renewal. There were four very large purifiers, but they were not yet finished. All that could be done to further purify the gas would be done.

Mr. R. RUNDLE seconded the motion, which was carried unanimously. The CHAIRMAN moved the payment of a dividend of 10s. per share on the "original shares," 7s. 6d. per share on the "additional shares," and 3s. 9d. per share on the "new additional shares."

Mr. J. PAYNE seconded, and the motion was carried unanimously.

The CHAIRMAN moved the re-election of the retiring directors, which was seconded by Mr. PETERS, and carried.

Mr. R. H. SNOW was elected a director in the place of Mr. May, and Mr. Turner was re-elected auditor.

The CHAIRMAN made a few remarks on the use of gas-stoves and fires. He had had a gas-stove in use for upwards of 20 years, and in this everything was cooked, both in winter and summer. The great secret in the economical use of these stoves was the education of their servants in turning off the gas when it was not required. He also had a gas-fire in his bed-room, and both the stove and fire were very economical.

Mr. WATTS remarked that gas used in a proper manner would not cost half what coals would.

The CHAIRMAN, in answer to a question, said his gas bill was not £1 per quarter.

Mr. BROWNING said that nothing injurious emanated from gas as there did from coal or coke.

Mr. PILLMAN asked whether the directors had under their consideration the advisability of either reducing the rental of the meters or doing away with it altogether. They got a large profit on the meter-rent, and it would be a gratification to him if they could reduce the rental or abolish it. He considered that the fact that the directors had spontaneously made a reduction in the charge for public lights, by which ordinary consumers and the ratepayers generally benefited, should not be overlooked.

The CHAIRMAN said that the meter question had been before the directors again and again, but they could not see their way clear to make an alteration. One of the best companies in the world—he referred to the South Metropolitan—did not for years charge for the loan of meters, but now they had done so, besides adding 2d. to the price for gas. That company were now charging 3s. 2d. per 1000 feet of gas, besides the meter-rent.

Mr. PILLMAN drew attention to the item of the interest on their unemployed capital, which was stated on the balance-sheet to be £330. This appeared to him to be a very small interest, considering that their unemployed capital was between £14,000 and £15,000.

Mr. R. WOOLLAND remarked that there was a large number of small consumers in the town, and if the meter-rent were taken off the bills of these consumers, they would pay next to nothing. He was pleased that the directors came forward spontaneously and lowered the price for the street-lamps, as it enabled the Town Council to devote more money towards macadamizing and pitching their streets—a work that was greatly needed. He proposed a vote of thanks to the chairman and directors for the manner in which they had performed their duties.

Mr. PILLMAN seconded the motion, which was put and carried; and the CHAIRMAN and Mr. RUNDLE acknowledged the compliment, the latter remarking, with regard to the meter question, that he believed Mr. Woolland had struck the right nail on the head when stating that if it were abolished large consumers would have the small sum of 10s. taken off, and small consumers would pay hardly anything.

The SECRETARY pointed out that a large number of consumers had 30-light meters, for which they had to pay 5s. If three men burned—one, 14,500 feet, at a cost of £1 16s. 3d.; a second, 166,000 feet, at £21 2s. 3d.; and the third, 354,000 feet, at £32 1s. 9d., the man who burned the last amount would get only 5s. if meter-rents were abolished, the same as the man who burned £1 worth. This, in his opinion, would entirely be for the advantage of small consumers only.

The meeting then separated.

NORTH SHIELDS WATER-WORKS COMPANY.—The annual meeting was held on the 18th inst.—Dr. Bramwell in the chair. The report stated that since the last annual meeting 196 services had been laid in to supply 281 new consumers, being a considerable increase over the last two years. The gross revenue for the year was £7384 4s., and the expenses £5173 9s. 5d., leaving a balance of £2213 14s. 7d., and adding to which £283 8s. 1d., the balance after paying the dividend last year, and various items, as shown in the accounts, made a total of £2497 2s. 8d. to the credit of profit and loss account. Out of this sum the directors recommended a dividend of 5 per cent., which amounted to £2000, to which must be added the sum of £20 10s. 8d. due to the Duke of Northumberland, being his one-seventh share, and after paying these amounts a balance would remain of £476 12s. to the credit of profit and loss account.

VISIT OF GAS MANAGERS TO CHELTENHAM.—On Friday, the 15th inst., a number of members of the British Association, including Messrs. Spice, Woodall, Morton, and Bennett, of London, Warner, of South Shields, Hunt, of Birmingham, Woodall, of Leeds, and others, availed themselves of the invitation of Mr. R. O. Paterson to make a flying visit to Cheltenham, principally with the object of examining the working of the jet exhauster. The party were conducted, immediately on their arrival at Cheltenham, to the works, and the principal matters of interest pointed out by Mr. Paterson. The system of carbonization by Spinney's ovens, without the intervention of the hydraulic main, was closely inspected, and the action of the jet exhauster, drawing the gas from the ovens at a level and perfectly steady gauge, created much interest. After examining the arrangements being made for the permanent adoption of the steam-jet, the party were entertained at luncheon by Mr. Paterson. Here they were joined by Mr. Skillicorne, the recently-elected first mayor of Cheltenham, who is also chairman of the gas company. Mr. Spice, in a few well-chosen sentences, proposed as a toast, "Success to the Cheltenham Gas Company," and congratulated his worship on the excellent condition of the works, which, he said, their inspection had shown them were conducted on the most modern scientific principles. After an appropriate reply from Mr. Skillicorne, the health of Mr. and Mrs. Paterson was proposed by Mr. Woodall, and acknowledged by Mr. Paterson, who stated that his object in drawing together a few of his fellow-members had been partly to carry out what he felt sure would have been done by his predecessor, Mr. Esson, who, there was no occasion to remind them, had always taken the warmest interest in the affairs of the Association, and partly to encourage that recognition of the merits of the Association which he considered it the duty of each individual member to promote. After doing justice to the good things provided for their repast, the party were conveyed in a brake through some of the principal streets of this fashionable inland watering-place, and thence along the side of the Cotteswold Hills (from whence the most charming views of the valley of the Severn are obtained) to Birdlip. After a short stay at the village, a further delightful drive was made, *via* Cranham Wood, to Gloucester, where the party separated for their respective destinations, highly pleased with the pleasant addition thus made to the Bristol meeting.

BRITISH ASSOCIATION OF GAS MANAGERS.

(Continued from page 1008.)

TUESDAY, JUNE 12.

Mr. R. O. PATERSON (Cheltenham) read the following paper:—

EXPERIENCE OF KORTING-CLELAND'S STEAM-JET GAS-EXHAUSTER, WITH NOTES ON ITS ADAPABILITY AND ECONOMY.

It is with some hesitation that I come before you to treat of the subject which stands at the head of my paper. The novelty of the subject, and the solicitation of many friends, while probably presenting a sufficient excuse for attempting the work, only adds to the anxiety and fear that I may not do it that justice which it deserves.

Being under the necessity of soon having to provide larger exhausting apparatus, my attention was forcibly drawn to the steam-jet, after hearing the admirable paper read by Mr. Cleland at the Association's meeting at Leeds in 1875. The change from the ordinary mechanical exhausters to a system such as this, was felt to be of too radical a nature to be adopted without careful investigation, and it is principally a record of these investigations I propose laying before you.

In April last year I had a No. 16, capable of passing 60,000 cubic feet per hour, fixed on the outlet of the scrubbers, and fairly tried. I feel it to be unnecessary here to say anything about the instrument considered simply as a medium for relieving the retorts of what is technically known as "back pressure;" as the principle of its action is well known, and similar contrivances have been successfully used, for analogous purposes in other manufacturing processes for a considerable time. It is sufficient to say that, in this respect, the steam-jet performs its work in a most admirable manner. The pressure-register paper lying on the table shows a fair average day's performance, and is a sufficient proof of the excellent work which may be done by it. No oscillatory movement is discernible—indeed, the exhaustion is done so steadily that the pointer of a King's gauge, indicating 1-100ths of an inch, can hardly be observed to move. But it is necessary to say that there was no hydraulic main, nor any hydraulic seal, interposed between the retorts and the exhauster in this case; and it is not at all likely that such regularity can be obtained where the hydraulic seal exists, nor, under any circumstances, without the close personal attention of the man in charge, any more than it could be by the use of the best mechanical exhauster known to us at the present time. The governor usually supplied with the exhauster is far from being sensitive enough for the purpose of economical exhaustion, which may be shortly described as consisting in obtaining a steady and unvarying pressure.

The gas and steam, after passing through the exhauster, were cooled in a horizontal condenser, composed of 326 feet of old 14-inch mains, which were in stock at the time, laid conveniently in an open space in the yard. The superficial cooling surface, including a small boiler, filled with rubble intended to catch and throw down any tarry particles that might be in suspension, was 1381 square feet. The gas, after this, entered a couple of washers of a new design, which had previously been used after the old exhausters for the absorption of carbonic acid, and into one of which the condensed steam was pumped. With an average hourly make of gas of 11,400 cubic feet, giving a condensing surface of 121 square feet per 1000 feet per hour, it was found that with the temperature of the air in the shade at 55°, and that of the gas entering the exhauster at 68°, the steam could not be thrown down, nor the gas cooled below about 100°, notwithstanding that the pipes were at the time protected by bags from the direct rays of the sun. The effect of this high temperature was to expel the ammonia from the strong liquor in the washer, and render the gas more impure in this respect after leaving them than it was before it entered. On this account, after about a month's work, operations had to be suspended until sufficient condensing surface could be provided. The experience gained in this short period was valuable, inasmuch as it revealed an action which, unless understood, would be sure to create a difficulty—namely, the conversion, by the heat of the steam, of the most volatile constituents of the tarry particles, held in mechanical suspension in the unpurified gas, into a gas of a more or less permanent character, leaving a residue of pitchy matter, of which this bottle [produced] contains a sample. This deposit is found to occur immediately on the outlet of the exhauster, where the temperature averages 143°, but is never found under 120°, at which temperature it is of a semi-liquid character. Fortunately, in the temporary condenser at about 120°, there was an open syphon-box, designed to draw off a portion of the condensed steam, where the pitchy matter was arrested and removed before reaching the cooler pipes, in which, no doubt, it would have ultimately presented a very awkward obstruction. This deposit was altogether unexpected, and, to my knowledge, hitherto unknown in connexion with the steam-jet exhauster. It was the more surprising as it occurred with a gas previously thoroughly condensed, and copiously washed and scrubbed with ammoniacal liquor.

In recounting the experience of this first trial, I have not said anything about the consumption of steam, because no satisfactory test was made. It was attempted several times, by gauging the condensed steam flowing from the pipe; but the results were variable, and manifestly unreliable. From the fact that the boiler, working the mechanical exhausters, was found to be inadequate to generate sufficient steam for the jet, there was a pretty clear indication that the quantity required was larger than had been stated; and more than is required by steam-engines. Incidentally I may mention here, as a lesson learnt from experience, that it would always be advisable to have the boiler as near as possible to the exhauster, otherwise the condensation of the steam, however small, unless removed from the pipes, will interfere with the free working of the exhauster, and cause an unsteady action. It is also advisable to fix the steam throttle-valve in a vertical position to prevent any water, condensed from the steam, accumulating behind the contracted aperture, which accumulation would be periodically displaced, causing an unsteadiness in the exhaustion.

After an interval of some months, during which time an additional condenser and a duplicate jet exhauster were put up, with the view of carrying on the experiments throughout the winter, a fresh start was made in October, since which time the steam-jet has been almost continuously at work. The additional condenser was fixed near the end of the horizontal 14-inch pipe, and consisted of 18 9-inch vertical pipes 18 feet high, down which the gas flowed from an upper to a lower chamber, where it is drawn off. Even with the addition of this condenser, which made the total superficial cooling surface 2541 square feet, or about 63 square feet to each 1000 cubic feet of hourly make of gas in mid-winter, the temperature could not be got below an average of 79°, under the most favourable conditions, at the entrance to the washers, formerly mentioned, and in which it was ultimately cooled to about 60°. In the washers a new and most unexpected difficulty arose, namely, a rapid deposition of naphthaline salts, the more unexpected, as hitherto naphthaline was unknown on the works.

I append a table compiled from the results of an experiment made in April this year, extending over five days, of which I will read the averages:—

	Gas Made.	Back Pressure of Gas.	Ex-haust.	Total Resistance to Ex-haust.	Total Water Used in Gallons.	Water Used to Exhaust 1000 Cubic Feet of Gas.	Steam Pressure.	Temperature (Degrees Fahr.).							Air.
								Gas Entering Ex-haust.	No. 1. Outlet of Ex-haust.	No. 2. 41 Feet from Ex-haust.	No. 3. 206 Feet from Ex-haust.	No. 4. 336 Feet from Ex-haust.	No. 5. Vertical Con-denser.	No. 6. Inlet of Washer.	
	Cubic Feet.	Inches.	Inch.	Inches.			lbs.								
April 9-10, 1877. . .	458,000	11·7	··	··	896 3	1·957	53·2	61	142·0	137·0	123	108·0	90 0	78·0	53·0
April 10-11, " . . .	395,000	10·9	··	··	709·0	1·772	52·5	63	143·0	137·0	119	103·0	84·0	76·0	56·0
April 11-12, " . . .	410,000	12·0	··	··	805·5	1·964	52·7	62	144·0	137·0	120	103·0	76·0	66·0	50·0
April 12-13, " . . .	433,009	11·6	0·50	··	891·9	2·060	52·9	60	144·0	136·0	119	101·0	75·0	67·0	49·0
April 13-14, " . . .	442,000	11·4	0·80	··	798·9	1·808	52·0	60	143·0	135·0	119	102·0	82·0	71·0	51·0
	2,138,000	11·5	0·85	12·35	4101·6	1·918	52·6	61	143·2	136·4	120	103·4	81·4	71·6	51·8

During the whole of the five days over which the experiment lasted, the sky was continually overcast, presenting very favourable conditions for condensation.

The total length of horizontal condenser used in this case was 336 feet, giving a cooling surface of 1311 square feet. In the first 41 feet, presenting a cooling surface of 150 square feet, the temperature was brought down 6·8° Fahr., that is, 1° to 24 square feet of surface; in the next 165 feet, having a cooling surface of 605 square feet, the temperature was reduced 16·4° Fahr., or 1° to 37 square feet; and in the next length of 130 feet, with a cooling surface of 556 square feet, there was a reduction of 16·6° Fahr., or 1° to 34 square feet. The total power of the horizontal condenser being equal to a reduction of 39·8° Fahr., bringing the temperature at the inlet of the vertical or slow-speed condenser down to 103·4°. The cooling surface of the latter, including a short piece of 14-inch pipe, was 1230 square feet. On the outlet of this the temperature was 71·6°, giving a reduction of 1° to every 38 square feet.

The total cooling surface of the condensing apparatus was, as I have already stated, 2541 square feet; and the total effective power equal to a reduction of 71·6° Fahr., or 1° to 35½ feet of surface. The average hourly make of gas was 17,816 cubic feet, giving a condensing surface of 142 square feet per 1000 cubic feet per hour.

As to the consumption of water, which you perceive is very large, namely, 1·918 gallons per 1000 cubic feet of gas exhausted, against a resistance of 12·35 inches head of water, I have simply to say that the matter was very carefully gone into, both in this and in other experiments to which I shall hereafter allude, and I have no doubt as to the correctness of my figures. The method adopted for ascertaining the quantity used was simple. A tank of sufficient capacity was filled with a supply of water to last during the whole experiment, and the consumption calculated from the difference in depth from day to day, due allowance being made for any variation in

the level of the water in the boiler. The steam-pipe was 3 inches in diameter, and 53 feet long. It was protected with a wooden trough filled with sand, and all under cover of the same roof as the boiler and exhauster, so that very little, if any, condensation of steam would occur. Both the steam and gas pressure were recorded every 30 minutes during the 120 hours the experiment lasted, and of which the figures I have read are the mean. It is interesting to note the wonderful regularity of the temperature of the gas and steam together at the immediate outlet of the exhauster. Of course, the greater the back pressure the more power—that is, steam—is required to overcome it, and consequently the highest temperature is coincident with the heaviest back pressure, other things being equal. The lowest temperature recorded is 142°, with a daily make of gas of 458,000 cubic feet, and a back pressure of 11½ inches; and the highest, 144°, with a daily make of 410,000 cubic feet, and a back pressure of 12 inches.

As I have already said, the condensing arrangements alluded to in this experiment were found to be insufficient to cool the gas in mid-winter. After it was concluded, therefore, I fixed between the outlet of the exhauster and No. 2 thermometer, where the temperature in the previous experiment averaged 143°, a light rectangular wrought-iron vessel, 13½ feet long by 6½ feet wide, by 13½ feet high, having 11 wrought-iron tubes, 9 inches in diameter, running through from top to bottom, which it was previously intended to use as a resting chamber for the deposit of tar and liquor in the primary condensing process before the exhauster. I append a table compiled from the results obtained from three days work with this vessel in use, from which it will be seen that the temperature at the condensed steam-syphon was reduced to 92°, and at the inlet to the washer to 55°, being respectively 28° and 16·6° lower than in the previous experiment without it. The cooling surface in this case was 3596 square feet, being equal to 190 feet per 1000 cubic feet of hourly make, the condensing power being equal to a reduction of 81°, or 1° to every 44½ feet of surface.

	Gas Made.	Back Pressure of Gas.	Ex-haust.	Total Resistance to Ex-haust.	Total Water Used in Gallons.	Water Used to Exhaust 1000 Cubic Feet of Gas.	Steam Pressure.	Temperature (Degrees Fahr.).							Air.
								Gas Entering Ex-haust.	No. 1. Outlet of Ex-haust.	No. 2. 41 Feet from Ex-haust.	No. 3. 206 Feet from Ex-haust.	No. 4. 336 Feet from Ex-haust.	No. 5. Vertical Con-denser.	No. 6. Inlet of Washer.	
	Cubic Feet.	Inches.	Inch.	Inches.			lbs.								
April 18-19, 1877. . .	434,000	10·7	0·88	11·58	641·2	1·477	52·9	53	136	112	88	68	55	48	42
April 19-20, " . . .	462,000	11·1	0·97	12·07	939·7	2·034	50·6	56	137	116	96	84	68	60	45
April 20-21, " . . .	461,000	10·7	0·95	11·65	713 7	1·548	53·2	57	135	117	93	75	66	58	47
	1,357,000	10·83	0·93	11·76	2294·6	1·683	52·2	55	136	115	92	76	63	55	45

You will see, on comparing this table with the former one, that there was a considerable diminution of temperature at the outlet of the exhauster. The gas and steam pressures being about the same in both cases, it might have been expected that the temperatures at this point would have been similar also, whereas there is a decrease of over 7° in the latter experiment. Probably the explanation of this is to be found partly in the fact that the temperature of the gas at the inlet is lower by 6°, and partly from the consumption of steam being less by about one-quarter of a gallon per 1000 cubic feet. I am not prepared to say positively what gave rise to the diminished consumption of steam in this case. It is quite possible that the rapid condensation of the steam in the chamber immediately on the

outlet of the exhauster is one of the causes; but the lessened resistance from the lighter back pressure, though small, must also be noted. Whether the difference, however, in the consumption of steam in the two experiments is to be entirely ascribed to this latter cause further inquiry must determine.

Before passing to the second part of my paper, I will ask your attention briefly to a third and last experiment, extending over two days. It was made to ascertain the effect of an increased back pressure on the consumption of steam. This showed, as you will see by the table annexed, an immense increase on the previous experiments, and amounted to 2·492 gallons, or say 2½ gallons per 1000 cubic feet.

	Gas Made.	Back Pressure of Gas.	Ex-haust.	Total Resistance to Ex-haust.	Total Water Used in Gallons.	Water Used to Exhaust 1000 Cubic Feet of Gas.	Steam Pressure.	Temperatures (Degrees Fahr.).							Air.
								Gas Entering Ex-haust.	No. 1. Outlet of Ex-haust.	No. 2. 41 Feet from Ex-haust.	No. 3. 206 Feet from Ex-haust.	No. 4. 336 Feet from Ex-haust.	No. 5. Vertical Con-denser.	No. 6. Inlet of Washer.	
	Cubic Feet.	Inches.	Inch.	Inches.			lbs.								
April 25-26, 1877. . .	362,000	15·4	0·65	16·05	887·0	2·450	53·7	61	148·0	122·0	100·0	81·0	67	60·0	51
April 26-27, " . . .	369,000	18·7	0·60	19·30	934·8	2·533	51·5	59	149·0	119·0	93·0	70·0	59	53·0	47
	731,000	17·05	0·62	17·67	1821·8	2·492	52·6	60	148·5	120·5	96·5	75·5	63	56·5	49

Having thus laid before you in as concise a form as possible, my experience of the working of the steam-jet, I propose to offer a few remarks on its adaptability and economy. I have already said that the steam-jet does the work of exhaustion, *per se*, steadily and reliably, and no better evidence of my confidence in it can be given than the fact of my having permanently adopted it. The cooling arrangements bear a close resemblance to those described in the second experiment, but a screw-condenser is substituted for the straight pipes. It may be asked, "Why not use Cleland's steam scrubber and get rid of all these pipes?" The effective work of the steam scrubber (or slow-speed condenser) is not more per unit of surface than that of a horizontal or screw arrangement, or even of a vertical one, where the gas has an ascending motion. I am aware that the aim of the steam scrubber is to convert into an ammoniacal solution the water condensed in it; but it has no special advantage as a condenser. There appear to me to be objections to an apparatus such as this when applied as a condenser in conjunction with the jet exhauster. The difficulty that there may be in regulating the flow of gas equally through all the pipes by reason of their clogging, even partially, by deposits of pitchy matter, such as I have shown you, or by naphthaline salts, both of which may be in a greater or lesser degree considered concomitants of the steam-jet, is a reason which, in my opinion, entirely precludes its adoption. At all events, I prefer an arrangement such as I have mentioned, based on old and well-tried principles. It is free from the dangers attending the steam scrubber, and per unit of surface is quite as effective for the purposes of condensation.

The best method of dealing with the condensed steam is one that must be determined by circumstances. In the case before us, the exhauster was working on the outlet of the washer and scrubbers, in which ammoniacal liquor was copiously used, so there was not much ammonia left in the gas. Consequently, the condensed steam did not contain more on an

average than two ounces of ammonia per gallon of water, but even with the large quantity produced, no difficulty was found in raising it along with the ordinary ammoniacal liquor to 6° and 7° Twaddell, with the pumping arrangements formerly in use. If the whole of the ammonia be removed from the gas by the use of clean water before the exhauster, the condensed steam may be most conveniently run to waste or used under the retort furnaces, as it will possess no value whatever. But in cases where large quantities of liquor can be easily disposed of, it would be found advantageous to use it for the purification of the gas in the ordinary washers and scrubbers.

The amount of steam required undoubtedly points to room for improvement in the construction of the exhauster; for it cannot be considered as having even approached perfection, so long as the expenditure of steam is so much larger than is required by engines. From an economical point of view this question presents the strongest argument that can be urged against the exhauster, and it is one well worthy the attention of the makers.

I will now take in order the various advantages claimed for the steam-jet, compared with other exhausters. These are nine; but may practically be summed up as consisting in—(1), greater make of gas per ton of coal; (2), increased illuminating power; (3), small cost compared with engines and mechanical exhausters; and (4), reduction of wear and tear and liability to derangement.

First, as to the statement that more gas per ton of coal is obtained by the use of this exhauster than with other forms, I would observe that the mere act of exhausting is not capable of realizing such a result, and if the claim is to be substantiated, it must be on the ground of altered conditions of manufacture, or changes of a chemical nature. The only change of manufacturing conditions due to the exhauster is a reduction of the

dip, and, so far as I can see, the only changes of a chemical nature that can come into operation arise *first* from the more rapid withdrawal of the gas from the retort, in the event of the dip being reduced; and, *second*, from the volatilization of the lighter portions of the tar by the heat imparted by the steam. From a scientific point of view it can hardly be considered a satisfactory test to set one period of working with an ordinary exhauster against another with the steam-jet, and claim for either of them any advantage which may be revealed in the comparison, unless it is clearly ascertained that like material was used, and that similar conditions of temperature in the carbonizing arrangements existed in both cases. To secure such a similarity of conditions is, to say the least of it, difficult, if not impossible in practical working, and in saying that I have not found any special advantages in favour of the steam-jet in regard to yield of gas, I must be understood as speaking by comparison. Steadiness of exhaustion, with the attendant advantages it presents for reducing the pressure in the interior of the retorts, is the special aim of all exhausting appliances in gas-works, and no doubt the belief, that the direct action of the steam is the likeliest method to secure this result is the origin of the claim of a superior production of gas by its use. But where the hydraulic main exists it is impossible to remove all pressure, or to prevent oscillation in the interior of the retorts, and I am not prepared to admit that under such circumstances the steam-jet can be brought to act in a way so much superior to good exhausters of the ordinary type. As I have already said, my experience without the hydraulic main leads to the conclusion that there is no gain in quantity; and to my mind more convincing proof than any that has been produced is required to show that it would be otherwise where the hydraulic main does exist. Compared with old and imperfect machines, the adoption of the steam-jet would undoubtedly present advantages; but the real merits of the machine must be measured only by comparison with the best mechanical exhausters. I simply allude here to the chemical action of the steam upon the tarry particles in the gas, to say that whatever may be the ultimate effect of their decomposition it does not appear to increase the volume of gas, while, on the other hand, I cannot but view the deposit of a pitchy mass such as I have shown you as otherwise than a disadvantage and a loss.

The next claim for the jet is an increase in the illuminating power of the gas. The amount is variously given, and reaches as much as 2 candles. I need not say that if such a thing could be shown to exist, a much stronger case could be made out for the steam-jet. I must confess to have had grave doubts as to the possible effects of the steam on the gas, and it was not until the matter was carefully investigated, in the manner I will presently describe, that my doubts were removed. In determining such a question as this, it is manifestly useless to make any comparison of the illuminating power during one period with another. Experience teaches that variations occur, even when apparently precisely similar conditions exist. It is only by submitting the same gas before and after exhaustion to comparative examination that the question can be satisfactorily settled. The gas on the inlet side of the exhauster, being in a state of partial vacuum, cannot be consumed by its own pressure, and mechanical means must be resorted to, to draw off samples for testing. The first method that occurred to me was to fill a small gasholder of 3 feet capacity, by means of counter-weights, testing the sample so obtained by means of Sugg's jet photometer, alternately with the gas on the outlet after being cooled. The results obtained by this means were very conflicting. I next endeavoured to obtain a supply by means of an ordinary wet meter, making the outlet of the meter the inlet for the gas, and turning the drum of the meter firstly by a weight working over a pulley on the drum-shaft, and, secondly, by hand. Both of these methods gave a supply of such a variable pressure that I had to resort to other means, and ultimately adopted the arrangement shown in the diagram, designed by my assistant, Mr. Coombs, in which the pressure of the outlet gas is utilized to give a sufficient pressure to the inlet gas to enable it to be consumed at the jet photometer. The apparatus consisted of a rectangular chamber, formed of sheet tin, and divided into two compartments by a partition in the middle descending to within 2 or 3 inches of the bottom. The chamber was half filled with water and the two compartments so formed connected with the two supplies of gas respectively. The outlet of each was connected with a pipe that supplied a few burners, and from which the supply to the jet photometer was also taken. The gas from both sources was, of course, purified by passing through lime before entering the water-chamber as shown.

The action of the water-chamber is as follows:—After blowing out the apparatus with the outlet gas, which in the present case had a pressure of from 12 to 16 inches, the supply of inlet gas and the delivery of outlet gas is shut off. The supply of outlet gas being continued, the water in this part of the chamber will be lowered, and that in the other part of the chamber raised by the accumulating pressure, thus expelling the gas on the inlet side to be consumed and tested. As the difference of level of water in the two compartments approaches that due to the pressure of the outlet gas (which is seen by the gradual lowering of the lights) the discharge of outlet gas from the chamber is substituted for the inlet gas by simultaneously opening the one cock and closing the other; and immediately afterwards the supply of outlet gas to the chamber is discontinued, and the inlet gas admitted by a similar operation. The outlet gas which has filled one portion of the chamber by its own pressure is now driven out by the head of water thus formed in the other compartment, and at the same time another sample of inlet gas is drawn in to be afterwards consumed and tested as before. The result of this experiment is to show an increase of illuminating power in the outlet gas corresponding to about 2-100ths on the gauge of the photometer; that is, about three-quarters of a candle in gas and from 15 to 16 candles.

The question arises, to what is this increase due? I think there is but one explanation. I have already mentioned the obtaining of a thick pitchy deposit in the condenser, and this fact, taken in conjunction with the increase of illuminating power, may be readily traced to the chemical action of the steam upon the tarry particles in the unpurified gas, which vaporizes their more volatile constituents, and converts them into a gas of a more or less permanent character. From the fact that no increase in the yield per ton has been obtained, together with the occurrence of naphthalene deposits in the washers and elsewhere on the works, I am inclined to think they are not permanent.

You are aware that it has been the custom of late years to condense the gas as much as possible in presence of the tar and liquor in horizontal condensers. One of the chief objects of the arrangement is to allow the tar to absorb those hydrocarbons which otherwise would be carried forward in the gas, and, under sudden variation of temperature, be deposited in the pipes in the form of a salt. I am not prepared yet to accept the theories of those, with whose opinions generally I have great sympathy, who consider it is possible to retain in the gas all the light-giving properties usually absorbed by the tar. I rather view the effect of the steam-jet in this respect as a disadvantage. The true office of the exhauster is to perform a mechanical operation, and the more strictly it is confined to it the better.

On the questions of cost and wear and tear, I do not propose to dwell, having already occupied too much time. They are matters which are

obviously in favour of the steam-jet, and such as can easily be determined by engineers for themselves.

The PRESIDENT: We have been listening to a very able paper—a paper which furnishes evidence that we have all of us something to learn. Our occupation has not gone; that is something refreshing. I have no doubt that the interesting matters which have just been brought before us will lead to further experiment and research.

Mr. MORTON (ex-President) said he had had some little trial of this jet exhauster, and having listened very carefully to Mr. Paterson's paper, he must confess to a feeling of considerable surprise at some of the statements made with regard to the apparatus, more especially with reference to the consumption of steam. Mr. Paterson stated that, having 12 inches of back pressure, he used nearly two gallons of water per 1000 cubic feet of gas exhausted, with a steam pressure of 52 lbs. He (Mr. Morton) had between 90 lbs. and 100 lbs. steam pressure, and, of course, there was less water evaporated to do the same duty, and less latent heat to be extracted. But working against something like 28 inches back pressure, or taking the total exhaust and pressure at 30 inches, he did not require to evaporate more than 1½ gallon of water per 1000 cubic feet. And this, he thought, pointed, in Mr. Paterson's case, to some defect in the exhauster itself, or in the arrangement of the ports of the exhauster, with regard to the quantity of gas that was being passed. He (Mr. Morton) found that by increasing or decreasing the area of the ports admitting the gas through the exhauster, he could use less or more water at pleasure. Of course, the object was to use as little water as possible, and with something like a 20-inch pressure at a vacuum, very little over one gallon of water was used when the ports were properly adjusted. He was, therefore, extremely surprised to hear Mr. Paterson state that he required to use two gallons at something like half the pressure. There must have been something radically wrong in the exhauster itself. Mr. Paterson had not stated how he measured the water. He (Mr. Morton) might say that he measured the water as put into the boiler, there being a separate boiler for the exhauster, so that he could determine the quantity exactly. Then the fact of Mr. Paterson having his exhauster placed on the outlet of all his previous apparatus, except the purifiers—his condensers, scrubbers, and washers—and having a deposit of pitch, due, no doubt, to the action of the steam on the tarry particles, pointed, he thought, to the apparatus being in a very defective condition. He did not think that Mr. Paterson or any other engineer present should leave tarry particles in the gas to that extent, after thorough condensation and scrubbing. His (Mr. Morton's) jet exhauster was placed at the outlet of the ordinary condenser, and the gas containing the bulk of its ammonia was passed through a Cleland steam-scrubber. The ammonia taken out by that scrubber gave a liquor of from 8 oz. to 10 oz. strength; but the difficulty he had to contend with when the distribution through the steam scrubber was as perfect as he could make it, was that when the temperature of the outlet gas was brought down to something like 60° or 70°, there were about 50 grains of ammonia per 100 cubic feet left in the gas. Mr. Cleland claimed for his steam exhauster that it practically took out the whole of the ammonia, and he stated that he used nothing else in Liverpool than this for taking out the ammonia; but he (Mr. Morton) found that, under the most favourable circumstances, something like 50 grains per 100 feet was still left in the gas.

Mr. BRETT (Hertford) said he had used a Körting-Cleland exhauster for about seven months. It was attached to the outlet of the hydraulic main, or rather to the main that was carried over the beds of retorts from the outlet of the hydraulic main. On first using it he found that he could not get his gas at the entrance of the meter below 76° or 80°; but on increasing the condensing power by the employment of a new horizontal condenser of about 200 feet of 10-inch main, he succeeded in getting his gas on an average in the winter down to 57°. He had also experienced the difficulty referred to by Mr. Morton, through not properly arranging the ports of the exhauster. Since the employment of the exhauster he had only been troubled with naphthalene once, whereas in the previous winter he had found it three or four times a week. Formerly, too, he had been troubled with tarry matter in the purifier; now he was quite free from it. With reference to the remark made as to the equalization of the gauge, he could vouch for its steadiness, for though close to the hydraulic main, the oscillation was scarcely perceptible. As regarded the illuminating power of the gas, he found that using the same description of coal employed the previous winter, there was an increase of about one candle, and the make of gas was certainly not less, but perhaps a little more.

Mr. WEST (Maidstone) would like to know whether the writer of the paper had tried the apparatus at a low pressure—say between 30 lbs. and 40 lbs. in the boiler—for it appeared to him to be entirely a question of high or low pressure. The higher the pressure the more economically they could work in all boilers.

Mr. BRETT said he worked at 25 lbs. pressure, but then he had a back pressure of 6 inches.

Mr. GODDARD (Ipswich) said he had had experience of the Körting exhauster during the last eight months working, and found it maintained a very even gauge. He had it placed after the horizontal condenser, and he had experienced the same inconvenience mentioned by Mr. Paterson with regard to the thick tarry matter. He passed the gas, after going through the steam exhauster, through a vertical condenser, and the liquor he got from it was about 10° Twaddel. He was able to get much stronger liquor from the hydraulic since he had adopted the horizontal condenser, and had not been at all troubled with naphthalene since he had had the jet exhauster in operation. He worked at about 50 lbs. pressure.

Mr. CRANMER (Stratford-on-Avon) remarked that in small gas-works they were not always able to get a man capable of looking after the pressure of the steam, and it might vary from 70 lbs. to 30 lbs. He would like to know what difference that would make to the use of the exhauster.

Mr. PATERSON, in reply to the observations made upon his paper, said he thought he had clearly explained that he gauged the water he used in his experiments by the difference of level in the tank, which he reserved exclusively for the purpose of the trials he was making. There was no particle of water drawn out of the tank, but what was going to the steam-jet. He thought Mr. Morton's remarks with reference to the ports of the exhauster were perfectly relevant, and he entirely agreed with him. It was to the construction of the jet that he wished to draw attention, because he could not consider it by any means at present as a perfect machine, requiring, as it did, so large an expenditure of steam to do its work. In fact, as he said in his paper, it could not be regarded as approaching perfection so long as the expenditure of steam was so much larger than was required by engines. He did not feel himself qualified, however, to say what alteration was necessary in the exhauster so as to make it more effective in its work; still he thought there was room for improvement. In his opinion, a longer induction-tube would conduce to more effective and economical work. After the experiments, the results of which he had stated, he purposely laid off the exhauster in order to ascertain whether the nozzle inside the exhauster was in perfect order, because one could understand that if that was choked or broken, or in an imperfect state, the steam would lose the action conducive to induction. He found, however, that it was perfectly in order. He

was not prepared to say that his condensing arrangements were as perfect as he should like to have them—he referred to the condensing arrangements before the exhauster; at the same time, he could not regard them as imperfect; indeed, he thought he had shown in his paper sufficient evidence as to the effective work his primary condenser was doing, because the highest temperature of the inlet gas in April, when the atmosphere was 56°, was 63°, and it had passed through a washer and scrubber, as well as a condenser, before it reached that point. The washer was a large resting chamber—a douche scrubber—consisting of a rectangular vessel with horizontal trays, over which a large volume of water was pumped, and passed through the holes up which the gas rose. There were only three trays in this vessel, which was something like 15 or 16 feet high, so that everything was conducive to the deposit of the tarry matters. He was not prepared to admit that any form of condenser would entirely remove the tarry particles that were held in suspension in the gas, which were so minute that it was with the greatest difficulty they could be kept down. The dip washer and the bell washer were the best appliances he knew of for the purpose, but they could not be used before the exhauster. Then in the steam-jet exhauster there was this difficulty to be dealt with, that the heat of the steam converted these light tarry particles into, first of all, gas of high illuminating power, and then depositing pitchy matter. This gas not being capable of being held in suspension, became deposited in the pipes in the form of naphthaline salts. He could not shake from his mind the conviction that these were concomitants of the steam-jet which no appliance before the exhauster would get rid of. Mr. Brett said he had fixed his jet on the hydraulic main. He (Mr. Paterson) believed there was ground for thinking that to fix the exhauster in that position must lead to mischief. The temperature of the gas in the hydraulic main was not less than 120°, and to run high-pressure steam into that would be to increase the temperature considerably, the consequence of which he could not imagine. He was not in a position to say where, but he knew that placing the exhauster on the hydraulic main had been tried elsewhere, and the result was that the condenser, which was a vertical one of the annular type, became completely choked with a deposit of naphthaline salts mixed with pitchy matters. In answer to Mr. West he must state that he had no record of the variations of the pressure of steam; he had not gone into that. He had varied the back pressure, and found there was an increased consumption with an increased back pressure, and he could not help coming to the conclusion that with a diminished pressure of steam there would be an increased consumption of water equivalent to the increased back pressure. He was rather surprised to find that Mr. Goddard, while getting pitch, did not get naphthaline. Seeing that he himself did get it, he was disposed to think that Mr. Goddard's condensing arrangements after the exhauster were more perfect than his own, for it was quite clear that if the gas were condensed in any way so as to retain in it those light-giving qualities which in some conditions became naphthaline salts, that must be the best form of condenser that could be adopted. But he could not imagine that Mr. Goddard would be able to go on very long in that way. He had only had a few months trial with the apparatus; and, with all deference to the opinion of that gentleman, he could only anticipate that he would have difficulties in this direction in the future. Mr. Cranmer's question as to the variation in the pressure of the steam was hardly a question growing out of the paper.

The President said he had listened with much interest to the reading of the paper and the discussion, having been led to put some faith in this exhauster. Indeed, so highly had he thought of it, that in recently designing new works, capable of manufacturing half a million feet of gas per day, he had intended to rely entirely upon the Körting exhauster, and to give it a fair trial. His opinions were somewhat opposed to those which had been expressed as to the practical working of the apparatus, and he would tell the meeting in what respect. He had yet to satisfy himself, for instance, as to whether the gas should be taken at or near the hydraulic main, or after the condenser, or after the scrubber. His notion was to take the gas from the ends of a pipe or pipes running round the retort-house (the retort-house being 200 feet long), the exhauster being placed before the condenser, and then send the gas forward. It seemed to him to be doing the work twice over to cool the gas down, and then to warm it up again, which would be the operation if the exhauster was placed after the condenser. He was not at present frightened at the apparent danger of treating it in this way. He was inclined to think the tar would be poorer by the process, but then one could not eat his pudding and have it too. The first object of the manager should not be to make rich tar, but good gas. From all he had seen of the apparatus, he was inclined to think that Körting's exhauster would be in favour with gas managers by-and-by; and as to the discrepancies alluded to by the writer, he was not at all surprised. It was a new machine, and might require some careful observation and experience before the best mode of handling it was determined on. Therefore he would say to every member of the Association, "Try it as you have opportunity. Separate some portion of your retort-house for the purpose, and try it in various ways, bearing in mind the vulnerable points, and seeking to remedy those disadvantages which have this morning been indicated in the experience of Mr. Paterson, and the better experience, in some respects, of Mr. Morton." Mr. Morton was satisfied with one gallon of water; Mr. Paterson was more thirsty, and required two gallons. These things could only be settled by practical experience; meantime, he was sure the Association would accord thanks to Mr. Paterson for the pains he had bestowed on the preparation of the paper just read.

Mr. R. W. BRETT (Hertford) read the following paper on

THE SUPPLY OF GAS TO PUBLIC LAMPS.

In bringing this paper before your notice, I feel I have undertaken a task to which I am unable of myself to give full justice; but I trust it will be the means of promoting a discussion or inquiry, in which we shall have the opinions of some of our more experienced members, thereby making it more authoritative, and paving the way to more profitable results.

There can be no disputing the fact that the system itself is not carried out with any universal arrangement; but the means adopted form a labyrinth of ideas in some cases almost difficult to conceive. We have had a number of papers on subjects from the retort-house to the burner, defining the causes of the loss of gas; but I am led to think that a very considerable amount of it passes off through that troublesome consumer, the public lamp.

I have to thank a number of brother members for their replies to my queries some time ago, and it is upon these replies I have to rely for my small amount of the information I shall produce. Some of them were supplemented with accounts of frequent troubles with the local authorities; and I deem myself (as questions were only asked of members of our Association) in duty bound to give an account of them, to the best of my ability, without stating name of town or authority. I have not included gas undertakings owned by local authorities under any heads but those of governors and meters.

The main points, then, are the services and stand-pipes, meters, taps, governors, and burners, the fixing and repairing the same, and the con-

ditions on which the gas is supplied to the local authority; and as any one of these is worthy of a paper, I am compelled to condense each of them.

Firstly, then, as to the services, no one can dispute the advisability of these being the property of those supplying the gas. But that this rule is not universal is proved in the fact that, in no less than 88 instances out of 243 they belong to the local authorities, and among the remaining 155 the gas company only claim to the foot of stand-pipe in many cases, the local authority repairing all above ground. The supplying, fixing, and repairing in a number of instances is done by painters, plumbers, gunsmiths, blacksmiths, and, in fact, most inexperienced men are employed by both gas companies and local authorities to perform this most important work. It matters not to such whether gas escapes or not; all they care is that the pipe is put out of sight, and that gas passes through to the burner, they know their bill is safe. The employment of such labour as this cannot be too fully deprecated. Those supplying the gas should insist (as a condition of supply) on fixing and repairing the service, even if it is to become the property of the local authority, but on no account should they be allowed to interfere in any way, though they are very apt to assert that they can do as they like with their own property.

It is very essential that none but skilled labour should be employed, and that it should be the labour of those supplying the gas, inasmuch as there is naturally more interest taken by them than by outsiders. The tools and the fittings, too, should be the best, for a badly-tapped main, or a badly-threaded pipe, would prove the source of as much escape as a badly-welded tube. To secure all this, the authority supplying the gas must have the entire control of all the service. To ensure a good supply, the service to a lamp should not be less than three-quarters of an inch, attached to the main by a connecting piece, and a back-nut and gummets screwed tight up to the main, and having a tee-piece and plug at the bottom of the stand-pipe.

A number of suggestions have been made and plans adopted for the preservation of services, especially for the hungry, damp, gravelly soil. Some propose that the pipe should be encased in a box or trough, filled with sawdust and tar; others pitch, tar, and paint; whilst some put the plain pipe into the ground, without making any provision for its preservation. Now, the troughs, though very effective, are rather too costly for small undertakings, and as for bare painting or tarring, it does not answer. The method I adopt is to have all wrought-iron pipe, when new, covered with a coat of good paint, and, when laying it into the ground, mix some tar with the earth, making, as it were, a tar concrete round the pipe. I think this will prove effective, but I almost question whether some tars alone preserve the pipes at all. I have found some very much eaten into when only tar has been used; but, let whatever methods be adopted for their preservation, they are futile when rust has once commenced its work, hence the necessity of well painting the tubes when new.

The stand-pipe from the service to the tap should not be less than half an inch, and inside the column, as also against the walls, should be wrought iron; any metal used in the brackets must not be less than three-eighths of an inch in the bore; copper or brass should not be used; in fact, iron throughout is the best. Care must be taken that the internal pipes of a lamp-column are firmly fixed, and I should recommend that at the annual, or other examination the pipes should be taken out and painted, as some of them will be found more rusted than if exposed to the open air. The stand-pipes against walls should also be well painted. The usual plan is to just bedaub the part seen, which is really that least needing it, as the dirt, cobwebs, &c., encourage the moisture between the pipe and the wall, and excessive corrosion is the result. As the painting is generally done by contract, these in no way mean points are entirely overlooked. To prevent escape when examining the stand-pipe of a column, a small india-rubber plunger attached to a ¼-inch rod may be used; it will also answer for a guide for refixing the pipe in its position, into which it may be lowered as painted.

The next things we have to consider are the meters. Some suggest that the average meter system should be adopted, others not; and to prove that this is a question far from settled, I may say that in 296 instances only 80 use meters—viz., 59 gas companies and 21 local authorities, leaving 179 gas companies and 37 local authorities not using them. Where they are used by the companies they are charged at a rental. As to the average number, it varies; for instance, in two cases a meter is fixed to every lamp, and as a set-off to that, one or two use it at the rate of one to every 100 lamps. But leaving out these exceptions, the average is one in 14. If the district is uneven, and no district or lamp governor used, I should say, have a meter to every lamp; but if the conditions are the reverse, the less meters the better. But with all this, some are contemplating using, and others discontinuing the use of, meters to the lamps.

Now, surely one system must be right, and there cannot be anything wrong in the meter system, under proper conditions. The authorities generally prefer them; at the same time they are the source of a great number of unpleasantnesses and warm disputes. The inspectors of the local authorities often being men ignorant of anything practically appertaining to gas, rush into figures attempting to prove that the company are doing everything to rob the public; and, should it be the lot of the company to light and extinguish, of course they are accused of leaving on metered lamps, or leaving out non-metered ones. If the local authority light, this would not be done; these are the chief difficulties to the more general adoption of the system. The conditions, I think you will agree with me, for more effectively carrying it out, are—first, that the meter must show as little as possible the result of friction, not taking more than 1-10th pressure to work it—less, if it can be; the position of the meter must also be taken into account. In a number of towns it is in the base of the column, in some underground, and I have seen some fixed in boxes on the flats of walls. The underground plan is by far the best, from its non-liability to be affected by changes of temperature, which alter considerably the registration. In the event of its being in the base of the column, the lowness of the temperature, especially when the consumption is at its highest—viz., in winter—must be the cause of a great amount of unaccounted-for gas. As to fixing the meters in boxes against walls, I should not at all recommend it for any reason.

Not only must the meter be the more perfect for the average meter system, but the tap, the governor, and the burner must be so also. The full way of the tap the Gas Referees put at one quarter inch, and the minimum pressure at the inlet of the governor at 5-10ths, and at the point of consumption 2-10ths. Most crank-taps in use are apt to get loose at the screw and collar, which tighten the plug into its place, and a liability to loss is apparent, there being sometimes rough usage to them when working stiff, from the torch, and often when the repairs are not under the supervision of the gas company, these leaks go on for some time unnoticed, or, if noticed, not reported. In some cases the screw is loosened by the knife of a lamplighter, and sometimes it is lost altogether. This evil is, in a great measure, met by a crank-tap; I am using one supplied by Mr. Sagg, the plug of which is held in position by a screw passing through the body of the tap into a groove in the plug; I think practice will prove that this is a step in the right course. I am now alluding to lighting by torch, although we have still the ladder in use where the torch would be advantageous.

Next in order follows by far the most important appliance—I allude to the lamp governors—and here alone, from their most importance, is room for a future lengthy practical paper and discussion, for great improvements have been made in them these last few years. I hold them to be essential, and the only safe appliance to lead to the goal of perfection and fairness between the gas company and the local authority as to the gas supply, and if anything will aid the use of meters to street-lamps, it will be the general adoption of a reliable lamp governor. I think with such instruments any zealot of the hourly rate system would give in at once. There are a great number of governors in the market, some of them excellent specimens. But I must recommend every one, before he generally adopts them, to make himself thoroughly acquainted with them. I am aware that in some instances the directors will not sanction a slight outlay for testing apparatus, but we must class these among the “penny wise and pound foolish” clique of ignoramuses. For instance, governors are ordered to pass, say, 5 feet per hour of 14-candle gas at a minimum pressure of 5-10ths. The governors come to hand, are tested for consumption at the above and augmented pressure, and they are apparently as required; but accidents will happen, therefore suppose a burner gets broken in springing, or by some other unlooked-for means, the result is that a number of these governors will pass 10 or 12 feet per hour. Now, in such cases as these, it appears they are dependent on the burners to help them, and very often the burners sent with them are not adapted to the gas; for one suited to 30-candle gas at 5 feet per hour would not give the light of a farthing dip of 14-candle gas at the same rate of consumption; hence arises one of the difficulties to the more universal adoption of the lamp governor, which, if a perfect one, should not pass more than its specified quantity, even without a burner. Then the person using the governor can make his selection of the burner best suiting his gas, taking care that it is sufficiently large to pass its full quantity at minimum pressure. Then if, with the governor and suitable burner, say 5 feet per hour can be passed at 5-10ths pressure, and this consumption cannot be increased with augmented pressure, nor can it with the burner out, we have all we require. I have taken 5 feet consumption merely as an example; of course these would vary according to requirements. The 5-10ths pressure would be as low (bar accidents) as one would expect to find even at metered lamps, but I think it essential to have at least 3-10ths margin above the 5, to ensure against little mishaps, &c. It is rather singular that out of 296 authorities supplying gas, there are still 91 using the burner without governors, 15 of these with meters, and 76 without. Some of the burners, very good in their way—such as the Brönnner, Bray, Clegg, German, and others—ensure a good combustion, but do not govern. Not only are these burners used, but there is likewise a strange admixture of common bat’s-wing and fishtail, supposed to consume in quantities from 2 to 5 feet per hour. There is the single jet in Scotland, and there and elsewhere we find union jets—No. 1 calculated to 2 and 2 feet per hour, No. 2 to 4 feet, and No. 3 to 6 feet, supposed to be passing, some one amount and some another, up to 5 and 6 feet per hour. Now, in such instances as these, how are they regulated? Will any of them pass the same at 5-10ths as at 15-10ths pressure? The following table proves to the contrary by giving the increase in consumption in 10ths of an inch.

No. of Burner.	Brönnner.	Bray.	Clegg.	Leoni.	Jet.	Bat.
3	1.5	2.0	—	3.3	2.4	—
4	1.65	2.5	—	4.0	2.9	2.0
5	2.9	3.2	4.3	4.2	3.5	3.7
6	3.5	3.6	4.4	4.4	4.4	4.8

With such burners as these, how are the charges regulated? They are all charged at some stated rate, and it cannot be disputed that, in some hilly districts, where the district governor is not used, there must be an alarming difference, and also an alarming loss, whether meters are used or not. As an example of the use of one of the better class of burners without a governor, but under the average meter system, showing clearly a loss by using a meter to other than governed burners, I may mention that I once tested and found that at the metered lamp-columns there were only 2.75 feet per hour passing, at the columns not metered 3.57 cubic feet, and at the brackets 3.31 cubic feet per hour; or, putting it in plain figures, the company were losing 0.82 cubic feet per hour, or 12s. 6d. per year, on lamp-columns, and 0.56 per hour, or about 8s. per year, on all the lamp-brackets—this, too, with a No. 3½ burner. Now, if so heavy a loss with so small a burner, what must it be where the burners are large, and, perhaps, 2-10ths or 3-10ths taken off by the meter, making, for every tenth, a difference of about 0.25 feet per hour, which, if going on for 4000 hours, gives 1000 cubic feet per lamp per year—no mean item where several hundreds of lamps are used. But this is taking it very low. Where the governor is not used, we are told the light is regulated by sight. I should like to know whose eye is sufficiently practised to tell the quantity of gas passing through a common bat’s-wing, some of which will give a far better light at 5 feet per hour than others will at 10 feet? In such cases the loss must be beyond conception, and hundreds of pounds are lost by the gas companies, the public reaping the benefit. Now, by the use of the governor, all these differences of district, meter, &c., are put out of question. But, as I before stated, there is scope for a separate paper here, still I hope I have said enough to show that the governor is really a necessity in street lighting. As to the use of a meter or no meter where the governor is used, it is immaterial (although I should prefer it), but it is positively essential at every lamp where it is not used.

As to the modes of lighting, I have not much to say, but will leave that to others more conversant with the tried and untried appliances. I think that the present almost universal means of lighting by torch will be some time before it is superseded. But who can tell what may be in store? We hear so much of the lime, magnesium, and electric lights—these are days of wonderful advances in science, and none of us can foresee what may be in the future; and it is well we cannot, for we might be almost ready to forsake our trust, and search in other fields of industry.

I have had an automatic lamplighter brought to my notice, and I must confess it is a most beautiful instrument. It is a governor as well as a lamplighter. On turning on the light, the pressure is conveyed from a small jet (where it is kept alight all day) to the burner, which takes up the increased supply of gas. Upon this lighting, the jet goes out, the light at the burner continuing the same at the decreasing pressure of the night. To extinguish the lights the pressure has to be increased, and on again taking it off, the apparatus is so arranged that the holder drops, opening the gas-way to the jet and closing it to the burner. I have one here for your inspection; but as I believe there are gentlemen here who have used it, perhaps we may hear more of it.

I should certainly recommend gas companies to light and extinguish the lamps themselves. There are many advantages, they being more readily made acquainted with anything in the shape of leaks, want of pressure, accidents, &c. Out of 237 companies, 163 do this work; but some of it is undertaken by contractors in their employ, these also do repairs.

As to the matter of lamp-posts and brackets, I think we may leave them, for it is almost impossible to set any rule for guidance. The local authorities generally direct them to be set up here and there, very often regard-

less of the position at which the light is required, and we are in many cases bound by their decisions. Some say they should be 70 or 80 yards apart; but this is not to be used as data. Lamps with a fair light and fair way to shine should not be more than 70 or 80 yards apart; but we find in the densely-populated City of London, 20 yards often nearer the mark. There is no question that towns well lighted are not so well robbed, for the public lamp is a public guardian always found at his post, when properly fed.

It is well on the part of those supplying gas to see that the lanterns are so constructed that the full benefit of light is obtained; for, in many instances, we see about an inch or two of paint, putty, and metal at each of the angles of a lantern, and as much shade as light thrown round. Then there is the very awkward cradle, casting positive shades in all directions. There are some excellent specimens of lanterns in existence—viz., the Catoptric, the Westminster, &c.; but I think these are more for local boards and private consumers in small towns than for gas companies to look to. I know where the introduction of the Catoptric led to the leaving out several of the town lamps; and we provincial folks find the public authorities take every opportunity of leaving lamps out. Mr. Keen, of Hastings, too, has a neat double-clipped lamp, which does away with the putty; the glass, too, can be removed whilst painting. But there is the objection in most lamps that they cast too much shade. I have a specimen of one here that I think meets the requirements. There is but one shade cast outwards from it, and that may be kept the wall side. Both the top and bottom frame clip on to the support, which can be used to pillar or bracket. The glass is fixed in by clips. The top may be glazed or not it can be easily taken to pieces, and can be packed in a very small compass.

It does not affect a gas company, whether or not they own the lamp-columns, &c.; if they own them they charge for their use. The conditions of supply seem to be the most varying. Some gas companies merely supply the gas; some supply gas and repairs, but do not light; others supply and light, but do not do repairs; and others neither light nor repair, whilst some do all. But I must say again that whether the fittings, &c., belong to, or the lighting is done by, the local authority, the gas companies must, under no circumstances, allow the local authority to either fix or repair any fittings through which passes unregistered gas, and this should be clearly laid down in an agreement, with other matters, which should always exist where gas companies supply local authorities.

The very generally adopted plan is to charge the number of hours consumption at per hour, by a table of lighting, the gas company doing the lighting and repairs. Then there is the yearly rate from sunset to sunrise, the average charges being in the north about £3, in the south £3 15s., in the west £3 5s., and in the east, including the London district, £4 15s. The highest under this head appears to be £5 5s.

The average charge for repairing, painting, and lighting is about 15s. 3d. per lamp. I do not consider this sufficient; 16s. or 17s. is little enough. One or two generous companies do the work for 10s., whilst another charge 23s. Among the charges we find 2d. per lamp per night for gas and lighting, 3s. 6d. for maintenance only, 1s. per lamp per week without repairs, 2d. per lamp per week for lighting only, and 8s. 6d. per lamp per year; 10s. per lamp per year, which is not bad, and we should do well if we could all get it. But all this must be affected in a measure by locality. Still the charge is pretty general. There are a few more eccentricities. We have some towns in which (though there are gas-works) the streets are lighted with oil; in another the gas is supplied at cost price, having a loan of money from the town free of interest, and it is given in two cases; ½d. per hour per lamp is another charge. Some put out part and others all their lamps at times varying from nine p.m. till sunrise; some leave out a week before and after full moon; some light three, four, five, and six months only; nine months is a very common time, and there are other mixtures too varying to bring to your notice.

I am sorry that I have encroached on so much time with this paper, but there is in any one of the subjects ample scope for an independent and lengthy discussion. I may add that in drawing up agreements of supply, the chief points that must on all accounts be inserted are, that the authority furnishing the gas should insist on supplying, and fixing, and repairing the services and fittings and on the use of governors, and if the local authority light and the gas is charged per hour instead of meter, the torches should be kept at the gas, police, or fire stations, and notes made of the time they are taken out and returned. I now place the facts in your hands, hoping that, by the aid of my more experienced seniors, general good may accrue therefrom.

Mr. A. F. WILSON (London) thought it would be very interesting if they could get at the bottom of the question as to the expense of laying a separate system of mains for the supply of the public lamps. If it could be done the lamp consumption would then be determined by a station or large meter at the outlet, and the disputes as to the variations of consumption now continually arising would be settled for ever. Most of the members present remembered the transitions which had taken place in the modes of supply, from the system of contracts at so much per lamp per annum, double taps, governors, average meters, &c.; and referring to the meter system, he might remark that it seemed to him, if they had to put a meter to every lamp, they might as well go to the expense of laying a separate main for the special supply of the public.

Mr. J. JOHNSON (London) said for a great many years he had been much troubled with this question of the supply of gas to public lamps, and he had come to the conclusion, after trying almost every scheme, that the only way to get along comfortably was to adopt the average meter system. He knew, from a great many experiments made during the past year, that gas companies had been serious losers by the ordinary contract system of lighting. Year after year he had taken down hundreds, and in some years thousands, of governors and burners for the purpose of testing them; and, after getting the best governors and burners that were made, he found great variations in the quantity of gas consumed by them. About four years ago, in the City of London, a bold statement was made by the chairman of the Gas Committee of the Corporation—that although the gas company were receiving payment for 5 feet of gas per lamp per hour, the consumption was only 3½ feet. He (Mr. Johnson) thereupon suggested that they should appoint some independent person to test the governors, to ascertain what the actual consumption was. The Gas Committee accordingly appointed Mr. Heisch for the purpose, and the matter was left entirely in that gentleman’s hands to select which of them he would experiment upon. In the result it was found that, instead of consuming only 3½ feet per hour, as was stated by the chairman of the Gas Committee, they averaged 5.7 feet per hour. At one time he was always having complaints made as to the irregular way in which the lamps were lighted in those parishes in which the average meter system was adopted, but now all such complaints had ceased, and those who formerly had the charge of doing this work had their minds entirely at rest on the subject, for they could answer any expressions of dissatisfaction by saying, “The matter is in your own hands; the gas company are not responsible; and if you have anything to complain of, you must go to the local authorities;” a very desirable state of things for a gas manager. With regard to the average meter system, no doubt there did arise certain little irregularities; but so far as his company were concerned, they had reached that happy condition that they were more nearly paid

for the gas consumed than they ever could be under the old system. He felt persuaded that it would be a great benefit to gas companies generally if they could introduce the average meter system, inasmuch as they would not only thus get paid for the gas actually consumed, but they would get rid of the continual complaints of the local authorities in respect of the public lighting. He did not think he could enter very largely into the questions touched upon by Mr. Brett, further than to say that the system adopted with his company was this: They took charge of laying the services; after the services were laid the meters and fittings were provided by the local authorities, and there were very stringent regulations as to the maintenance and repair of these things. The company had an inspector in each district, whose duty it was to go round and see that everything was in good order. The meter, they found, was a great indicator of the state of the burners generally. They knew very well if the governors were properly constructed and well regulated, and were working well, on those lamps which had no meters, by the results indicated by those which had meters. They took out the meters once a year to test them, and they had an arrangement with the local authorities by which those bodies were required to test their governors once a year. It was also done occasionally by the company's own officers in conjunction with theirs, and such governors as were found to be slightly irregular, say, beyond one per cent., were taken out, re-adjusted, and set right. This continual readjustment secured for the gas companies, in his opinion, a much nearer approximation to a correct registration of the gas consumed by the public lamps than any other plan which had been adopted. As to the suggestion of a meter to every lamp, that, he thought, would be a very great and quite unnecessary expenditure, and as to the proposition of laying a separate main for the public lamp service, he did not think there would be much gained by it. The main would necessarily be smaller than that in use for the general consumption, and therefore more liable to breakage, more liable to leakage from the joints. Looking at the question from all points of view, he thought the system would be an extravagantly expensive one to adopt as compared with the system now in operation, and he should certainly expect to find that the unaccounted-for gas would be very much increased. He had some experience with small mains in London. A great quantity of them were laid down by the late Great Central Company, and when they came under his supervision some years ago, he found them to be in a terribly bad state indeed. He could not go a hundred yards, even where these mains were laid under the footway, without finding broken joints and much consequent leakage. As the fruit of his experience, extending over a long period and a considerable district, he was clearly of opinion that the adoption of a system of small mains for the exclusive service of the public lamps would lead to a large increase in the per centage of unaccounted-for gas. On the other hand, he was fully convinced that the adoption of the average meter system was the best solution of the difficulties hitherto experienced between the authorities and the companies in reference to the public lighting question.

Mr. CARR (Halifax) said he was one of those happy individuals whose lot it was to serve a corporation, and, therefore, it might be supposed that this question did not much affect him, but was only of interest to gas companies. Still, corporate officers were affected by it. The Lighting Committee of his borough were the Highway and Watch Committee; they bought gas from the Gas Committee for the public lamps, and some little differences arose at times as to the proper measuring of the gas, and the proper way of supplying it. The lamps were supplied on the average meter system, and there were governors to every lamp. The district was a very irregular one, and the pressure varied from 5-10ths to 50-10ths. He had lately been trying some experiments to ascertain the consumption of the public lamps. On removing the governors he found the average consumption throughout was 4.1 feet per hour, testing at 8-10ths pressure. When the governors were replaced, the consumption was 3.5 feet, on the average of the whole. He set a man to watch the metered lamps to see the exact time they were lighted and put out, and in that way he succeeded in getting another quarter of a foot per hour in those lamps. Something might be said about the meters taking off a certain amount of pressure, but still the pressure over the whole district was much higher than what he had been testing at, and it was one of the things he had not quite satisfied himself about, that governors could be so relied upon under varying conditions of supply, such as in his district. He was much pleased with the paper which had been read. It gave a large amount of statistical information, and furnished some interesting details of the various modes of supply adopted, from the most primary which was still retained in some places, down to the most improved plans which experience had devised. He agreed with the writer when he said that some burners were so defective that the companies lost half the gas supplied to them; but he did not agree in his further remark that the public reaped the benefit of it. In truth, no one derived benefit from it. The miserable burners employed in some towns for the consumption of gas in public lamps were a perfect disgrace at the present time of day. And in reference to the disputes which sometimes arose, he thought that if the local authorities better understood their business, and, instead of railing against the gas manager, would try and obtain information for themselves as to the best conditions of gas supply, not only would the companies be benefited, but the public would be better satisfied. There was one point in the early part of the paper to which he wished to refer. Mr. Brett, speaking of the importance of the preservation of the service-pipes, said the method he adopted was to mix a quantity of tar with the earth in which they were laid, so as to make a sort of tar concrete all round the pipe. He would like to ask Mr. Brett how many pounds of tar per yard he would require to imbed his pipes in, supposing tar to be a good thing to apply to wrought-iron services, which, he thought, was not quite proved. To him it appeared to be rather a lavish system, when tar commanded a high price, to employ it in the preservation of lamp services.

Mr. WARNER (South Shields) said he did not gather from the paper what proportion of metered to unmetered lamps the writer advocated. As to the laying of the services, there could be no doubt that if a thing was worth doing at all, it was worth doing well, and he could not understand that the lavish mode proposed, of pouring tar in unlimited quantities around the service-pipes, amongst a lot of loose damp earth, was at all comparable to the plan of laying the pipes in troughs, and filling them up with melted pitch. He quite agreed with Mr. Brett that the fittings should be entirely in the hands of the gas company. He had maintained for many years that they should have entire control over the gas. With reference to the cocks used for public lamps, many of them had no means of indicating whether the supply was on or off. He had had his furnished with a little pointer, which was turned upwards when the gas was on. In addition to the ordinary washer and nut, he had a thumb-screw, so that in cold weather the lamplighters could keep hold of them.

Mr. BATES (Workop) said he thought that, when adopting the average meter system, the fewer meters in use the better. He would as soon have 1 in 20 as 1 in 12. As to having a separate main for the public lamps, he was sure it would not be worth the expense. It would, as Mr. Johnson said, add to the leakage considerably, and would yield no permanent benefit. Some three years back the lamps in his town passed into the hands of the local board, and there appeared to be a question whether they should buy the lamps from the bottom of the stand-pipes or from the

main. He suggested that it should be from the bottom of the stand-pipe, but the chairman of the local board would have it from the main. He, therefore, inserted a clause in the agreement that the services should be thoroughly examined, and, if any defects were discovered, that they should be repaired at once; and that, if not attended to by the local authorities, they should be repaired at their expense by the company. He thought it was best to lay service-pipes in troughs filled with sawdust, and he could state that some taken up by him within the last six months, that had been laid nearly 30 years, were as good as ever. As to the position of the metered lamps, he regarded it as of little consequence; the registration would be nearly the same so long as good governors were in use.

Mr. G. ANDERSON (London) said he was not an advocate of the average meter system, and he felt bound to give his reasons for not adopting it, seeing that so experienced a man as Mr. Johnson had given in his adhesion to it. First, then, in order to be paid for all the gas supplied under that system, it was necessary to have in the mains an extra pressure of about 2-10ths beyond what was required when no meters were in use, and this additional pressure caused increased leakage at the unmetered lamps. He did not agree with the writer of the paper that the local authorities were ignorant. On the contrary, he found, as a rule, that they were very acute, and required a considerable amount of looking after. There was a gentleman present on this occasion who had the charge of lighting a large city of 100,000 inhabitants on the average meter system. This gentleman informed him that there was a continual complaint in the city that the local authority were in the habit of sending round and turning out the metered lamps an hour or two before the regular time, so that the gas company were put to the expense of having to employ men to perambulate the streets during the night to stop these proceedings. For such and other reasons he (Mr. Anderson) could not approve of the average meter system. He believed there were only two methods that could satisfactorily be adopted—one was the system very wisely advocated by Mr. Hawksley—that of having a meter to every lamp, or the laying down of a separate main for the public lamp service. He did not see that it followed there would be more leakage from having a separate main, because under that system a meter would be put down at the gas-works to measure all the gas supplied to the main, and it would therefore be to the interest of the local authority to see that the main was sound, and the company would be paid for all the gas registered as having passed the meter. But really it was not necessary practically to have a separate main in that broad sense. Why not have one meter in the middle of each street, with pipes supplying 10 or 20 lamps each, branching out from it, and one small main for each section. This would give almost the same result as now was obtained with a meter to every 10 or 12 lamps. No doubt, under the old system, the companies supplied much more gas to the public lamps than they were paid for, and it was important some improvement should be effected upon that state of things.

Mr. COLES (Tadmorden) thought the public lighting would never be satisfactory until the supply of gas came under corporate management. One difficulty in connexion with the meter system was the influence of frosty weather upon the meters.

Mr. CORR (Watchet) said in his town, until about two years ago, the company entered into a contract for the supply of gas at so much per lamp, but since then the authorities had introduced the meter system with painful results to the company, for it had actually reduced their returns 50 per cent. The claim was set up on behalf of the local authorities generally, that because they were large consumers, therefore they should be supplied at a lower rate, the fact being lost sight of that each lamp, requiring a separate service, was a distinct source of leakage as well as expense. He thought more attention than hitherto should be paid to the burners employed in the public lamps.

Mr. WILKINSON (Harrogate) said he had had some little experience, not only with regard to the meter system, but also, for one year, in relation to the supply of the public lamps with petroleum oil. The company to which he belonged supplied the public lamps by contract for some years, using the best burners they could get, and they offered to furnish governors to the lamps and to keep them in repair, provided the commissioners paid the first cost of them. This they refused to do, and at last the parties got into such hot water, that the local authority determined to discontinue the use of gas, and light the streets with petroleum oil. He was glad they did so, and he would advise all his brethren in similar circumstances to let it be done; the authorities would soon get sick of the experiment. His company had always calculated that there was a very serious loss by over-consumption in the public lamps, when supplied without meters, and, in proof of that, he might mention that during the year the lamps were lighted with petroleum, the company were enabled, by the saving of gas alone, to pay half the bonus to their shareholders. Reference had been made to the difference between the metered and unmetered lamps—probably there was some little difference—but he believed that, where proper meters were used, and properly fixed and charged with glycerine and water, there was no danger of any great difference arising. The adoption of the average meter system in his town had given great satisfaction to the local authority, and to the company likewise. The former purchased the posts from the company, and laid their own pipes under the company's supervision, and under agreement that they should be such as met with their approval. The governors professed to fix the consumption at 5 feet per hour, and the experience of their working was that they gave an average result of 4½ feet. The commissioners at one time had it in contemplation to lay a main of their own for the supply of the public lamps, and to take all the gas through a single meter. He wished they had done so, because then the company would have been saved all the leakage on the lamp-services; but they found upon investigation that the cost of such a main for their 330 lamps would have come to something like £3000.

Mr. EDWARDS (Thornton) had had the average meter system at work for three or four years to between 300 and 400 lamps. The company forced the adoption of it upon the authorities on their bringing against them a charge of fraud, and since the first quarter's bill went in there had not been a single complaint of any kind. In fact, every one was satisfied. With regard to the remarks made about the difference of consumption between the metered and unmetered lamps, he had taken a course different, perhaps, to some members. He tested every governor by putting it upon an experimental test-meter, and all those which would not stand an increase of 10-10ths of pressure, without altering the registration, he rejected. The result of that was that he had got paid for 93 per cent. of all the gas he made.

Mr. LIVESAY (Ventnor) differed from Mr. Anderson in reference to the average meter system, and was decidedly in favour of that mode of supply to the public lamps. For some years he was secretary and manager of the gas and water works in his town, and was also surveyor to the local board. The disputes and squabbles arising out of the contract system of lighting were interminable, and it appeared that the company could never give satisfaction. The local board consisted of 18 members; there were three newspapers in the town, and every member was fond of writing to them. The company lighted the lamps, cleaned them, extinguished them, and supplied the gas for about £3 per lamp per annum, during eight months of the year, every night, from sunset to sunrise, except five nights at the

full moon. About six years ago, when the contract was about to terminate, they intimated to the board that they could not renew on those terms, and suggested the adoption of the average meter system. Several interviews took place on the subject, and, as he had the confidence of both parties, he was asked to draw up an agreement. He did so, the arrangement was made, and they had gone on very amicably ever since. Under this arrangement, the company still had the control of the services from the main to the burner. The local board paid for the stand-pipes, governors, burners, &c., and kept them in repair. They also provided wet meters, specially adapted for the purpose, in cast-iron cases, which were fixed beneath the pavement. The number of meters was one to every six lamps. The district was a very heavy one, the variation in level from the sea being 360 feet. They had no governors. The local board kept the lamps in repair, lighted, cleaned, and extinguished them, and for the quantity of gas supplied they paid at the same rate as that charged to the private consumers. As he had already stated, there had been no dispute at all between the company and the board since this agreement had been made. But there was one circumstance which he thought had rather pleased the ratepayers, but about which he thought the local board had rather hoodwinked them. When the company lighted under contract at so much per lamp, they kept the lamps alight from sunset to sunrise, but directly the local board took the matter in their own hands the lamps were extinguished at one o'clock; now they were extinguished at eleven o'clock. The ratepayers, of course, had not so much to pay for the gas through this retrenchment; but the company had no reason to complain, as they received nearly as much for the public lamps now as they did when they were kept burning till daylight. As a word of advice to members, he would caution them, in adopting the average meter system, not to put too few meters, especially in some districts.

Mr. BRETT, in the course of his reply, said he did not think his plan of laying services was open to the observation of lavish expenditure, as he only used about a gallon of tar to every 10 feet of pipe, at a cost of about 2d. There was no necessity to fill the whole of the trench, but only just round the pipe, with the tar. He thought the general opinion in the meeting seemed to be in favour of the meter system, especially if governors were not used. As to the number, his own idea was that one to 14 lamps was sufficient, and this he found was above the average.

The PRESIDENT said the members generally would agree with him that they were much indebted to Mr. Brett for bringing forward this subject. His paper had elicited a great amount of information from one and another in the way of recapitulation of personal experiences, which, no doubt, would be of general benefit. It was a very fruitful subject, and had borne fruit in the way of suggestions as to what to do and what not to do, what rules to observe, what errors to avoid, and how best to meet difficulties in the supply of gas to the public lamps. With regard to Mr. Wilson's remarks, he (the President) did not sympathize in the notion of supplying the public lamps through a separate main. It would involve a very large expenditure, and the interest on the capital would more than balance any saving that could be effected, to say nothing about the additional leakage, and the friction which would take place in a small main of that kind. But this was a matter which each could settle for himself; given any town, to ascertain how much main would be required to be laid for this service, and how much the cost would be. In some cases he apprehended it would amount to half the cost of the public lighting. Looking at it from all points, he was not himself inclined to the adoption of this plan. On the contrary, he objected entirely to having two mains in the streets. It should be a great point with every company to have abundant main capacity. By using large mains instead of small mains, the unaccounted-for gas was reduced because the supply of gas could be given anywhere in the district at the lowest potential pressure—i.e., the initial pressure at the works. This he held to be a very important consideration. Assuming the mains were properly laid and properly cared for, then he would say, "See how economically you can supply gas at the lowest pressure when the consumers are all gone to bed, and no one up but the public lamps." He knew from experience that very great economies had been effected by carefully watching the pressure after eleven o'clock at night. In some towns, of course, where a night train was due at twelve o'clock, that must be the time; but his advice was, wherever practical, reduce the pressure to the lowest point after your consumers' meters have left off working. With regard to some remarks made by Mr. Anderson, it was a matter of congratulation to see Mr. Anderson in such excellent form. He was always vivacious and lively, and incisive; but, *query* whether the alteration in the old state of things ought not to modify one's old feelings of—well, he would not say unkindness, because gas men were never unkind to any one. But seeing that a great many corporations had bought works belonging formerly to companies, they might now be regarded as occupying the position of companies in former times. They were bound to manufacture and supply gas, and the Gas Committees had to see that the Lighting Committees paid for all they consumed in the public lamps, and it was a matter for congratulation that corporations had been brought to supply gas on sound constitutional principles. Now, with regard to the average meter system, which did not find favour with Mr. Anderson, he (the President) would say for himself that, having been a bitter opponent of it, and fought many battles for the companies against it, he now approved of it. Some 30 years ago, in a town with which he was connected, he found the old principle in vogue of bribing the corporation by supplying gas to the public lamps at a lower price than to the private consumer. His first stroke of business was to increase the charge to the public lamps 15s. per annum, and reduce the price to the private consumers. A meeting of the corporation was held, and he was asked to attend. There was a great deal of vigorous speaking, and when he got a hearing, he said: "I am not putting this 15s. into my own pocket; I am taking it from you and putting it into the pockets of the consumers, and I say that the old system of charging less to the public than the private consumers is not justice and equity. It is not a sound commercial principle that you should pay 4s. while the private consumers pay 6s. You say you are a large consumer, but I say that, taking each individual case—and I treat each lamp as a single consumer—you are a small consumer. You pay only £3 per year for each service, whereas I have consumers in this district who pay £150 for a single service. Although, therefore, we know that the corporation may always be relied upon to send their cheque to the secretary of the gas company as soon as the amount is due, yet there is the leakage on the public lamps to be taken into account—and service-pipes are a greater source of leakage than mains; therefore (I said) you must put up, for the common good, for the good of those whose representatives you are, with having a wholesome and honest and consistent state of things established." In that case the corporation were men of such common sense that they actually said "Amen" to everything he brought before them. And he believed managers would find, as he did, that, after all, common sense, if only applied properly, would prevail, and that if they did the thing that was right, they would in the end, to employ a rough expression, "shame the devil." It must be always borne in mind that the saving effected in the public lighting was a saving, not so much for the benefit of those who supplied gas, as in the interest of the consumers. Everything

by which the company could economize, and by which their profits were improved, was so much to the good of the private consumers. A company might be able to sell gas at 6d. per 1000 less if they had not to maintain an unreasonable and stupid loss from the lighting of the public lamps. Therefore, in arguing the public lamp question, they were arguing a question in the consumers' interest, and in which they were themselves disinterested. Referring to the observations of Mr. Johnson, the President said he had heard of Mr. Johnson as one of the best abused men in connexion with this matter, and, therefore, he was pleased to find that his troubles had not made him shrink away. It was good to see a well-abused man preserve such a rotundity, and retain a spirit so genial. Mr. Johnson spoke more strongly in favour of the average meter system than some others, and believed it to be the most conducive to a satisfactory settlement of all disputes between the companies and the local authorities. There was no doubt the system had had this effect; it had established the principle, brought it to the front, and confirmed it, that the public consumer, the corporation, or the local board should pay a price for the public lamps, not less and not exceeding that charged to the largest private consumer. This principle was now sanctioned by parliamentary procedure.

(To be continued.)

A NEW AND EXACT METHOD FOR THE DETERMINATION OF ALL THE SULPHUR IN ILLUMINATING GAS.

By T. O'CONNOR SLOANE, A.M., E.M., Ph.D., Chemist of the New York Gaslight Company.

[Read before the New York Academy of Sciences, March 5, 1877.]

Many methods for the determination of sulphur in illuminating gas have been proposed. Two only are in general use—"Letheby's" and the "Referees" sulphur tests. In both of these the gas is burned, and the products of combustion brought into contact with ammoniacal gas. This condenses the sulphur dioxide and sulphuric acid formed in the combustion. The solution is washed out of the apparatus, and the sulphur which it contains determined. The efficacy of these methods depends upon the complete oxidation of the sulphur in the process of burning. No attempt is made in either to purify the air. Hence the operation has to be conducted in a room in which there is no coal fire, and in which no gas is burning. Even then the air may contain sulphur, as sulphur dioxide, or sulphuretted hydrogen; and this is most to be feared in the vicinity of factories, or in large cities, precisely the places in which these determinations have to be made. Then, in the case of the Letheby apparatus the flame is liable to be extinguished by draughts. I have never used the Referees apparatus, but should imagine that it was to some extent open to the same objection.

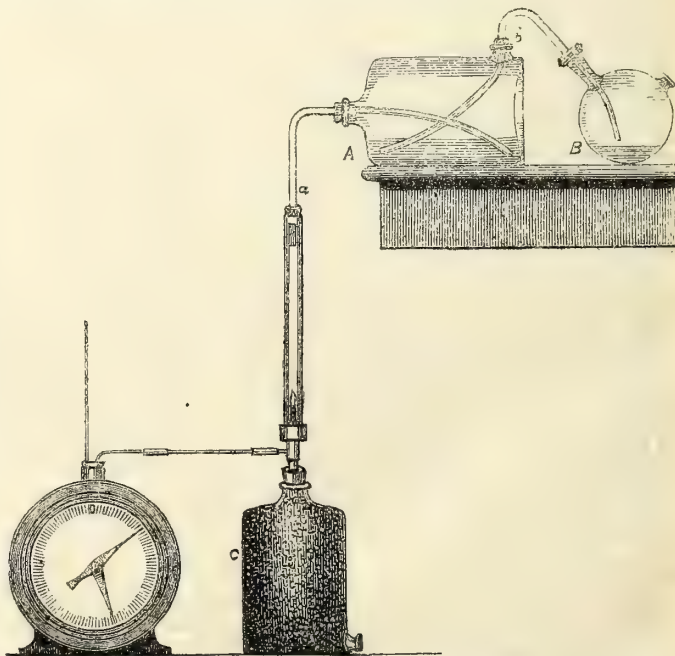
I am of opinion that the most practicable method of determining all the sulphur contained in gas is by combustion. This being admitted, the following requirements are essential:—1. All of the sulphur in the gas, and no more, must be collected. 2. The air must be purified from any sulphur which it may contain. 3. The apparatus should be simple, and require for its construction no special forms of glass. 4. The flame should be protected, so that it will not be seriously affected by draughts, such as may be caused by opening or shutting doors close to the burner. 5. No aspirator should be employed.

In the apparatus here described all these points are met.

The gas is burned in a Bunsen burner, the foot of which is unscrewed, and a tube of about 16 m.m. internal diameter is soldered around it, leaving an annular opening. This tube rises to within 25 m.m. of the top of the burner, and descends 75 m.m. below its bottom. Before fastening it in position all of the air-holes of the Bunsen burner, except one, must be soldered up. This should be one-half closed. The air-tube then has a cup fastened around it, making a second annular space, only, in this case, a closed one. It should be 50 m.m. deep and 50 m.m. wide. Its top should be a little lower than the top of the air-tube. If the cup be filled with water, the burner lit, and a chimney placed over it, resting in the cup, all the air consumed by the burner must rise through the air-tube. Below the burner it may conveniently be reduced to one-half the diameter given. I also advise that the air-tube be made to unscrew, just above the burner nipple. Then the supply of air to the interior of the burner can always be regulated by partly closing the one air-hole with sealing wax or gummed paper.

The air is purified by potassic permanganate. A bottle, tubulated at the bottom, and of six litres capacity, is filled with small marbles, or broken glass, or a mixture of both, and a solution of permanganate spread all through it. Its upper neck is supplied with a perforated cork, which receives tightly the air-tube of the burner. Thus the bottle supports the burner and acts as an air purifier. It will be seen that all the air which passes through the air-tube must first pass through the glass and marbles.

The products of combustion rise from the burner, through a chimney tube, into suitable receiving and condensing apparatus.



The whole arrangement is shown in the above engraving.

The chimney tube must be of thin glass, and not over 32 m.m. in diameter; 25 m.m. is a good size. The sides must be straight, and it may be 380 m.m. to 420 m.m. long. A tube of 14 m.m. to 17 m.m. in diameter, bent exactly as indicated, is fitted into its upper end with a perforated cork. The heat is rather hard on the cork, so the best quality should be employed. This tube passes into the tubulated bottle, A. The bend must be smooth, and the tube must slope down from this bend into the bottle. Thus, any water which may condense in it will flow away from the burner. If any ran back, it might crack the tube or chimney, or put out the burner.

The bottle, A, is an ordinary tubulated bottle, of 5 or 6 litres capacity. It rests upon its side, and should be secured in position with some wedges, or weights. One must be selected whose lower neck is of large diameter. The exit tube is of 13 m.m. internal diameter. It runs forward and to within 20 m.m. of the lower side of the bottle, A. Its shape can be seen in the figure. It enters the receiver, B. This may be of a litre capacity. I employ a tubulated retort receiver, but any bottle will answer, and a hole in the cork is sufficient to permit the escape of the gas from the combustion. If a flask be employed, no cork will be required. The flask can be fixed in position, so that the tube will reach nearly to its bottom.

By an eduction-tube, of large size, 50 m.m., tin or iron, the fumes may be carried off if this be desired.

The gas, whose temperature should be noted from time to time, is burned at the rate of 0·8 cubic foot per hour. A solution of potassic permanganate, with an excess of hydrochloric acid, is contained in the receivers, A and B. The products of combustion pass over this solution, and are acted on by the chlorine, nascent and evolved; 95 per cent. of the sulphur will be absorbed in A, the remainder in B.

I will now give the details of the manipulation, and the minor adjustments.

The meter is put in position, levelled, and the water-line adjusted. A good wet meter is a very satisfactory measure of gas, and is more convenient and portable than a graduated gasholder. Its connexion with the gas-main should be as short as possible, and all metal or glass. India-rubber connexions should be few, and the ends of tubes so connected should be in contact. If the connexion with the main be through a long service-pipe, gas should be permitted to escape from it before and during the entire experiment, so as to ensure a fresh supply. In a laboratory, the regular burners which are in use will secure this end. The burner is in like manner connected to the outlet of the meter. The gas is now turned on, lighted, and permitted for a while to burn at its full capacity. It may temporarily be supported on a ring-stand. This expels all old gas or air from the meter. The purifying bottle is now charged.

Ten or fifteen grammes of permanganate are dissolved in about 200 c.c. of water. The solution is poured into the bottle. Both necks are tightly corked, and the whole is turned over and over in every direction, until the solution is spread all over the surface of the glass and marbles. The bottle is then placed by the meter, the corks removed, and the burner fixed with its cork in the neck.

Two solutions of permanganate must now be made. Each one must contain one gramme of the salt for every two feet of gas which it is proposed to burn in the experiment. This is the minimum. Twice the quantity would not be too much for the receiver, A. It should be dissolved in distilled water, about 70 c.c. to the gramme being employed. As an allowance has often to be made for the sulphur contained in the permanganate, it should be weighed out for each experiment, not guessed at. These two solutions are now poured, each into one of the receivers. For each gramme of permanganate 2 c.c. concentrated hydrochloric acid are added, and the whole slightly shaken. The tubes are now put in position. The chimney, for the present, passes down by the side of the burner. Its position is adjusted by moving it up and down on the tube *a*, so that when it rests on the bottom of the burner cup, the far end of the tube *a* will be 13 m.m. above the surface of the liquid. The near end of this tube should descend some distance, 10 to 20 m.m., below the cork in the chimney-tube.

The gas-cock is now adjusted so that the gas will pass the meter at less than the ultimate rate. It may afterwards be brought up to nearly a foot, and this rate should not be exceeded. The meter reading is taken, the whole absorption apparatus lifted up quickly and set down gently, with the chimney-tube over the burner. There will be a slight error in the meter reading, owing to the time required for this operation, but it can be allowed for. The burner cup is now filled with water. Here care must be taken, or by pouring against the hot chimney-tube it will be cracked. Another precaution is to avoid dipping the end of tube *a* or *b* into the solution, or, of course, the flame will be extinguished. The combustion now goes on quietly, and after enough of gas has been burned, 1 to 5 cubic feet, it may be turned off, the solutions washed out into a beaker, and the sulphur they contain determined. The solutions, on removal, should still be violet in colour.

The easiest way of getting rid of the excess of permanganic acid is to add and heat with a little alcohol. The precipitated brown oxide of manganese dissolves with difficulty, but hard boiling and a large excess of hydrochloric acid will do it. It is well to let it settle, decant the supernatant liquid, and then dissolve the precipitate. It is very slow work to filter it all out, so its solution is recommended.

There are only two ways in which any sulphur can escape collection in this apparatus. One is insufficient oxidation, the other insufficient condensation.

To investigate the first of these points I employed an apparatus essentially the same, but supplied with air by an aspirator. Thus I could measure pretty closely the relative volume of air to gas, and I found that it made very little difference whether the gas was burned with five or ten times its volume of air. By calculation from analysis it appears that to completely burn gas, 1·16 to 1·18 parts of oxygen are required, or six parts of air to one of gas.

I here give some of these results; the sulphur I express in per centages, taking the highest result obtained as 100 per cent.—

Gas.	A.	B.	C.
Feet of air to one foot of gas . . .	6·6	10·0	5·2
Per centage of sulphur	100·0	98·6	96·8

These, with other results, will be found tabulated at the end of the paper.

This proves that the sulphur will be perfectly condensed within very wide limits of oxidation. I may observe that 1 per cent. of sulphur on the quantity of gas I employed for each experiment was represented by less than three milligrammes of baric sulphate.

To prove that the condensation was perfect, I performed the following experiments:—I made sulphur determinations with the apparatus arranged as shown in the engraving, but in place of the receiver, B, I used an ordinary wide-mouthed bottle, which I shall still designate as B.

	Exp. 1.	Exp. 2.
Per cent. of sulphur in A	95·54	97·87
Per cent. of sulphur in B	4·46	2·13

Finally, to try how perfectly the air was freed from sulphur by the purifying bottle, C, I passed air over a surface of a strong solution of sulphur dioxide, through the bottle in question, and then through the receiver, A, containing the acidified solution of permanganate. Air was passed

through at the rate of about 10 cubic feet per hour, and only a trace of sulphur could be found; this trace I attribute to the permanganate. Air was passed through at the rate of about 10 cubic feet per hour, and only a trace of sulphur could be found; this trace I attribute to the permanganate, which contained 53-1000ths of 1 per cent.

Now, the amount of sulphur which coal gas in England may contain under the law is 20 grains per 100 cubic feet. An error of 5 per cent. would here involve the question of only one grain, and of all the experiments quoted none has so large an error. The average difference is only 3 per cent. For the Referees apparatus it is claimed that it will show 20 to 30 per cent. more than Letheby's. Compared to this difference, 5 per cent. even seems a small discrepancy. It may be noticed that the highness of the results was independent of the amount of air.

The receivers may be placed on a table, and the meter and purifying bottle on the floor. The dimensions given favour such a disposition.

I give below a number of results obtained with a slightly different absorption apparatus. In conducting the experiments leading to them an aspirator was employed giving a close approximation to the amount of air consumed.

Date, 1876.	July 10.	July 17.	July 18.	July 20.	July 21.	July 24.	July 25.
Gas, cubic feet per hour.	0·60	0·70	0·77	0·50	0·59	0·70	0·55
Rate of air to gas	8·25	9·1	5·4	5·8	6·4	7·2	9·4
Cubic feet of gas burned.	1·00	1·00	1·00	1·00	1·00	3·00	3·00
Sulphur, grains	12·7	13·2	13·9	13·8	15·9	12·4	14·0

Date, 1876.	Aug. 22.	Same.	Aug. 23.	Same.	Aug. 25.	Same.	Aug. 26.	Same.
Gas, cub. ft. per hour.	0·97	0·623	—	0·895	0·652	0·985	0·723	1·06
Rate of air to gas	6·6	10·0	10·2	5·2	8·9	4·7	9·8	6·5
Temperature	80°	80°	83°	83½°	86°	88°	88°	85½°
Sulphur, grains	14·1	13·9	16·2	15·7	15·1	15·3	14·5	15·7

ON THE GASES ENCLOSED IN LIGNITE COAL AND MINERAL RESIN FROM BOVEY HEATHFIELD, DEVON.

By Mr. J. W. THOMAS.

[A paper read before the Chemical Society, June 7, 1877.]

Four samples were examined. No. 1 lignite consisted of the leaves and stems of plants in a closely compressed condition, and is known locally as "leafy coal." No. 2 lignite—dense, compact, of a distinctly woody character, and dark brown. No. 3 lignite was very dense, but earthy and wet in appearance, the cleavages being much encrusted with hydrated oxide of iron; in colour it was nearly black. No. 4. mineral resin retin-asphaltum—soft, brown, powdery, lighter than water.

No. 1. Leafy coal from Bovey Heathfield.—100 grammes after heating to 50° for 12 days, gave 56·1 c.c. of gas, containing—CO₂, 87·25; O, 0·24; CO, 3·59; OH₂, 8·92 per cent. After heating to 50°, 100 grammes were heated to 100° for 18 days, and yielded—59·9 c.c. of gas; CO₂, 89·53; C_nH_{2n} gases, 0·33; CO, 5·11; N, 5·03 per cent. On raising the temperature to 150° decomposition set in, and the pellets of mercury in the Sprengel became blackened by the formation of sulphide of mercury. The gas given off had at first an aromatic odour, but afterwards became exceedingly disagreeable from the presence of organo-sulphur bodies, mercaptan, sulphide of allyl, &c. At 200°, more than 18 c.c. of gas were collected, the last portions of which contained CO₂, 82·06; OH₂, 2·82; CO, 14·00; C_nH_{2n}, 0·49; C₂H₄, 0·48; N, 0·27 per cent. Above 250° it was impossible to collect any gas, the action of the sulphur compounds on the mercury being so energetic as to block the Sprengel.

No. 2 Lignite.—100 grammes, at 50°, evolved 48·5 c.c. of gas, consisting of—CO₂, 96·23; O, 0·11; CO, 2·42; C_nH_{2n} gases, a trace; nitrogen, 1·24 (the first portion of gas which came off contained 16·23 per cent. N). At 100° sulphur sublimed in small yellow crystals; the lignite began to decompose at 185°. At 200° the gas consisted of CO₂, 86·30; CO, 7·41; C_nH_{2n} gases, 2·08; marsh gases, 3·34; hydride of propyl, 0·53; nitrogen, 0·34 per cent.

No. 3 Lignite began to decompose at 180°; the gas evolved at 200° consisted of SH₂, 0·41; CO₂, 91·68; C_nH_{2n}, 0·41; CO, 7·12; H, traces; N, 0·38 per cent.

No. 4. Mineral resin from Bovey Heathfield.—At 50° a very small quantity of gas was given off. At 100°, 21·4 c.c. of gas from 100 grammes came over; CO₂, 88·24; O, 0·23; C_nH_{2n}, 0·47; CO, 7·90; N, 3·16 per cent. At 110° to 120° it began to melt and decompose, the sulphur compounds coming off so rapidly as to block the pump. When the temperature was raised to 160°, about 180 c.c. came over, consisting of SH₂, 0·41; CO₂, 78·88; C_nH_{2n} gases, 2·67; CO, 7·82; marsh gas, 9·05; hydride of propyl, 1·86; nitrogen, 0·31.

When compared with the coals of the carboniferous period, it is seen that, as far as the occluded gas is concerned, these lignites resemble most cannel coal, but contain C_nH_{2n} gases, and only matters of the aromatic series instead of gases and compounds of the paraffin series. The lignites are far less stable *in vacuo*, decomposing below 200°, whilst the true coals usually resist a temperature of 300°. The existence in Nos. 1 and 3 of organo-sulphur compounds in the presence of hydrated oxide of iron suggests that the iron pyrites of true coal may have derived their sulphur from that existing in organic combination in the plants from which coal is produced, and not from the reduction of sulphates. The author concluded by pointing out the extremely hygroscopic nature of the Bovey lignites.—*Chemical News.*

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been another very quiet week in all branches of the iron trade, and no changes, of any real signification, have taken place either as to the demand for, or the prices of iron. The pig iron smelters now hold their production steadily, at the prices quoted several times recently in these notes, but users are not content to buy except at a reduction of at least 6d. to 1s. per ton. Vendors are very unwilling to fetter themselves for longer periods than about three months, whilst buyers, allege that they would rather buy from hand to mouth during the summer months, when their needs will be by no means pressing. Under these circumstances, the quantities which change hands are of limited size, and are almost all made the subjects of special negotiations and prices. The same rule holds good as regards finished iron and foundry products, neither of which are in such good request as they were a couple of months back. Some of the manufacturers of merchant iron allege that they can now make and sell ordinary bars at a profit; but it is confessedly difficult to see how £5 17s. 6d. or £6 can be made to pay, even if the makers possess their own ironstone mines and blast furnaces. It is, at all events, pretty certain that no producer can now afford to buy pig iron in the open market, and expect to get any profit on it when turned into merchant iron. The foundry

branches afford exceptions to this assertion, inasmuch as many of the smaller foundries are kept going on patent and other special articles. At the larger concerns which have foundries attached there is still some semblance of briskness, chiefly on colliery castings and large sized mains for gas and water works uses.

The coal trade is not so well supplied with orders as it was last month, and shipments from the Humber ports are consequently falling off. Last month there were over 19,000 tons exported from Hull, Grimsby, and Goole, the two first-named places having the lion's share. At several of the local collieries strikes exist in opposition to reductions of wages, ranging from 6d. to 2s. weekly. House coal is almost wholly neglected, but steam and gas coals are in fair request at 6s. to 9s. 6d. per ton at the pits.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is no very material change to notice in the position of the coal trade of this district, except that engine classes of fuel and slack especially exhibit a decidedly upward tendency in price, new customers having in many cases to pay an advance upon late rates before they can obtain supplies. In the round coal trade there is only a moderate amount of business doing, the warm weather having considerably reduced the requirements for house fire purposes, and although the pits are still stopped in West Lancashire, there is no pressure of orders in the market, and prices, though firm, are no higher as a rule. Good Arley coal at the pit mouth can be bought at 10s. to 11s. per ton; Pemberton four-feet, 8s. 6d. to 9s.; and common coal, although not offering at quite such low prices as were ruling last month, at 7s. to 8s. per ton. For burgy and slack, advances of from 3d. to 6d. per ton are being obtained, and the average pit quotations are 5s. 6d. to 6s. 3d. per ton for burgy, and 4s. 6d. to 5s., and 5s. 3d. per ton for slack.

In the shipping trade there is scarcely anything doing, the West Lancashire colliery proprietors, in consequence of the strike, reserving what stocks they have for their regular customers, and most of the vessels in the Mersey are getting their supplies from Birkenhead.

The West Lancashire colliers are now in the third week of the strike, and they still evince a determination to hold out unless the masters agree to arbitration. On the other hand, the masters show no signs of giving way, and at present they, in most cases, are able to meet the requirements of their regular customers from the stocks they have on hand, but these cannot last much longer.

The iron trade continues in a very depressed condition, and north country brands of pig iron are still being pushed here at extremely low prices, the local smelters, indeed, being undersold in the immediate vicinity of their own works. In finished iron, however, Lancashire makers are able to hold their own against the Middlesbrough firms, who, at present, are doing little or no business in this district; local bars, delivered into the neighbourhood of Manchester, being offered at £6 12s. 6d. per ton. The Lancashire forges, however, are very short of work, and both founders and engineers are, as a rule, only partially employed.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The shipments of gas coals from the Tyne Dock, notwithstanding that we are close upon Midsummer, are remarkably well maintained. In point of fact, they are very large; 36,000 chaldrons of coals were shipped from the Tyne Dock last week, the bulk of which were gas coals. Where all the coals find a market it is difficult to say. The prices remain about the same. They are about 8s. 6d. best, and from 6s. 6d. to 7s. seconds. The steam collieries have now got fully settled to work. There have been considerable arrivals of large ships, amongst them a fleet of Dutch East Indiamen, which have come to the Tyne to load steam coals. The first-class collieries are fully employed, and the second-class pits are doing very well also. The prices of steam coals are 12s. best and 10s. seconds. The coal trade of the Tyne will be kept back a good deal this week through Newcastle races. Most pits are off work for two or three days.

The freight market is quiet. The supply of tonnage is quite in excess of the demand at present. Rates for steamers to load coals to the Baltic fell £1 per keel last week, and very little was done with the Mediterranean. All the coasting ports accessible to steamers are extremely well supplied with tonnage, and generally the market is favourable to shippers. Within the past month or so a considerable quantity of gas-retorts and other fire-clay goods have been shipped from the Tyne to British America, mostly to Montreal. It looks as if the British-American gas companies were taking advantage of the moderate price of manufactured goods in this country, and were renewing their plant.

The iron trade of the North of England is unchanged. The market is very quiet, and only a limited business is done. The chemical trade is not so strong as it was ten days ago. The then advance of prices seems to have been due to "bulling" operations. Some merchants, it is stated, have rather burnt their fingers through them. The importation of timber has been pretty large within the fortnight; but the general building trade of the North of England is falling off considerably.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

On the 18th inst. the annual meeting of the Muirkirk Gas Company was held—Mr. C. Howatson in the chair. From the profits of the year ending the 31st ult., a dividend of 10 per cent. was declared to the shareholders, and £58 11s. 6d. carried to the fund for repair of works. The price of gas was continued at last year's rate—namely, 5s. 5d. per 1000 cubic feet. It may be remembered that a second gas supply undertaking was commenced in Muirkirk some months ago by the Eglinton Iron Company (Messrs. William Baird and Co.), for the convenience of their works and offices and their employes.

The annual meeting of the Dundee Gas Commissioners was held on Wednesday last. Ex-Bailie Edward, in submitting the estimates for the current year, mentioned that they began last financial year with a surplus of £437, and ended with a surplus of £1964. The amount of gas manufactured during the year was 292,000,000 cubic feet, the quantity sold being 242,170,000 cubic feet. It was estimated that 30,000,000 cubic feet of gas would be required for this year, which would yield a revenue of £58,826, and the expenditure was reckoned at £58,698. He moved that the price of gas for the current year be reduced from 4s. 5d. to 4s. 2d. per 1000 feet, with 5 per cent. discount for payments within 28 days; that the price for gas supplied at Invergowrie and Harecraigs be 5s. 2d., and at Downfield 6s. 8d.; and that the gas for the public lamps be charged 3s. 11½d. without discount. The motion was unanimously agreed to. It is remarked by the leading local paper—the *Dundee Advertiser*—that the reduction in price now announced has been, to a considerable extent, brought about by diminished leakage. Mr. McCrae is urged to persevere in this direction, the editor being of opinion that the leakage has even yet scarcely been reduced to a minimum.

A meeting of the Forfar Gas Commissioners was held on Monday, the 18th inst., when Bailie Lowson's proposal to appoint a Gas Examiner to report at stated intervals on the quality of the gas supplied to the con-

sumers was considered, the salary not to exceed ten guineas per annum. The motion was not seconded. It was reported that during the year 1875-76 there had been sold 17,901,040 cubic feet of gas, while the amount sold during the year 1876-77 was only 17,211,950 cubic feet. Before passing away from Forfar and Bailie Lowson, the convener of the Gas Committee, I may mention that in the action at law for defamation of character raised by that gentleman against Mr. Rutherford, town councillor, in which the jury found for the defender, parties were heard in the First Division of the Court of Session on Saturday, on the question of an application for a new trial. The Court refused the application.

The annual meeting of the Catrine Gas Company was held last Tuesday evening. The treasurer's report showed a balance for the past year against the company, but that was due to the fact that certain alterations and improvements were in progress, part of which had been paid from the year's revenue. A dividend of 5 per cent. was declared, and it was agreed to borrow money to meet the cost of improvements being carried out, and which, it was expected, would place the works in a much better condition.

A dividend of 5 per cent. has been declared by the Nairn Gaslight Company. Had it not been for a recent accident at the works, the dividend would have been higher. The Doune Gas Company have declared a dividend of 3 per cent., and the Auchtergaven Gas Company one of 2½ per cent., after laying aside one-fourth of the profits to the reserve-fund.

The Bathgate Gas Company have reduced the price of gas from 5s. 6d. to 5s. per 1000 cubic feet.

On Tuesday last the usual report by the city gas analyst was submitted to the Town Council of Edinburgh. It showed that on the 12th inst. the Edinburgh Gas Company's gas had an illuminating power of 26 standard candles, and that of the Leith Company 25 candles.

The application of the Johnstone Police Commissioners to the Johnstone Gas Company to negotiate a transfer of their works to the municipal authorities has resulted in the gas company signifying their willingness to treat with the commissioners in order to effect a sale. The matter will be brought before the Police Commission at an early date, when steps will be taken to complete the transfer.

At the last meeting of the Gas Committee of the Dumfries Town Council the clerk was instructed to intimate to the gas company that the council were prepared to treat for the acquisition of their works and lands, and to correspond with Mr. McCrae, gas manager, Dundee, and ascertain from him on what terms he would revisit Dumfries, and again report to the committee what sum he would advise them to offer the gas company for their undertaking.

The annual meeting of the Bankfoot Gaslight Company was held last Wednesday, when the directors submitted their report. It contained a recommendation that the dividend for the past year should be fixed at 2½ per cent., which was approved of. The price of gas still remains at 10s. 10d. per 1000 cubic feet. Surprise is expressed at the fact of so few of the shareholders who are consumers taking any interest in the management of the company, and endeavouring to reduce the price of gas in accordance with the reduction in the price of coal. It is stated that the meeting was rather stormy.

A special meeting of the Glasgow Corporation Water Committee was held on Monday, the 18th inst., when there was submitted an abstract statement of the revenue and expenditure for the year 1876-77. The revenue amounted to £136,203 15s. 8d., and the expenditure to £119,887 18s. 9d.—leaving a balance to go to the sinking-fund of £16,315 16s. 11d. It was stated that these figures were very close to the probable estimate made in the spring of last year. The revenue had exceeded the estimate by £4808, the gain being principally on trade charges, and the expenditure by £2240, arising mainly from extra castings which have been found necessary. It was explained that trade had been better during the latter part of the year than they had anticipated when making up the estimate, and a larger sum had consequently been drawn from meter accounts. In the last quarter of the year it had fallen off again, and the receipts from trade charges had been reduced by £300. The domestic rate was steadily increasing. There was an increase of £4981 in revenue, and of £13,244 in the expenditure over the former year—the latter increase being due to the laying of pipes in Bridgeton district, for the better supply of water in case of fire. On the motion of Mr. Osborne, the accounts were passed.

The superintendent of the Kirkintilloch Water-Works reports that, as the result of a test recently made, he had found the consumption of water throughout the area of supply to be equal to an average of 11½ gallons per head over a population of 8000. The supply continues to be fully maintained, and the works are in excellent order.

Very slow progress is being made with the Dour Water-Works for the supply of Burntisland, owing to the occurrence of numerous springs in the bed of the reservoir, which must all be puddled with clay. It would thus appear that instead of too little water, too much is to be the complaint.

On the 9th inst. the store-ponds from which Dunfermline is at present supplied with water were 18 inches down, and the quantity in store was equal to 118 days supply. The rain-gauge showed that the rainfall during May was 2.20 inches, as against 1.40 inch in May of last year.

On Friday last the Perth Water Bill was under the consideration of a committee of the House of Lords, and further opposition was given. The opponents of the measure petitioned the committee to insert a clause in the Bill naming the Police Commissioners as the first commissioners under the Bill, in place of the commissioners named by the promoters. After hearing evidence, the committee announced that they adhered to the Bill. They thought the promoters, who had borne the burden and heat of the day, were fairly entitled to consideration, and that the works would be better carried out if entrusted to their hands than to those of a body previously opposed to them. In September, 1878, the Act will be administered by the Police Commissioners, and the committee ordered a clause to be altered so that they should not be subjected to expenses as to salaries, &c., over which they had no control when arranged.

At the last meeting of the Dumbarton Water Commissioners, Mr. Cameron, the inspector, reported that there the supply of water in store amounted to 51,000,000 gallons—16,000,000 gallons in the Garshake reservoir, and 35,000,000 gallons in the Blacklinn reservoir. He had supplied eight additional public works with meters, and was authorized to provide meters for other two works.

A good deal more activity was shown in the Glasgow pig iron market during the past week, and a large amount of business was done. The market closed on Friday—sellers at 54s. 6d. cash, and 54s. 7½d. one month, buyers 1½d. per ton less. On the week there was an improvement of 7½d. per ton.

The coal market is still dull, notwithstanding the advance of wages given to the colliers in some districts. House descriptions are slow of sale, and the local trade is otherwise dull. Shipping is not above the average, and prices remain unaltered.

NAPHTHA EXPLOSION NEAR THE NEW YORK METROPOLITAN GAS-WORKS.—On Monday, May 28, an explosion took place near the works of the Metropolitan Gaslight Company, foot of Forty-second Street and North River, which resulted in the death of three persons, and the severe injury

of a fourth, the latter being the only *employé* of the gas company that suffered. The facts of the case are as follows:—A lighter came to the company's dock to deliver a cargo of naphtha. The usual method is to deliver the naphtha from a tank barge by means of a hose, attached to the company's pump, by which the oil is forced into tanks on the company's premises; but, for some reason or other, on this occasion the cargo, consisting of about 100 bbls. of naphtha, was brought in barrels, and not in bulk, in the hull of the vessel. To enable the company's pump to receive it, the contents of the barrels, after removing the bungs, was run into a large cask or hogshead, by means of an open trough, and then the hose was put into this cask and the pump started. No sooner had the pump been set in motion than an explosion was heard, and the whole mass was in a blaze. The energetic action of the company's officers, in applying the fire hose, saved what otherwise would have been a very serious conflagration, probably resulting in the destruction of the trestle work and coal sheds which were adjacent. The three men killed belonged to the boat. The coroner is giving the matter a thorough investigation, and his report may throw some light on the cause of the sad accident, which, from all that can now be gathered, was undoubtedly a match or lighted pipe in use by some of the boat's crew. We are told that naphtha is perfectly safe. So it may be if nothing happens to set it off. But, certainly, any such method of handling it, and pouring it about loosely, is not to be commended. This matter, however, would seem to be something entirely beyond the control of human intelligence. Men get perfectly careless after constant handling of any dangerous material, and if the captain of a lighter sees fit to go sailing up the North River with a lighted pipe in his mouth, and the air about him full of naphtha vapour, it is somewhat questionable if any one is very anxious to go near enough to him to knock the pipe out of his mouth. From all that we can learn in this case, every precaution is taken in the handling of the material by the company after they get it in their possession; but does the risk and danger involved in the use of naphtha as an enricher pay? It would seem that, at the present price of coal, there must be an enormous margin of profit in using oil to compensate for the anxiety and danger, both to life and property, which must inevitably accompany it.—*American Gaslight Journal*.

SUB-WEALDEN EXPLORATION.—The final report of this undertaking has just been issued by Mr. H. Willett (honorary secretary). He reports that the depth attained on the 21st of December last year was 1823 feet, and on the 12th of April 1905 feet. On the last-mentioned date a letter was sent by the Diamond Boring Company, stating, "We have used our best endeavours to reach a depth of 2000 feet, and have failed, owing to the want of lining permitting the hole to fall in on our rods and jamming them." It also stated, "There will be no difficulty at all in continuing the hole, subject to the arrangements being made for lining and the use of a big machine, which were submitted by Major Beaumont on the 26th of February." It was decided, however, not to make any renewed efforts. Mr. Willett writes: "The Sub-Wealden exploration is, therefore, brought to a close, and has proved conclusively that in the lowest part of the Wealden area no Palæozoic rocks exist within 1900 feet of the surface. That the search was justified, and that the scientific deductions of Professor Prestwich, F.R.S., were entitled to the highest consideration may be found in the fact that Palæozoic rocks of the Devonian period have been discovered (containing spiriferæ) in the boring made at the brewery of Sir Henry Meux and Co., at the corner of Tottenham Court Road, London. The following are the approximate measurements of this boring, the surface of which is about 70 feet above high-water mark:—Strata above the chalk, 159 feet; chalk, 653 feet; upper greensand, 28 feet; gault, 160 feet; lower greensand, 130 feet; Devonian (about), 40 feet—total, 1170 feet." Mr. Willett adds: "The search should, therefore, undoubtedly be further promoted in the valley of the Thames, and at other points in the south-east of England."—*The Times*.

ERRATUM.—SOUTHWARK AND VAUXHALL WATER COMPANY'S MEETING.—In our report of the proceedings in last No. (on page 980, col. 1, line 7) the word "important" was printed for "impertinent." The error occurs in that portion of the chairman's speech in which he was illustrating the spirit in which the company were treated by the Richmond Vestry. The chairman, feeling most anxiously for the inhabitants in case such a calamity as fire should be added to their existing difficulties, wrote to inquire if the vestry were prepared for such a contingency—an inquiry which was characterized by the chairman of the vestry as "impertinent."

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

- 2353.—SWAN, J. W., Newcastle, and STEARN, C. H., Rock Ferry, Cheshire, "Improvements in Sprengel pumps." June 16, 1877.
 2362.—WALLACE, R. W., Battersea Park, and CLAU, C. F., Great St. Helen's, London, "Improvements in the purification of gas and the utilization of bye products by the manufacture of secondary products therefrom." June 16, 1877.
 2373.—NAWROCKI, G. W. von, "Improvements in furnaces for the manufacture of illuminating gas, partly applicable to furnaces for heating purposes generally." A communication. June 19, 1877.
 2381.—LEAVER, J. C., Barnes, Surrey, "An improved combination of valves for machines used in compressing air and other gaseous fluids." June 19, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

- 4774.—BARTLETT, G., Dulwich Road, Surrey, "Improvements in filters for filtering water." Dec. 9, 1876.
 4805.—WERDERMANN, R., Princes Street, London, "Improvements in electric lighting apparatus." Dec. 12, 1876.
 4816.—BLAMURES, T. H., Huddersfield, York, "New or improved means and apparatus for automatically opening and closing taps, valves, ventilators, and other similar purposes." Dec. 13, 1876.
 4830.—BROMLEY, U., Crowe, G., and JAMES, W., Chester, "Improvements in and relating to motive-power engines and pumps, applicable also in part to water-meters." Dec. 14, 1876.
 4844.—PRESTON, F. P., PRESTIGE, J. T., and PRESTON, E. J., Deptford, London, "Improvements in apparatus for regulating and controlling the flow of water and other liquids, and preventing waste of same." Dec. 14, 1876.
 4909.—HARRIS, H. G., Westminster, "Improvements in steam-pumps." Dec. 19, 1876.
 4916.—DUGARD, W. H., Birmingham, "Improvements in fans for blowing, which improvements are also applicable to fans for exhausting, and to centrifugal pumps." Dec. 20, 1876.
 4917.—GILL, J., Bridgnorth, Salop, "A new or improved gas-stove." Dec. 20, 1876.
 4967.—STORER, J., and PUGH, C. H., Stafford, "Improvements in retort-lid fastenings." Dec. 23, 1876.
 4983.—GOODFELLOW, G. E., Hyde, and HALLAM, S., Stockport, Chester, "Improvements in steam-pumps, and in actuating the valves of steam-engines." Dec. 23, 1876.
 4987.—HALLEWELL, R., Blackburn, Lancs, "Improvements in gas motor engines." Dec. 23, 1876.
 4988.—HALLEWELL, R., Blackburn, Lancs, "Improvements in gas and water motor engines, and in gas-motor engines." Dec. 23, 1876.
 8.—STITCHBURY, F., Leyton, Essex, "An improved method of heating box-irons by a mixture of gas and air." Jan. 1, 1877.
 431.—POPE, J., Folkestone, Kent, "Improvements in taps or cocks, which improvements are also applicable to regulating the flow of water to water-closets and other like receptacles." Feb. 1, 1877.
 995.—CALDWELL, A., Renfrew, N.B., "Improvements in apparatus for measuring and controlling or regulating the flow or supply of water." March 13, 1877.
 1428.—JOHNSON, R., Manchester, "Improvements in machinery for pumping, forcing, blowing, and exhausting air and other fluids." April 12, 1877.
 1462.—LIVERSEY, J., Westminster, "Improvements in filters for water and air." April 13, 1877.

NOTICE OF APPLICATION FOR LEAVE TO FILE A DISCLAIMER AND MEMORANDUM OF ALTERATION.

- 2587.—AITKEN, H., Falkirk, N.B., "Improvements in the manufacture of illuminating gas, and in the apparatus or means employed therefor." July 24, 1874.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

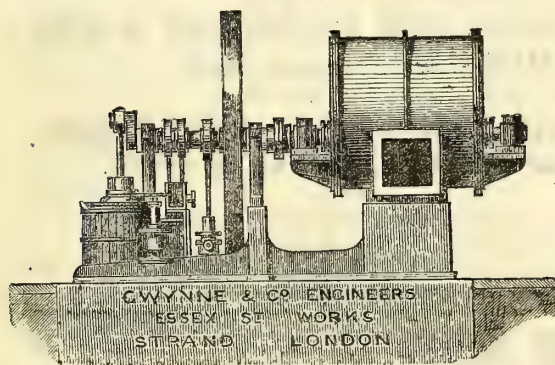
- 2060.—PERRETT, E., "Improvements in apparatus for filtering liquids." June 13, 1874.
 2061.—PERRETT, E., "Improvements in the arrangement of bag-filters." June 13, 1874.

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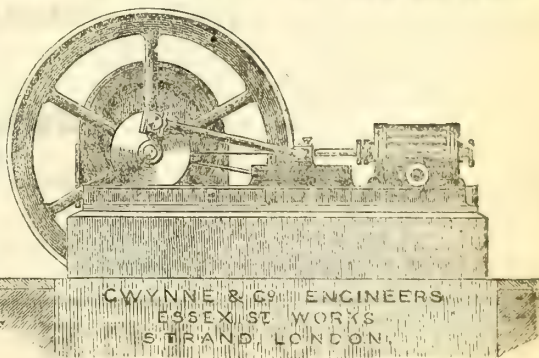
EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

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WANTED, a steady Man, as Main and SERVICE LAYER, and to make himself generally useful at a Gas-Work. Constant employment.
Address, stating wages, references, &c., to No. 373, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a practical mechanical Man, of good education, a Managership, or Assistant Managership of a Gas-Work. Has had charge of gas-works, and is well recommended.
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Send character, and all particulars, and wages required, to No. 379, care of Mr. King, 11, Bolt Court, Fleet Street, LONDON, E.C.

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WANTED, by a Provincial Gas Com-pany, a thoroughly qualified and experienced person to act as ASSISTANT METER INSPECTOR. Must have a thorough knowledge of Wet and Dry Gas-Meters; also Consumers Fittings.
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A Gentleman of experience in the Rating of Properties of Public Companies is willing to undertake, in the interests of Companies, the Valuation of Gas and Water Works for Rating purposes.
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FOR SALE—Hydraulic Main, 18 in. diameter, with ascension and dip pipes complete, for five benches of retorts, suitable for a small Gas-Works.
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FOR SALE—A Set of Four Purifiers, 8 ft. by 6 ft., with covers, grids, centre-valve, and 6-in. connexions complete.
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FOR SALE, as they now stand, and at any reasonable price, as the ground upon which they stand is wanted, four 12-ft. square Cast-Iron PURIFIERS, with centre-valve and connexions, grids, tee bars, &c., complete.
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FOR SALE One New 6-inch Centre-VALVE, by Messrs. C. and W. Walker (patent), with service connexions; not been fixed.
One STATION-METER, by Messrs. J. and J. Braddock, Gidham, for 6-inch connexions, to pass 8000 feet per hour. Has been in work five years; in first-class condition.
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Address R., Mr. Fenton, 1, Commercial Street, LEEDS.

TO MANUFACTURING CHEMISTS, &c.
THE Guildford Gaslight and Coke Com-pany invite TENDERS for the purchase of the TAR and AMMONIACAL LIQUOR produced at their Works for a period of One year, from the 9th of July next.
Tenders to be sent in on or before July 5, 1877.

By order,
JOSEPH SHAW, Manager.
Guildford, June 23, 1877.

GOVERNOR FOR SALE.
THE Newmarket Gas Company have for immediate SALE a 6-in GOVERNOR in excellent condition by H. Balfour and Co. (1875); also a 6-in. Anderson's Four-Way VALVE.
Apply to THOMAS WILKINSON, Manager, Gas Company, NEWMARKET.

THE Newmarket Gas Company invite TENDERS for the supply of a 9-in. GAS GOVERNOR, and a 9-in. Four-Way VALVE, delivered at Newmarket Railway Station.

Tenders to be sent to the undersigned on or before the 5th day of July next.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
THOMAS WILKINSON, Manager.

GAS-WORKS, LOW BRIDGE, KEIGHLEY.

MESSRS. WEATHERHEAD and SKAIFE are honoured with instructions from the Gas Committee of the Keighley Local Board of Health to Catalogue and SELL BY AUCTION, on Thursday, the 5th day of July, 1877, on the above Works,

ALL the SURPLUS GAS PLANT & APPARATUS consisting of 140 mouthpieces, 18 in. by 15 in., hydraulics, dip-pipes, exhausters; tar, liquor, and water pumps, scrubber, purifiers, station-meter, 60 tons of iron, boiler for storing tar, gasholder, 6 ft. diameter, single-lift, complete, and other apparatus, particulars of which will be given in descriptive catalogue in due course, and may be obtained from the AUCTIONEERS.

Sale at Eleven o'clock a.m.
Auctioneers Offices, Low Street, Keighley.

TO MAIN LAYERS.
THE Directors of the Hungerford Gas Company are prepared to receive TENDERS for the laying of about 400 yards each size of 5 in., 3 in., and 2½ in. MAINS, and other works in connexion.
Further particulars may be obtained on application to the Secretary.
Tenders to be sent in on or before the 30th day of June, 1877, addressed to the Chairman of the Hungerford Gas Company.

J. H. WOOLDRIDGE, Secretary.

GASHOLDER FOR SALE.
ONE Telescopic Gasholder, 70 feet by 20 feet, complete, with cast-iron tank, columns, girders, and inlet and outlet pipes, valves, &c., of modern construction. In first-class condition, and made by Messrs. Pigott and Co., of Birmingham.
To be seen at work at the Gas-Works, Birkenhead.
Cause of removal to make room for extensions.
To be sold a bargain, taken down, and re-erected ready for work.
For particulars, apply to Messrs. ASHMORE AND WHILE, STOCKTON-ON-TREES, or to view to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

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LAMP-METERS IN CAST-IRON BOXES,
And every Description of Gas Apparatus.

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DIBDALE FIRE-CLAY, BRICK, AND GAS-RETORT WORKS,
STOURBRIDGE (Established 1834),
MANUFACTURER OF EVERY DESCRIPTION OF
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A LARGE QUANTITY OF RETORTS ALWAYS IN STOCK.

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Ovals . . 17 in. × 14 in., 17 in. × 15 in., 20 in. × 15 in., 21 in. × 15 in., &c.
D's . . { 14 in. × 14 in., 15 in. × 12 in., 15 in. × 13 in., 17 in. × 14 in., 18 in. × 13 in.
 { 18 in. × 15 in., 20 in. × 16 in., 22 in. × 14 in., 24 in. × 14 in., 24 in. × 15 in., &c.
Special attention given to the execution of Export Orders.

NOTICE OF REMOVAL.

D. BRUCE PEEBLES & CO.

Beg to announce that they have REMOVED to their New Premises,
TAY WORKS, BONNINGTON, EDINBURGH,
To which all communications should now be addressed.
May 30, 1877.

SUPPLEMENT
TO THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXIX.

LONDON, JUNE 26, 1877.

No. 737.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 18, 1877.

The Chairman of Committees informed the House that the opposition to the Bolton Improvement Bill was withdrawn.

The Examiner's certificate, in the case of the Local Government Board's Provisional Orders Confirmation (Bishop Auckland, &c.) Bill, so far as it relates to the Bishop Auckland Order, was referred back to the Examiner.

The following Bills were read a second time and committed:—Bishop Auckland District Gas; Southend Gas; United General Gas Company (Limerick); Waterford Gas; Woolwich, Plumstead, and Charlton Consumers Gas.

The Heywood Water Bill was referred to a Select Committee, consisting of Lord Wolverton (chairman), Earl Selkirk, Viscount Leinster, Lord Cloncurry, and Lord Leigh; to meet on Wednesday, June 20.

The Kent Water, Gas and Water Orders Confirmation (Abingdon, &c.), Perth Water, and Ashton-under-Lyne Gas Bills, were referred to a Select Committee, consisting of Lord Wimmarleigh (chairman), the Duke of Grafton, Earl Ilchester, Lord Balfour of Birley, and Lord Oranmore and Browne; to meet on Wednesday, June 20.

Petitions were presented against the United General Gas Company (Limerick) Bill from (1) Corporation of Limerick, (2) Limerick Water-Works Company; and against the Waterford Gas Bill from Corporation of Waterford.

TUESDAY, JUNE 19.

A petition against the Waterford Gas Bill was presented from the Waterford Harbour Commissioners.

THURSDAY, JUNE 21.

The Examiners reported that no Standing Order is applicable to the Bishop Auckland Order, confirmed by the Local Government Board's Provisional Orders Confirmation (Bishop Auckland, &c.) Bill, which was then read a second time.

The Select Committee on the Kent Water Bill reported that they had not proceeded with the consideration of the Bill, no parties having appeared in opposition thereto.

HOUSE OF COMMONS.

MONDAY, JUNE 18, 1877.

The Londonderry Gas Bill (Lords) was read a second time and committed.

WEDNESDAY, JUNE 20.

The Gas and Water Orders Confirmation (Brotton, &c.) Bill (Lords) was considered in committee of the whole House, and reported without amendment.

THURSDAY, JUNE 21.

The Gas and Water Orders Confirmation (Brotton, &c.) Bill (Lords) was read the third time and passed.

PUBLIC HEALTH (METROPOLIS) BILL.

In answer to Sir J. M'GAREL HOGG,

MR. SCLATER-BEOTH said he had no objection that further time should be taken before the Public Health (Metropolis) Bill went into committee. As he had already explained, the measure was, with little exception, essentially one for the consolidation of the existing law. He proposed to fix the committee for that day week.

THAMES RIVER (PREVENTION OF FLOODS) BILL.

SIR C. DILKE asked the Chairman of the Metropolitan Board of Works on what day he proposed to proceed with the Thames River (Prevention of Floods) Bill.

SIR J. M'GAREL HOGG read in reply a resolution passed by the Metropolitan Board of Works to the effect that the Bill had been rendered so essentially different from that which had been presented to the House by the resolution of the Select Committee, as in their opinion the expenses under it should be paid out of a rate to be levied over the whole metropolitan area, that the Board did not feel justified in proceeding further with it during the present session.

MR. GRANT-DUFF subsequently reported from the Select Committee, who were instructed to inquire into the most equitable mode of charging and meeting the expenses to be incurred under the Bill: "That they had proceeded to examine the allegations of the Bill, and had taken evidence thereon, which they had directed him to report to the House, together with an appendix. That, the committee having resolved that the most equitable mode of charging and meeting the expenses to be incurred for the prevention of floods within the metropolitan district would be that the works should be carried into effect by the Metropolitan Board of Works, and the expenses paid by a rate levied over the whole metropolitan area, the Metropolitan Board of Works, who were promoting the Bill, had stated to the committee that it was not their intention to proceed with the same. That the committee had therefore agreed to report the Bill, without amendment, to the House."

HOUSE OF COMMONS COMMITTEE.

WEDNESDAY, MAY 16.

(Before Mr. D. R. PLUNKET, Chairman; Mr. FOLJAMBE, Mr. STARKEY, and Mr. COURTNEY.)

THE GASLIGHT AND COKE COMPANY BILL.

(Concluded from p. 1004.)

Mr. George William Wigner, examined by Sir E. BECKETT.

I am an analytical and consulting chemist, and have been making some experiments showing the result of gas burning in London with an average amount of ventilation. I have here a table which shows these results:—

Experiments with Ordinary Coal Gas burnt through Argand, Fishtail, and Bat's-wing Burners under ordinary circumstances, in a Room with a Fair Average Amount of Ventilation.

Mark	B	C	F	G	H	J	M	N	P	T
No. of Experiment	1	2	3	4	5	6	7	8	9	10
Gas consumed	150	140	300	300	350	250	150	110	34	42
Number of Burners going	3	3	8	8	8	6	6	3	1	2
Sulphur in gas per 100 cubic feet	16.30	16.30	9.10	9.00	14.68	18.51	10.50	10.30	13.20	9.60
Equal to sulphuric acid	47.32	68.46	83.73	82.71	157.35	141.71	48.23	34.70	13.74	12.34
Amount recovered as sulphurous acid	—	—	—	—	—	—	—	—	—	—
Amount recovered as sulphuric acid	23.27	40.61	35.30	33.80	35.86	32.48	30.10	20.95	6.03	5.57
Per centage of total sulphur recovered as sulphuric acid	49.10	58.66	42.16	46.91	22.80	22.00	62.40	60.40	44.00	45.10
Cubic feet of air drawn out of room per foot of gas burnt	103.80	125.90	52.50	56.90	55.40	72.60	135.00	166.00	311.00	150.00
Per centage of total sulphur recovered as free sulphuric acid	26.70	38.10	26.90	25.10	13.50	12.70	45.70	46.70	12.70	23.40

To make that table intelligible, I should say that these experiments differ from the experiments of Dr. Odling and Dr. Stevenson, inasmuch as, instead of drawing a small sample of air from the centre of the room and testing that, I have ventilated the experimental room in which these experiments have been carried on through a ventilator of fair average size—that is 6 inches square—and have actually tested the whole of the air escaping from the room during the whole time the gas was burning. In the worst experiment out of ten which I made, I had recovered 22 per cent. of the sulphur present in the gas in the form of sulphuric acid; and in the best experiment I collected 62 per cent. in the form of sulphuric acid. The experiments differed slightly in the conditions under which they were carried on, mainly in the number of burners which were used. Instead of allowing the ventilation of the room to take place through an ordinary Arnott ventilator, which would be at the top of the fireplace, close to the ceiling, I drew the whole of the escaping air from the room by means of a steam exhauster, worked by a steam boiler, through a series of glass tubes, made of plate glass, and of an area of about 6 inches, and in those glass tubes I suspended various articles on which I wanted to test the effects of the product. Those tubes would make a total length of about 15 or 16 inches, so that the air, or, rather, the products of combustion, in the passage through the tubes became cold; therefore the articles which I exposed so as to test the character of the products were not exposed to hot air. They were not exposed even to the temperature which would be at the ceiling of the room; but the temperature very rarely exceeded 80°, and sometimes was only 65°. I then passed those products of combustion further through a series of cylinders of about 18 inches or 1 foot 9 inches long, each full of glass marbles and bubbles—those glass marbles and bubbles being kept wet with water, or with different solutions, so as to absorb the acid, and so on, which might be given off—and again I passed them into a second long glass tube, so that any further deposit might take place from them, and then finally they escaped through the steam exhauster into the chimney. Therefore, I first of all cooled the products of combustion by letting them pass through the tube; secondly, I passed them over certain materials: thirdly, absorbed, as much as I could, the sulphuric or sulphurous acid produced; fourthly, I allowed them to deposit any moisture carried away; and fifthly, passed them up into the chimney; and the net results of all these experiments is—and I have carried them on altogether for 18 entire days—that during those 18 entire days there has not been drawn through this ventilator, as I call it, for want of a better name, at the top of the room, enough sulphurous acid to discolour in the slightest degree a piece of iodic acid and starch paper. In other words, I am quite justified in saying that there has been no sensible or appreciable amount of sulphurous acid produced. On the other hand, taking the sulphuric acid, I have recovered different per centages, varying from 22 to 62 per cent. of the sulphur present in the gas in the form of sulphuric acid. Thus, on the particular day on which I got the best results, I burnt 150 cubic feet of gas. Six burners were used, of which two were Argands, two were bat's-wings of different kinds, and two were fishtails, and the gas contained 10.50 grains of sulphur per 100 cubic feet, which would be equivalent to 48.23 grains of sulphuric acid. I actually recovered from it, in the form of sulphuric acid, 30.10 grains, which is 62 per cent. of sulphur present; and of this 62 per cent., 46 per cent. was recovered as free acid; that is, sulphuric acid. I have here a sample of a bit of iodic and starch paper,

which I exposed in this apparatus to the products of combustion of some 50 feet of gas per hour for 20 hours—that is 1000 feet of gas [producing the same]. Sulphurous acid will discolour that paper, and will turn it blue directly; and here is the other [producing another sample], which is obtained by combustion, in an open vessel, of only 5 grains of bisulphide of carbon, in a room of a similar size. I observed Dr. Tidy's statement about the sulphur matches yesterday, and have made some experiments upon that subject since. I have no doubt whatever that Dr. Tidy's evidence was perfectly correct as far as regarded sulphur matches; but they are things which are perfectly unused in London now.

The CHAIRMAN: We need not go any further into this business.

Sir R. BECKETT said he did not wish to do so, only Dr. Tidy seemed to think it of consequence.

Cross-examined by Mr. RICHARDS: I am public analyst for three districts, Gas Examiner of Greenwich, a Fellow of the Chemical Society, and a Fellow of the Society of Public Analysts, but am not connected with any hospital.

Mr. RICHARDS: If sulphuric acid is present in the quantities you describe, would you not expect to find it depositing itself in the lower parts of the room, rather than rising to the ventilator?

Witness: To a very small extent. During those experiments I placed at the ceiling of my room, which is about 10 feet 6 inches high, a small circular plate of ground glass, whitewashed each morning with pure precipitated lime and distilled water, and each evening this plate was taken down, and the whitewash on it carefully scraped off and tested, in order to find the amount of carbonate of lime which had been converted into sulphate, and I found I had as much as 7-100ths or 8-100ths, and, in one case, 13-100ths of a grain, on a small plate about 4 inches round, converted into sulphate of lime, showing that sulphuric acid was present in the air. I further placed at the entrance to the Arnott ventilator, to use the same term, a flask of ice and salt, much in the same way as Mr. Heisch described in his evidence, and I collected on that sometimes as much as three-fourths of a grain of sulphuric acid during the day's experiment.

Am I right in saying that a certain amount of sulphuric acid would be deposited as the vapour passes through the ventilator?—Certainly.

Sulphuric acid itself does not remain in a vapour at the ordinary temperature?—In small quantities, precisely as water does—water remains in a vapour.

Were the experiments that you made in this room repeated from time to time?—Eighteen times.

By the time you performed your eighteenth experiment, all the pictures, and walls, and so on, were entirely destroyed?—There were no pictures. The walls were papered, but they were not destroyed.

Let me call your attention to a statement made by Dr. Odling on the Crystal Palace Bill, which was: "I should say, as regards the general result of my own observations, that of the very small proportion of sulphurous products that are produced, about one-tenth part of that small proportion is converted into a state of sulphuric acid, and that is in a large measure neutralized by the ammonia existing in the air." What do you say to that?—I say I entirely disagree with that, and I will give my reasons for so doing.

Sir E. BECKETT: He says, "I should say." I call that a guess.

Mr. RICHARDS: I do not. I call it an assertion, as used in ordinary conversation. (To witness:) I will now take you to Dr. Thomas Stevenson, who had made experiments with the sulphur in gas, and who found that on burning the gas only about 5 per cent., or the 20th portion, of the sulphur in the gas, as determined by the Referees apparatus, was directly converted during combustion into sulphuric acid, and that most of that sulphuric acid was neutralized by the ammonia present in the gas and in the atmosphere.

Witness: I not only dispute that, but I say that Dr. Stevenson's own evidence deliberately contradicts it.

It is a great blessing that chemistry is an inexact science?—If you refer to Dr. Stevenson's evidence you will find that, so far from bringing out 5 per cent., he himself brings out 40 per cent.; and, in the same way, if you work out Dr. Odling's, you get 60 per cent. The apparatus I used was the ordinary Referees test for determining the sulphur.

Re-examined by Sir E. BECKETT: From the table handed in by Dr. Odling, taking the grains of sulphur per 100 cubic feet of air, in a room of 3800 cubic feet, where the gas had been burning for upwards of five hours at the rate of 15 cubic feet per hour, it was found, at a height of 1 foot 6 inches from the ceiling, to give a mean of 0.160 of a grain per cubic foot; at a height of 5 feet 6 inches from the floor, 0.056; at a height of 3 feet 6 inches from the floor, 0.059. If, in the first instance, the mean of those results was taken, and multiplied by 3800 cubic feet—the capacity of the room—that would amount to a total of 3.32 grains of sulphur contained in the room in the form of sulphur products at one time, which would be just as much as would be produced by gas burning for 40 consecutive minutes. In other words, if the room was ventilated so badly—and it would be extremely bad ventilation if the air was only changed once in 40 minutes—all the sulphuric acid formed by the combustion of the sulphur would be found in that air, according to the results of Dr. Stevenson and Dr. Odling.

Sir E. BECKETT: I have gone over the figures, and I make the same results.

Witness: I take it further, and if you go on to Dr. Stevenson's experiments you find that he carried those experiments on in his drawing-room, which differs apparently 40 feet in capacity from the experiment-room which was used by Dr. Odling and Dr. Russell; and, if you take that room as being something like the same shape, and multiply out the surface area of the walls and ceiling, and take the average deposit of combined and free sulphuric acid on the different plates which Dr. Stevenson exposed, the average amount deposited on the walls will equal 3.05 grains of sulphur, or 9.42 grains of sulphuric acid per hour; and, if you add those two results together, they will come in excess of the total amount of sulphur present in the gas, and Dr. Odling and Dr. Russell's alone are as high as my best results. Dr. Stevenson's results are about 42 per cent., which is about my average.

In short, you agree?—When the figures are properly worked out, the experiments are the most striking confirmation of the presence of acid that you can have.

Gases diffuse freely among vapours, do they not; and although sulphuric acid is heavier than common vapour, it diffuses quite freely through it?—Quite so. Water is heavier than common air, and yet we know that the air is partially saturated with watery vapours.

Mr. MICHAEL: Do I understand you mean to say that the sulphuric acid exists in a room in the form of vapour?—Certainly, as water does.

The COMMITTEE: Have you made any experiments of the process of purification of these sulphur compounds by peroxide of iron?

Witness: I have made no special experiment on that, but I am pretty fairly aware of the general results.

Are you able to say what degree of purity from the sulphur compounds can be attained by the use of the peroxide of iron process, if properly carried out, without having recourse to the lime process?—That would depend a very great deal upon the character of the coal used; but taking

the average character of the coal used in the London gas-works, I have no doubt that 38 grains, or 35 grains, may very easily be accomplished.

As an average?—Yes, as an average; and perhaps you might even say 37 or 38 grains as a maximum; but if coal of a sulphurous character is used, it would be very greatly increased.

Mr. Thomas William Keates, examined by Sir E. BECKETT.

I was examined upon the Crystal Palace Gas Bill, but wish to say a word about the lime produced just now by Mr. Anderson. I have made an examination of that lime, and find it is almost free from sulphuretted hydrogen. The object of the process, as he has explained, is to draw the sulphuretted hydrogen away from the lime, and that is most effectually done here. These two samples [producing the same] represent the different layers of the purifiers. The one which was exhibited to the committee represents the upper layer, and this, which is in a damper form, having the very same smell, represents the lower layer. In the upper layer there was only 33 of sulphide of calcium present; in the lower layer only 45; so that practically it is free from sulphide of calcium, and is converted almost entirely into carbonate of lime. I heard the evidence given by some of the managers as to the enormous quantity of lime they thought it necessary to use, and it appears to me most extravagant. Mr. Anderson tells me he uses a quantity of lime, which is altogether different from anything which I have heard stated here. The quantity he uses is equal to only 2-10ths of a bushel per ton of coals—that is, 2-10th of a bushel of slaked lime. It was stated by Mr. Evans, I think, that the usual practice is to take a bushel of lime to a ton, but I do not know whether that is a bushel of caustic lime or of slaked lime.

Mr. EVANS: Caustic lime.

Witness: That would be equal to two bushels of slaked lime; but, to continue that subject a little further, I may say that the quantity of lime used in gas-making, so far as I understand it, is out of all proportion to anything like the theory of the thing. Of course I do not mean for a moment to say that anything like theoretical perfection can be reached in these instances. In the first place, you have to deal with impure materials; in the next place, the processes themselves cannot be applied so perfectly as they might be to secure anything like theoretical results. But the theory of the thing is this: Take 100,000 cubic feet of gas, containing, say, 40 grains of sulphur to be reduced to 20 grains per 100 feet, that would necessitate the use of 30 lbs. of sulphide of calcium. Now, if you want to reduce 40 grains to 30, it would only be necessary to employ 15 lbs. of sulphide of calcium. The make of gas at Beckton is, I believe, about 15 million cubic feet per diem; to reduce 40 grains of sulphur in that gas to 20 grains would require about 450 lbs. of sulphide of calcium; to reduce 40 grains to 30 grains it would require only 225 lbs., and I am very much corroborated in that view by a publication of Mr. Mann, who is very well known as a gas engineer in London. He was for many years gas manager to the old City of London Gas Company, and ceased to hold that office when the companies were amalgamated. I knew nothing of his publication when these calculations were made; but I find that he agrees with me exactly in a letter published in the JOURNAL OF GAS LIGHTING of February, 1875. He there says that 1½ tons of sulphide of calcium would reduce the sulphur of 800 million cubic feet of gas from 32 to 10 grains, which works out to the same figures that I have here—that is, 30 lbs. to the million. I am not saying for a moment that I think any gas company could do it; but that is the result of the calculation. I said in my evidence on the Crystal Palace case that I thought the limit as to sulphur might be enlarged a little, but I think the Gas Referees are far better qualified to judge of the matter than anybody else outside the works, because they have statutory powers which enable them to go to the gas-works whenever they like. I have been in constant communication with them from the time of their appointment, and I am bound to say that they all appear to be most desirous of fulfilling their obligations both to the public and to the gas companies.

Sir E. BECKETT: Do you believe that anything, except the existence of some such body, with a control and power to vary, according to the requirements and according to the circumstances, can keep the requisite pressure upon the gas companies?

Witness: I think there is great advantage in having that elastic machinery to work with. If you fix a hard and fast line, there are no means of altering it, no matter what improvements take place. You are bound by that, and you must come to Parliament to get any change in it; but where a body like the Referees exist, they have the power to relax whenever they like.

There is a provision in the Act, independently of the Referees, that the gas shall not contain sulphuretted hydrogen at all; but is sulphuretted hydrogen in burning gas (I do not mean in leaking gas) any worse than sulphur in any other form?—No, I think not; it burns into the same compounds. If you burn sulphuretted hydrogen you get the same thing as you get if you burn bisulphide of carbon; there is merely the difference of its being a hydrogen compound instead of a carbon compound.

As a practical matter, do you believe after all that there is any real difficulty in keeping the quantity of sulphur below 30 grains?—In answer to that, it is constantly, and has been for years past, kept below that. I also think that lime can be treated in such a way as to do away with the nuisance during its removal. There are means of taking out the carbonic acid without the use of lime. Mr. Livesey pointed out that he had been using Hill's process of separating ammonia and the ammoniacal liquor from the carbonic acid and sulphur, and that he used the liquor so prepared for taking the carbonic acid out of the gas.

He stated also, I think, that the quantity of sulphur, apart from sulphuretted hydrogen, which is left in the gas before it is purified, is only 30 grains, or thereabouts?—Yes; but I think that is a great deal too low.

You mean, in fact, that there is a great deal more left in?—There is. I find in the sulphur reports of the Gas Referees in January, 1872—which is an account of a large number of experiments made at Beckton—that the quantity is very far in excess of what I state.

The experiments went on for some time, and there are weekly averages taken?—Here is Oct. 7 to 20, which is a fortnight, an average of 48 grains; Oct. 21 to Nov. 3, a mean of 46.4 grains for the first week, and 47.8 for the second; Nov. 4 to Nov. 10, a mean of 46 grains; Nov. 11 to Nov. 17, a mean of 45 grains; Nov. 18 to Nov. 24, a mean of 44.9; Nov. 25 to Dec. 1, a mean of 44.3, and then after that they are irregular.

How is the difference between 30 grains and 48, or whatever it may be that is actually left, to be dealt with? Supposing that 30 were placed as a minimum, would you have to use lime?—I know of nothing else but the use of lime. The figures I have read represent the state of the gas after the oxide of iron purification, as I understand; that leaves in the whole of the sulphur products other than sulphuretted hydrogen.

It seems impossible to get it down to anything like 30 grains without using lime?—That is the experience of the Gas Referees—or was.

Mr. MICHAEL (in cross-examination): Do you wish the committee to understand that it makes no difference to the consumer whether the gas supplied to him contains an equal quantity of sulphur in combination with hydrogen, as opposed to a similar quantity of sulphur in combination with carbon in various forms?

Witness: No, certainly not.

Whatever may be the theoretical non-difference between those two

chemical compounds when burnt, it does make a great difference whether or sulphuretted hydrogen is taken out of the gas?—I should say it makes a great difference, and I think that the Legislature for years past has always made it a *sine quâ non* that the sulphuretted hydrogen should be taken out.

Mr. MICHAEL: Do not think I am in any way at variance with you. I simply want your answer to be thoroughly explained in justice to the committee, to myself, and yourself. I did not think you wished the committee to understand that it made no difference whether it was in combination with carbon or hydrogen. May I direct your attention to the evidence you gave with respect to this very matter in 1874, upon Mr. Anderson's process:

Is it possible, as the result of that process, that there should be no sulphur in the gas and no sulphur in the lime, or in any portion of the lime, that is removed from the purifiers?—No; it is impossible.

Some of the spent lime, then, must be in a different condition from that which you analyzed?—Yes; as I understand Mr. Anderson's system, it is this: He uses a number of purifiers, and he works those purifiers in such order that the lime in some is always being converted into carbonate of lime, while it remains in a state of sulphide of calcium in others. As I understand, it comes to this: He begins with the series of four purifiers, and he passes the gas through No. 1 till the whole of No. 1—we will assume for the sake of argument—is converted into carbonate of lime.

That is for the purpose of getting rid of the carbonic acid out of the gas, which we all acknowledge is desirable for illuminating purposes.

He maintains a sufficient margin of lime in those purifiers to be enabled to take out not only the sulphuretted hydrogen which is proper to the gas itself, but also the sulphuretted hydrogen that has been expelled from No. 1 purifier, that must always be going on. When he has thrown out No. 1, to take out the carbonated lime, and replenished it, he must still have a margin to carry it on with. He must always have enough lime in the purifiers left, not only to purify the gas itself, but to purify the gas that has taken up an undue quantity of sulphuretted hydrogen from the purifier.

Supposing Mr. Anderson goes on purifying with lime for 12 months, and during the whole of that 12 months he does not remove any sulphur in his lime, where does the sulphur go to?—There must be an end of it at last, that is very clear, and at some time or other he must clear out his purifiers, sulphide or no sulphide.

Do you wish to add anything to that?

Witness: I may say that is very much altered by the explanation that Mr. Anderson gives, that he uses, after he has employed this lime purifier, oxide of iron, which gets over the whole difficulty.

Whatever may be the fact theoretically in the laboratory, is there not a great difference in carrying out the process practically on a large scale?—Of course; but if a maximum of 30 grains were allowed, you would be able to purify the gas with so much less lime, and then it would cease to be a nuisance. I think 30 grains is the extreme limit which ought to be allowed, and if there should be 5 or 10 grains above, it should be taken out.

May there not be at the present time (you told us Mr. Anderson's process is an improvement on something you heard in 1874), something which, in accordance with the evidence given before the committee, would reduce the average to 33 grains?—There is no single reason for such a thing. The gas in this case was purified by oxide of iron; the coals are a mixture of all sorts; and I see no reason why there should be any difference at the present time. I do not say there is no change, but there does not appear to me to be any reason to believe that to be the case. I consider the sulphur ought to be kept down to 30 grains, no matter what means are used.

The COMMITTEE: Do you speak of 30 grains as an average or as a minimum?

Witness: An average.

Therefore the difference between you and Mr. Michael is between an average of 30 grains and an average of 33?—I thought the committee suggested 35.

A maximum of either 35 or 40—either 35 over a week, or 40 over three days?—It appears from what I have read, from these elaborate series of experiments carried on for a long time, that the amount of sulphur in the gas exceeds 33 grains.

Do you think that in Paris and in London the sulphur compounds are different?—I only know from the evidence I have heard, but I think very little is known of that question in Paris. I think it is quite clear that the Paris gas is not so well purified as the London gas.

Mr. Thomas Hawksley, examined by Sir E. BECKETT.

I have been engaged in designing and looking after gas-works in England and on the Continent for between 40 and 50 years, and during a great part of that time I have turned my attention to sulphur. I have no recollection of ever having appeared in opposition to a company before; nor would I do it now if I thought that this was not a case that required the facts to be explained. I think the companies have generally been more sinned against than sinning; but this is the opposite case, and they seem to have gone boldly into sin now they have started.

At the request of Sir E. BECKETT, the CHAIRMAN repeated the suggestion made in the early part of the day—viz., that the maximum should be fixed for the present at 40 grains if the average was taken on three days, or 35 grains if taken for a week, and that it should be subject to variation only by a direct order from the Board of Trade, and also that the company should give every facility to the Board of Trade to make such experiments, under such conditions as the Board might desire, upon their works. There was likewise a further question to be considered, as to how the financial result or saving in that change of procedure should be received or enjoyed either by the public or the company.

Sir E. BECKETT: Having heard that, what do you say would be the effect upon the company?

Witness: The latter part of the suggestion is exceedingly valuable. How it would operate upon them and their dividends it is impossible for me to say, but with regard to the proposed limit of 40 grains I have to say—

The CHAIRMAN: That is the maximum?

Witness: Yes, but it is an average maximum. They may be at 50 grains one day, if they will come down to 35 on two other days, and that would amount to (if I may use such an expression), poisoning the consumers on two days out of the three in order that they might be relieved of 5 grains on the other one.

You mean that if the Acts, going as far back as the Act of 1860, had not been passed, they would probably have given us no more than 40 grains?—If there had been a thorough good purification in other respects, good washing, taking out the ammonia, and a previous washing with ammoniacal liquor for taking out such sulphur compounds as the alkaline and the ammoniacal liquor will take out, then there ought not at most to be more than 40 grains left after purification from sulphuretted hydrogen; so that, in fact, it is repealing the law entirely as it now stands.

The two practical issues we all see; and, first of all, the influences of, I will say, the difference between the 20 grains and the 40; and, secondly, the possibility of getting rid of this 20 without nuisance. First, as to the influences between 20 and 40, what have you to say about that?—Let me first explain, as it stood yesterday, with 35 grains, that would be the means of distributing into the houses of the consumers the equivalent (and it would be performed to a very large extent) of 2 million pounds of sulphuric acid per annum, and if it did not pass into sulphuric acid, and were only sulphurous acid, there would be more than a million and a half pounds so distributed through the town. I have seen the effects where gas has

not been properly purified, and the effect would be, taking a mercer's shop, that the exposed edges of all silks in the upper part of the room would be bleached. Sulphurous acid has great bleaching power; it removes colouring matter, and has a great many other injurious effects. It affects the throat very sensibly, and communicates a nasty coppery taste in the mouth. I am a gas-maker in many parts of the kingdom, and I do not want to exaggerate the effect, but I regard this as a very retrogressive movement.

Sir E. BECKETT: Now, although 2 million pounds of sulphur are not to be sent into one house in the year, would that be enough to make a very sensible effect over all the houses?

Witness: Very sensible. I do not mean to say that if in a great room like this you had a good ventilating-pipe out of the corner, as I have in my dining-room, that you would suffer very much from it; but taking all the ordinary cases of habitations and shops, and workshops particularly, the mischief would be very considerable.

That is one part of the story; the other part is the nuisance question. What do you say as to the possibility of reducing the sulphur to 20 grains without any nuisance?—There ought to be no nuisance by reason of reducing it to 20 grains. A gas-work is not an agreeable neighbour, but the smells which come from thence are not in general created by the sulphur, if the process be properly conducted. Of course you may make a great nuisance by an improper way of purifying the gas, or of treating the lime after it has become refuse. At Nottingham we can, without any difficulty, keep the sulphur, other than sulphuretted hydrogen, down to 15 grains. I have also had to do with Derby, Sunderland, and other large towns, in great numbers, where lime is used, either by itself or in conjunction with oxide of iron. Where lime is not properly used, it can be made a nuisance, and many gas companies do make an unnecessary nuisance—I am bound to admit that—but by properly conducting their operations, both in gas-making and in dealing with the waste lime, there need be no nuisance whatever. The process of gas-making in London, as it is generally known, is a very bad one. It is very imperfect, and might be very much improved; but, in point of fact, in some places they try to do too much in a very limited area, and out of that particular circumstance arises a great deal of the trouble which the gas companies get into.

I suppose they will say that they cannot help their area being limited?—Yes, they can; at least, this particular company can. They have got very large means, and need not be making the great quantity they are doing at Fulham; or at the little place which used to be the Equitable works; neither need they be pressing other stations to the extent they do. I remember the time when Mr. Cardwell's committee suggested amalgamation, which was with a view to getting rid of the manufacture of gas in the thick of London; and it has had that effect. For instance, the City Gas-Works are discontinued as a place of manufacture.

It has been suggested that the men suffer from removing the lime, and so on; have you found that to be the case in other gas-works which are properly managed?—The men do not suffer from the removal of the lime; they suffer rather more from preparing the lime than from removing it.

With reference to the preparing, is that necessarily an unhealthy process?—It need not be, because it may be done mechanically if they choose to do so; therefore, of course, it would not be injurious.

The only remaining point is with reference to the powers of the Board of Trade to vary this maximum from time to time, and that has to be contrasted with the power of the Referees. Do you see how the Board of Trade can act in this matter except through some officers, whatever those officers may be called?—I have the pleasure of knowing all the Referees, and I know they are very competent people; they are scientific men, and they know enough of the practice of gas-making to guide their science, so as not to make mistakes; and I also know that the limits which they have prescribed from time to time are fair, and such as the companies, if they would only make their gas by a proper process, could fairly and reasonably adopt and comply with.

Supposing the Referees were abolished by name, can you see any way by which the Board of Trade could act, except by having some similar officers, but who would be called something else?—No; there must, I suppose, be some control, although the Bill seeks to get rid of all control, not only with respect to sulphur, but with respect to all impurities whatever.

As the Referees exist, and assuming them, for the sake of argument only, to be competent, supposing they came to the conclusion that it would be impossible to do this work without a nuisance, can you see any reason why they should not relax their conditions?—No; the Referees can tomorrow, if any reason is shown why it should be so, make their limit 25, 30, 35, 40, or 50 grains. They can make it anything they like; but if it is done by Act of Parliament it is done rigidly, and without any regard to what might be an improvement in gas manufacture.

But that is not the committee's proposal. The present proposal is, that the Board of Trade should have the power of reducing the 33 or the 40 grains, whatever we call it, below that amount whenever they think fit. I ask you if there is any advantage in that over the Referee system?—No; it amounts to the same thing, I should say, in the end. It is 33 grains, as I understand, with a power of diminution.

Whereas it is now 20, with a power of raising it?—Yes, and it is raised; it is 25 in winter.

So that the introduction of anything like the recognition of 33 or 40 grains would be very nearly doubling the maximum which they have been allowed for the last 17 years?—Not doubling, but adding two-thirds to it.

Examination continued: I have burnt the Chartered Company's gas for nearly 30 years, and am satisfied with it; it is not very rich in illuminating power, but it is a very pure gas—reasonably pure. Some time ago I had cause to complain, because my office, which consists of several large rooms, was perfectly unbearable, and that was within half an hour after the gas was lighted. I applied to the company, and they sent one of their people, who looked round my room—not knowing who I was, or what I knew about gas—and he said, "Oh, it is your burners." That is the staple answer or suggestion of remedy; but my burners had been there long before, and are there still. The company paid no attention, and so I wrote a letter to the Gas Referees, and they took some steps (what they were I do not know), but after a short time the gas became quite pure, and I have had no cause of complaint since.

By the COMMITTEE: I should think that took place three or four years ago; but I can show you something which is very interesting. This [producing a bottle of water] was taken out of one of my gas-pipes, not experimentally at all, but was the result of less than two hours burning of three gaslights in my drawing office. A chemist will follow me who will tell you what are the contents of this water in sulphur, and also tell you how acid it is, and that it destroys the iron of the pipes. He will show you the iron in it.

Sir E. BECKETT: Before the chemist comes, will you just explain how that water was actually obtained?

Witness: I have in one of my offices three gaslights over a drawing-table, and those communicate by a ventilating tube with a horizontal pipe which carries the products of combustion into the chimney; that pipe is cold, and condenses the products of combustion into water, or rather

into this liquor which I have here. That is drawn off by a decending pipe into a vessel, and out of that vessel it was poured into this bottle, and this was the result of less than two hours burning of three Argands.

It is the distillation of the gas vapour?—In the ordinary course, and I can bring you pints of it from my office, in which every light is ventilated; and from the pipe which conveys off the products of combustion I can get this liquid in quarts at any time. It is not, of course, the amount of liquid, because the consumption of gas results in the formation of water, but it is what the contents of it are. You will find plenty of acid in this if you have a bit of litmus paper.

By the COMMITTEE: I have a bell over each light, and they go into one tube, which tube communicates with the chimney. About 5 cubic feet of gas is consumed by each burner, making 30 feet. [The litmus paper was produced, discoloured.] Now they say that there is no sulphuric acid generated. Just look at that.

Sir E. BECKETT: I hear it stated that sulphurous acid will do the same?

Witness: Sulphurous acid dissolved in water will, but I have no doubt this is sulphuric acid. At all events, you see the effect of it; it does not matter what it is, whether it is called an acid or not.

Examination continued: Purifying gas properly ought not to cost more than a penny per 1000 feet above what it costs to purify it improperly. I have some knowledge of the Paris gas, which was spoken of yesterday. I know there they manufacture their gas by a very much better process than the one which is adopted in London. They work with four-hour charges, whereas in London they work with six-hour charges, and the result is that they produce in London more of this obnoxious compound than would be produced by a more rapid distillation of the coal, and not draining it to the dregs, as they do in London. I believe the bisulphide of carbon is produced in this way.—There is, especially at the latter part of the charge, a good deal of carbonic acid, and also carbonic oxide, and there is likewise sulphuretted hydrogen coming off from the coke, which contains a good deal of ferruginous matter with which the sulphur is commonly combined. Now the way in which it happens, I believe, is this—that two molecules of sulphuretted hydrogen are combined with one molecule of carbonic oxide, or it may be carbonic acid, the result of which is the formation of bisulphide of carbon, which is a very obnoxious matter; and if it be with carbonic acid, then one equivalent of oxygen is set free, and that may account for the small quantity of free oxygen which is always found in coal gas, and which has been a difficulty, as far as the theory goes, hitherto. If they work off the charge, as I do in a shorter period in these provincial works, and particularly if they worked it off in the manner which is adopted in Paris, I have no doubt they would have less of this obnoxious compound. The next thing to do is to wash the gas well with ammoniacal liquor, and that absorbs an enormous quantity of bisulphide of carbon—so much that the ammoniacal liquor stinks abominably. Then there is less to go forward to the next process of purification, which ought to be passing the gas through oxide, to take out all the sulphuretted hydrogen. There ought next to be lime, for the purpose of taking out the carbonic acid, because the two can be taken out together, and I do it constantly, notwithstanding all that has been said to the contrary. Then the gas goes on to what is called the catch purifier, filled with oxide of iron; and if any sulphuretted hydrogen passes over, it is caught in that vessel. The process is very simple, very economical, and very sure in its results; and the lime, instead of coming out in the obnoxious state in which it ordinarily does from the purifier, comes out very nearly white, without a very obnoxious smell, and is only coloured by sulphur in a pyrophoric state diffused through it.

Sir E. BECKETT: To sum up, do you think that, on the balance of convenience and inconvenience, between leaving an extra 20 grains of sulphur in the gas and running the risk of the nuisance of purifying it, the balance on the part of the public is in favour of having their gas kept pure?

Witness: Undoubtedly.

Cross-examined by Mr. RICHARDS: It is not a question of conduct on the part of the gas company, because they are obliged to be good boys at the present time; but they come here for leave to be able to behave as they please. I consider that the company are doing too much work upon particular areas of land, and that their apparatus is not well adapted to the requirements which Parliament has imposed upon them. The company are doing too much at Fulham, and also at Pimlico.

Mr. RICHARDS: Do you know what they are doing at Fulham, and that for the last year a large portion of the Fulham district has been handed over to Beckton?

Witness: No, I cannot answer that. All I know is what they say they are doing.

By the CHAIRMAN: With regard to the alleged nuisance in the neighbourhood of Kensington, I may mention a fact within my own knowledge. I happen to live in that district myself, and the great nuisance there is not from the gas-works, but from a brick-kiln, which many persons take for a gas nuisance.

Cross-examination resumed: We had a complaint exactly similar to that of Mr. Veitch, made at one of the Nottingham works, some years ago, by a florist; and what the company did was to set up a flower-garden in the works, and the flowers grew so beautifully that they never had a complaint afterwards. I do not wish to suggest that the engineers of the company have not done their best to prevent a nuisance, but, from what I have heard in this room, the process which they adopt for the purification of gas is well calculated to make a nuisance. They are very intent on purifying the gas by sulphide of calcium, and, as I understand, use the foul lime for the purpose of taking out the bisulphide of carbon; and if that is done, it will to a certainty make a nuisance, for the gas lime is a most offensive thing. It need not be done in that way, because there is no occasion to bring the sulphuretted hydrogen at all in contact with the lime. The lime, as I have mentioned, will take out the bisulphide of carbon when it is in a pure state, and it does not require to be made impure for that purpose. One ton of lime will purify the gas of 40 tons of coal, both from carbonic acid and bisulphide of carbon, and that after you have taken out the whole of the sulphuretted hydrogen. That is what I did at Nottingham.

Mr. RICHARDS: What is it that makes such an abominable stench at Nottingham at the present moment?

Witness: Nothing. No gas-work is free from smell; the oleaginous and ammoniacal matters which are produced in the distillation of coal always produce a smell, but that is a very different thing from the smell of the foul lime.

I understand you to admit that the sulphur compounds must be got out in order to meet the requirements of the Referees, and that necessitates the use of lime to get them out?—Yes; but the use and removal of the lime may be so managed as not to produce an obnoxious nuisance.

You also think there should be shorter charges—that is to say, that the retorts should be filled at more frequent intervals?—I do not say that is a *sine quâ non*. I am merely telling you how the Paris people conduct their works, and how it is in the country works of mine. I can also tell you that in Scotland (but they use a different coal there) they work with three-hour charges.

The CHAIRMAN: What, in your opinion, is the degree of purity from sulphur compounds—exclusively, of course, of sulphuretted hydrogen—

which can be attained by the peroxide process, without recourse to the lime process?

Witness: That would vary according to the quality of the coals. Many coals contains as much or more than half a hundredweight of pure sulphur in a ton; the Midland coals do.

But the kind of coals which are used in these large works?—They use all kinds, and there is a difficulty in answering the question without an explanation. The best gas coals do not contain more than 40 lbs., and, therefore, the question is not so easily answered; but I should think, taking the Midland coals, that there are quite 50 grains of this bisulphide compound in 100 cubic feet. Taking the north country coal, I do not believe that there are more than 35 or 40; but it is a question very difficult to answer, because in the crude gas, as it reaches the purifier, or, rather, the commencement of the process of purification, the sulphur very often amounts to 250 grains.

What I want to know is this: Supposing a limit is fixed for this City company—we will say an average of 35 grains—will they be able to attain that degree of purity without having to resort to the lime process?—I should think not.

What degree of purity do you think they could obtain?—It would rather restrict them as to the purchase of their coals, which will be a very undesirable thing; but I should think that they could find coals which would bring the quantity down to about 40 grains.

Do you mean an average of 40 grains?—Yes; but I do not know exactly what is meant by average, because that is a very uncertain thing. You might have a very impure gas one day, and a very pure one the next.

Mr. Keates said he thought the companies might be allowed safely and properly to go to an average of 30 or 33 grains of the sulphurous compounds in the manufacture of their gas; do you agree to that?—No; I think you would perceive the effect of that in a close room. I think the 25 grains fixed by the Referees is as low as it would be prudent to allow. If that amount is right for winter, I do not see why it is not right for summer; that is the difficulty, I see, in the Referees instructions.

You seem to me to have a very strong objection to this principle of average, but suppose the average was 35 grains, would you then say that, for the sake of a relief of five grains on one day out of three, people are to be poisoned for the other two days—that is to say, by an increase of two and a half grains?—No. I have been very much misunderstood, or have very inaccurately explained myself, if I have been misunderstood to say that.

You terrified us when you began, because I took down your words that "people were to be poisoned on two days in order to give a relief of five grains on the other one"?—No; what I say is this—that if you have 35 grains on two days and 50 on another day, it does not at all relieve the people.

The CHAIRMAN: What I understood you to say distinctly was, that the public would be poisoned for two days in order to give them a relief of 5 grains on one day, and that is a very serious thing.

Sir E. BECKETT: "Poisoning" is, of course, a metaphorical expression.

The CHAIRMAN: If it went forth to the public without some qualification it might produce a very injurious effect.

Witness: I was not in earnest in using those words, and, with very great deference to yourself, I do not think I used the words "being poisoned on two days," but I think I may have used the expression, "being poisoned one day out of three," because you may have a very large quantity of sulphur on one day, and from that the public would suffer, while that quantity might be corrected down to the average by the two other days showing a very low quantity comparatively.

The CHAIRMAN: You may have intended to say that, but you stated exactly as I tell you now. With regard to another of your answers, you spoke of distributing 2,000,000 lbs. of sulphuric acid; you do not say exactly where, but I suppose if that were extended over the three kingdoms it would not do much harm; and, therefore, it depends entirely upon what area it is to be extended over?

Witness: It is a practical question—Can you perceive it by the nose, and does it produce injurious effects on delicate goods? I answer in both cases in the affirmative from experience.

By the COMMITTEE: When I used the word "poisoned," I did not mean poisoned to death—that is quite a different thing—but what I meant was, poisoned in the sense of the quantity of sulphur being then very obnoxious, and in amount sufficient to do injury both to health and goods upon that one day out of the three. Supposing myself to be in the position of President of the Board of Trade, and that the committee had stated their conviction that 40 grains was the proper limit, I should be very careful indeed about taking any steps to impose a lower standard of quality upon the companies.

The COMMITTEE: In one of the letters which has been put in, from the Referees to the Board of Trade, they admit that there is much to be said in favour of the view that the presence in gas of sulphur, which the lime process removes, is of no great consequence to the consumer?

Witness: That depends entirely upon the state of the consumer's ventilation. If the consumer will make perfect ventilation in his house, which very few consumers will make, then it is not of much consequence; but under the ordinary condition of houses, I have no hesitation in saying that it is of considerable consequence, and in workshops particularly.

The COMMITTEE: The proposition referred to is as follows:—"While admitting that there is much to be said in favour of the view that the presence in gas of the small amount of sulphur which the lime purification removes is of no great consequence to the consumer, we are still of opinion that it would be a measure of questionable expediency to relieve the companies altogether from the obligation to make and supply gas as pure as can reasonably be required, because the main inducement to invention and effort in this direction would thus be removed."

Witness: What the "because" means I do not know, but stopping at the word "required," I agree with the sentence.

The COMMITTEE: Do you agree with the admission that there is much to be said in favour of the view that the presence of this small additional quantity of sulphur is of no great consequence?

Witness: Yes; but there is very much to be said on the other side.

Mr. Charles Heisch, examined by Sir E. BECKETT.

I examined the water which came out of Mr. Hawksley's gas chimney, but I have not had time to make a quantitative analysis of it. I precipitated half an ounce of it with chloride of barium, to which I added a considerable amount of hydrochloric acid, to make sure that nothing but sulphate of barium was precipitated. I have here a bottle which will show the amount of iron which is taken up from the pipe [producing a bottle]. This is the iron in solution, which was precipitated by ammonia, and it will give an idea of the amount of the corrosion going on in the interior of the pipe.

By the COMMITTEE: I cannot say how long that pipe has been in use.

The COMMITTEE: If it goes on at that rate every two hours, it will not last very long?

Witness: That is what is in solution in this particular quantity of water. Of course, the whole corrosion of the pipe would represent a good deal more than that; but I can mention, as a matter of experience—because I

have tried it—that if I start with a perfectly new pipe, I find that about one-half of the sulphur existing in the gas burnt is condensed in the pipe in the form of a sulphide of the metal of which the pipe is made, provided it is a metal on which sulphuric acid acts.

Examination resumed: I have heard of the proposal to substitute the Board of Trade, acting through somebody, for the Referees; but I do not think it would make any difference, except that it would give them a starting position, which the Referees have not. I should not like to go to the gas-works for the purpose of making experiments, because it would require a combination of elements which I do not possess in my own person. To make those experiments properly a man ought to be a mixture of a chemist and a gas engineer.

Sir E. BECKETT: Take this hypothesis. If we suppose the company themselves undertake to make the experiments, would you like to be bound by the results, supposing you were a Referee?

Witness: I do not think I should. It would depend so much upon circumstances what the experiments were. The carrying out of experiments in that way is a thing which it is difficult to do without interfering with the works to a certain extent. If it were merely trying certain modifications of processes in use, that is one thing; but if it is trying an absolutely new thing, it is another.

Mr. MICHAEL (in cross-examination): Putting yourself in the position of a chemist, and assuming that you had devised in the laboratory some mode which you had proved in the laboratory to be successful, you would not consider that successful until you had an opportunity of trying it on a large scale?

Witness: No.

What could you wish for better, if you have confidence in your experiment, than to have it tried upon a large scale at the gas-works, where practically you could test the system which you had elaborated in your laboratory?—I think that would depend a good deal upon the amount of assistance which you could obtain in the engineering part of the business from the engineer of the company. If he were willing to take the thing up, and willing to help you over the engineering difficulty, and you to help him over the chemical ones, I would wish for nothing better.

All you want in the gas-works is the presence of gas in large quantities to be purified; that will be the first primary condition, of course?—That is the primary condition, of course.

What difficulty would there be in the Board of Trade sending their own engineer to put up the box which you had invented in the laboratory?—I should think there would not be any difficulty in that.

The COMMITTEE: There have been experiments conducted by the gas company, at the instance of the Board of Trade, at considerable expense. Were there any complaints of the way in which those experiments were conducted on the part of the Board of Trade at the gas-works?

Witness: I am not aware of that.

Whatever Mr. Vernon Harcourt has suggested has been tried?—I can give no evidence about that.

At the conclusion of Mr. Heisch's evidence the **CHAIRMAN** said the inclination of the committee was to give some such relief to the gas company as had already been suggested at an earlier period of the day. They were the more inclined to do so, as on the balance of convenience they thought the injury to that part of the public which suffered by the process of lime purification was on the whole greater than the inconvenience suffered by the public through a slight increase of the maximum of the sulphur compounds, other than sulphuretted hydrogen, permitted to remain in the gas. It was not, therefore, in any way to relieve the company from the bargains which they entered into when they obtained their Act last year, and it would be for those who represented the public to make any suggestion they thought fit, and support it by such evidence as they might require, as to whether any alteration should be made in the price at which gas was in future to be sold by the company. The committee would also like to know, as exactly as possible (because up to that time there had been some little difference of opinion on the subject), about what the minimum of sulphur impurity obtainable in gas, without using the foul lime process, would be. Besides that, the committee would have to take care that the clause (should they agree to vary the clause as it stood) should be drawn in such a way as to give the most ample opportunities to the Board of Trade to make all experiments they might think fit under the most favourable conditions.

Mr. CRIPPS expressed a wish to consult with Sir E. Beckett, and, after some conversation, the committee adjourned.

THURSDAY, MAY 17.

Mr. Frederick Joseph Bramwell, examined by Sir E. BECKETT.

I am an engineer, and have given evidence upon a great many gas inquiries. I have visited several gas-works, both at home and abroad. As regards the question of nuisance, I do not consider that the evidence which has been given by the Chartered Gas Company is at all conclusive, neither do I think that the best means have been adopted to prevent it. From my own knowledge, I am convinced that there are means of carrying on the reduction to 20 grains by means of lime, without imposing any nuisance on the neighbourhood.

Sir E. BECKETT: Evidence has been given of various conditions of things at the different works; for instance, at Pimlico, it sometimes appears there is a nuisance, and sometimes there is not a nuisance. What do you infer from that?

Witness: That at one time more care is taken than at another. I know the Pimlico works well, and I heard the evidence that was given about the nuisance created by taking the spent lime in a cart across the roadway, and shooting it into a barge. I know there is a subway along which the coals come, and through which the lime might have been taken; and it does not look to me as though that was a strong effort to get rid of the lime with the least nuisance possible. I have heard the evidence which has been given, and I agree with it as to the fact that no nuisance need necessarily be created.

Do you also agree that there is, in some cases, carelessness?—The instance that I cited just now appears to me to be carelessness.

On the question of getting rid of this lime; have most of the works railway communication or canal communication?—Yes; almost all the important works now have either railway or water communication.

Take the case of the railway, would it be easy to get the lime on to the railway without exposing it, and so creating a nuisance?—It appears to me to be so, in the following way:—Instead of putting the purifier in the open air, place it on the first floor of the building, and deliver the lime through the bottom of the purifier instead of shovelling it over the top; it could then be delivered straight down through the shoot from the bottom of the purifier into the very receptacle that you have to take it away.

That is assuming the lime is in the state in which Mr. Anderson tells us it need not be?—It is assuming the lime is in an offensive state, but I am not chemist enough to say whether it need be in such an offensive state. Some years ago I had occasion to study this matter, in connexion with one of the most offensive trades I know of—viz., bone-boiling, in which odours were emitted worse than those coupled with the notion of putrescence; and in that trade, by the precaution of carrying it on within a

building, and having an exhaust fan to make an in-draught of air, there was no nuisance whatever outside the building.

Inasmuch as the company have now Beckton and other places out of London, they need not necessarily carry on so much work at Fulham, St. Pancras, and other places in London?—As regards Beckton, except the outfall of the Metropolitan Board of Works sewers, I do not know what neighbourhood there is to be offended. They have no neighbours to complain there—their nearest neighbour is the outfall.

You mentioned having seen several gas-works abroad; can you tell us anything about the mode in which purification is carried on?—No, except seeing the children going about to be cured of whooping-cough. At Brussels the purifiers are made with an internal framework, so that the whole of the contents are lifted out bodily, and taken away and revived, instead of being shovelled out.

A suggestion has been made to the committee that experiments should be carried on by some new Referee or officer, or whatever he is to be called, on the gas-works themselves, by the gas people. How do you think that would work?—If the Referees have practical knowledge, they do not want the aid of the gas company; but if they want the aid of the gas company to get practical knowledge, it is asking the company to make a rod for their own backs.

And show the Referees how to flog?—Yes. That is to say, if the experiments are successful, it is to impose upon them the continuance of the purification from these other sulphur compounds; whereas, if they are unsuccessful, the suggestion is that they are to be relieved.

Would you yourself like to be a Referee, and have these experiments carried on by those whom you have to control?—I should feel that my office was really a nominal one.

Cross-examined by Mr. POPE: I have given attention to the purification of gas for the last five years. I am not a chemist, but I suppose I know as much about purification as any other gas engineer who is not a chemist. I know that at Brussels there is a purifier of lime in connexion with the oxide.

Mr. POPE: So there is everywhere; but on the question of the possibility of conducting the purification by lime without a nuisance, you are vouching continental works, and I want your knowledge on the subject.

Witness: I can only tell you of the one at Brussels, and that I have not seen; but the question put to me was not as to purification by lime; it was a question as to what I had seen. I have not seen the process of removing the spent lime at the Pimlico works, but I heard Mr. Dines's evidence, and I know those works, and also the subway, as I had particular occasion to inquire into it some years ago. That subway communicates with the river side, and if a cart containing spent lime were taken there it must necessarily shoot its contents into the barge lying upon the river brink.

Which is the precise material which Professor Tyndall said caused the nuisance?—So I understood. Will you let me state that my impression was that the lime was taken in a cart across the public roadway, on a high level, and from there shot into the barge; and I say that that was a way that was much more likely to cause a nuisance than if it had been conveyed in a truck along the subway under the road, and turned into the barge from a less height.

Do you suppose that any of the nuisance arises while it is crossing the road?—Certainly.

In what condition is it taken across?—In a cart, covered with a little earth probably, but I do not know whether it was or not.

If it is covered with breeze, it is perfectly inodorous, and there would be no nuisance created?—If it is inodorous, of course there is no nuisance.

Do you believe that it was shot uncovered into the barge?—No; I believe it was covered.

Then the whole difference would be that taking it along the subway would make the shoot less high, in fact?—Yes; but I may make a remark upon that. Either the operation is so conducted that there is no nuisance at all—and I thought that the suggestion was that there was a nuisance—or it is so conducted as that it might be improved, as regards the descent through the shoot.

The improvement possible is a reduction of the height of the shoot?—Yes.

That is the whole of it, though you have not seen or investigated for yourself how far the nuisance arises in that way or otherwise?—I do not know whether you put to me that there is a nuisance or that there is not. If there is not, I suppose there is an end of the case; but if there is, then I think it could be reduced.

How about the rise and fall of the tide? That would increase or diminish the height of the shoot, would it not?—The road being above the subway, it is quite clear the height, whatever it is, is *plus* this fall.

I do not quite understand your analogy between sulphuretted hydrogen and bone-boiling?—I think the analogy, I will not say is obvious, but is pretty smokable—two bad stinks.

Do you yourself make no distinction between vapour given off by bone-boiling, which contains an organic stink in it, so to speak, and sulphuretted hydrogen, which is gaseous and diffusible?—I have no doubt I could demonstrate between one smell and the other.

Do you mean to say that the physical conditions of the two are altogether analogous?—I do. For the purpose of preventing the diffusion of the smell, it does not matter very much whether it is sulphuretted hydrogen or Eau de Cologne.

What is it that causes the nuisance of bone-boiling, which runs over in vapour?—I am not chemist enough to tell you. I can tell you it is a dreadful stink, but I cannot give it you chemically.

You cannot say whether it is gas or organic matter which comes over in steam?—I tell you it is partly uncondensable, I believe.

Cross-examination continued: What I suggest is that a purifier might be placed on the first floor, railway-trucks run underneath, and the lime shot from the bottom into those trucks, or else into a barge, by which means it would be quickly got rid of.

Quickly getting rid of the stuff—that is to say, taking the bottom out of the purifier?—Not taking the bottom out, but shovelling it through openings in the bottom, as is done, and as is thoroughly well known.

The COMMITTEE: Done where?

Witness: At the Commercial Gas-Works.

Mr. POPE: That is an awkward illustration, for that is the place where the maximum is raised by the Referees to 30 grains?

Witness: Yes, and where the works themselves are making at the present time, I believe, only 13 grains. I do not think there is any smell from the Commercial Works at the present time.

Then there is no necessity for what the Referees have done, in your judgment?—I believe the cause to be that at the time the Referees made that order the plant of the Commercial Company was not complete.

All you suggest is, care in the administration of this lime process?—Yes.

And you also express decidedly the opinion that lime purification does not necessarily create a nuisance, however small?—I do; that is to say, no greater nuisance than arises from the conduct of other processes of gas-works. I have likewise seen the process of lime purification carried on at Beckton without a nuisance. Supposing Beckton were in the middle

of London, the whole works would be a nuisance, but I do not believe the lime process need be. As I understand the Act, the function of the Referees in lime purification is limited by whether the process can be conducted so as to be a nuisance or not. If, therefore, it be a nuisance, the companies are relieved from the expense of lime purification. My evidence is based upon the assumption that the best efforts are made to prevent its being a nuisance.

Re-examined by Sir E. BECKETT: The Commercial Company were one of those that accepted Mr. Forster's legislation of 1875, and whether the Referees have prescribed or not prescribed, I know as a fact that they are making gas with only 13 grains of sulphur left in without a trace of nuisance. My last visit to their works was about a month or six weeks ago.

Sir E. BECKETT: My learned friend seems to have got some notion that there are diffusible and indiffusible smells; I have not met with the indiffusible ones, have you?

Witness: I have no notion of a smell which is capable of being laid hold of, which appears to me to be a smell which is not diffusible. I do not like to refer the committee to the lines in Pope about what will perfume a spacious drawing-room and does not weigh half a grain.

You were asked about your experience abroad, and so on; I suppose you need not go abroad to find out that purification can be done without smell when you see it done in England?—To my mind, if you get it done on a large scale in one works, that establishes the fact; just as if you had seen a locomotive running once, that would be establishing the fact that there was such a thing as a locomotive, although every coach builder and coach driver in England swore that it could not answer.

Do you know how long it is since the Commercial Company finished their plant? As I understand, it is a plant for an improved process of purification by lime?—The completion of the plant, I believe, has not yet taken place for their winter make. It was in progress when I was there, but not completed. The plant for the summer make was completed.

Did you see the process of opening the lime purifiers and cleansing them whilst you were there?—It had finished the moment before I got there.

How do you know that it finished the moment before you got there?—I was told so by the foreman. I went on board the barge, which was lying there with the stuff put into it, but I think there was a tarpaulin over it. When I took hold of the lime and lifted it, it had an offensive smell.

Until the cover was removed you perceived no serious smell?—No, but I may describe it to you very briefly. There is a house containing four lime purifiers of large size—I think 36 feet by 28 feet—upon the first floor. That house abuts upon the canal, and the material is emptied down through the bottom of the purifier into the bottom floor, and is then carried away into the barge which lies immediately outside the house.

As a matter of fact, when you say it had been a moment before, I suppose it might have been half an hour or a quarter of an hour?—It was this: "I believe we are emptying now." I go into the house: "We have just finished."

If it had been a quarter of an hour before, whatever smell there was created in opening the purifier was all over, and probably would have been removed?—I should think not, because this is in a closed building. I should tell you that the purifier was open, and the contents had to be delivered, and were at that moment on board the barge, and some were lying about. I hope you do not fancy that I am saying that there was no offensive smell within the house, but what I am saying is that it did not spread outside the house.

If any smell had escaped from the house a quarter of an hour before you went there, it would not be likely to be hanging in the air still?—No; if it had escaped a quarter of an hour before, probably not.

I have not quite caught from you the process by which you believe the nuisance, which might otherwise have been created, is avoided at the Commercial works?—The purifiers are in a close building, with only the ordinary openings, and instead of the stuff being pitched over the side of the purifiers, so as, it appears to me, to perfume the air as much as possible, it is sent through the bottom of the purifiers through four openings.

Are there layers or trays, may I ask you?—Yes.

You have not seen them working the process of getting rid of this stuff, therefore you cannot tell us in what way they clean out the lime between the trays?—The trays are lifted. When the first row of trays is cleared, that is lifted, and the next cleared, as in any other purifier.

Do you think that that is an experiment which, supposing it were successful at the Commercial works, it would be possible to have tried at the other works, under the superintendence or by the order of the Board of Trade?—I do not think it would be possible. If it is to be a Board of Trade experiment, it will be said that it is not a practical one; and if the Board of Trade, to get rid of that objection, are to put themselves in the hands of what are called practical men, I am sorry to say I think you are asking practical men to—

Surely, as I understand you, the experiment is not only a practical one, but one which has been carried into effect in other works. Then, what difficulty can there be, if competent men are employed for the purpose, to have that process entirely imitated?—As I understand, the Gas Referees, being gentlemen of knowledge and skill, say, "It is not for us to give directions as to what is to be done; but we do know, as a matter of fact, that it can be done, and therefore we go on with our orders."

Do you believe that that decision of the Referees is founded upon the success of the Commercial Company's experiment?—I will not say upon that, but upon consideration of what really can be done. I do not call it an experiment at the Commercial Gas Company; it is a question of construction.

Re-examination continued: I have visited the Beckton works on three occasions, the last being in 1876, but I cannot say that I have been there when the purifiers were opened and cleared. All I can say is, that when I was there I observed no serious nuisance, but that is quite consistent with the fact that when the purifiers were opened and cleared there might be a considerable nuisance.

Sir E. BECKETT: Do you know enough of those Brussels works to say whether the process of lime purification there is for the same purpose as is conducted, we will say, at the Fulham works?

Witness: I do not know. But whatever the material might be that was in the purifier, it was possible to empty it out without shovelling it, by taking it out *en masse*.

The mechanical difficulty would depend very much upon the size of the purifiers and the work that they had to do?—Upon that I would say "Yes;" but at the present day we have so improved in our power of lifting weights that I know of no difficulty that could occur.

Is it your opinion that at Beckton, or at Pimlico, or at Fulham, there is no mechanical difficulty in applying such a process as you have described to us as being adopted at Brussels?—I do not believe there is any.

Would it be a very great additional expense?—If you were making the plant new I should say it would be trifling, but if you were to adopt the old plant I should think it might be a considerable cost, but it would be wrong for me to give you any suggestion upon that.

Do you think that, supposing the company were willing to go to the expense of obtaining more space, we will say at Fulham or Pimlico, that

they could thereby adopt the improved process that you have spoken of, and in that way mitigate the nuisance?—It appears to me that if the process can be conducted upon their present ground in a manner which is said to cause a nuisance, that it could be conducted on their present ground in a manner that would not cause a nuisance; but following that, I do not see how the mere increase of ground, without improving the manner that might be adopted on the present ground, would prevent the nuisance.

Re-examination continued: As to the saving of expense to the gas company, supposing that they were not required to use the lime process, that is a matter upon which I would rather not offer any opinion at present. I consider that the evidence of the promoters is not conclusive, because they attempt to negative the proposition that purification can be done without a nuisance, while I believe it can be.

Sir E. BECKETT: How is this matter of taking out the trays managed at the Commercial works?

Witness: You change the top tray first, then take it out, and then empty the next tray.

Do you shovel it over the top of the purifier?—You shovel it down the shoots; it comes through at the bottom.

Mr. POPE: You must take the top off before you can get to the top tray?

Witness: Yes.

What is the difference between them—one goes over the side, and the other down a hole in the middle?—If it does not commend itself to your mind as being a difference, it does to mine. One thing is, that the purifiers are under cover; and the other is, that, being under cover, the stuff is shot down through openings in the purifiers.

By the COMMITTEE: If a man is in one of the purifiers, he has the stuff to shovel out into a sort of watch-box, and there is far more probability of the air being impregnated with odour than if it is simply turned down alongside the shoot which stands up through the bottom. There are four shoots which stand up through the large purifier, and which go direct into the floor below.

The COMMITTEE: Have you any knowledge as to the balance of discomfort or the balance of injury resulting from the difference between 20 and 40 grains of sulphur?

Witness: Not to give it you in quantity. I have, however, this knowledge, that occasionally the gas in my house is extremely unpleasant when tasted; at other times it is better, and you do not taste that unpleasant flavour; the difference being, as I presume—in fact, as I know from tasting—the difference of sulphur; but how many grains of it are present I cannot tell. My supply is from the Wandsworth Gas Company, but I do not think they are under the Referees. I do not know their maximum, but I may tell you that I will not use gas, on any account, in my sitting-room.

The CHAIRMAN (addressing Sir E. Beckett) said he thought the evidence just given was the most important on behalf of the opponents they had hitherto heard. Mr. Bramwell had formed his opinion and given his evidence very clearly; but he had only formed that opinion from a visit. According to his evidence, the Commercial Gas Company had lately adopted improvements which had practically got rid of the nuisance; but that evidence had not been given by a witness who was present when the most difficult part of the process was being performed, namely, that of opening and cleansing the purifiers; and, therefore, some further evidence ought to be given upon that subject.

Sir E. BECKETT said he had no control over the Commercial Company. How on earth was it likely that he should get witnesses from one gas company in London against another gas company in London. Of course, if the present Bill was passed, they would all come for a relaxation. If the committee thought proper to send for the engineer, it was quite open for them to do so.

The CHAIRMAN: I think it would be as well. It is quite plain that we cannot finish to-day, and, therefore, supposing you failed in changing us from the opinion we mentioned yesterday, and which you understand was entirely a suggestion, it will then be necessary to go into the financial question, which no doubt will be a difficult matter. It would not be possible to conclude the case to-day entirely, under those circumstances.

After some conversation, and the committee having deliberated, The CHAIRMAN said it was not only the evidence of the gas engineer, but the learned counsel would probably be able to call some of the residents in the neighbourhood of the Commercial Gas Works, and they could not be supposed to be hostile to the case of the opponents at all, but it was rather throwing too much upon the committee to require them to find out evidence for themselves in support of that view. The question was one entirely of a balance of convenience between that part of the public who as consumers might be supposed to suffer from the greater amount of sulphur present in the gas, supposing the limit were now relaxed at all, while on the other hand there was the injury to that portion of the public who lived in the neighbourhood of the gas-works where the lime process of purification took place. Of course a great deal in the decision or in the estimate of the balance of convenience must turn upon whether it was possible, by greater care and attention, to diminish or entirely remove the nuisance created by the lime purifying process. The case made by the promoters was that there was not in existence at present, or known, any means of using lime for the purpose of purifying those various compounds out of gas which could successfully be adopted, but the committee had just heard of a process or a practice in using the lime purification which produced a great degree of purity, and at the same time was innocuous. That was an exceedingly important circumstance, especially as the experiment was conducted under all the conditions under which it would have to be carried out, if adopted by the gas company at present before the committee. He (the chairman) thought Sir E. Beckett would see that it would be very satisfactory, before they arrived at a final decision, to have that case as fully explained, and as completely before the committee, as possible, both as regarded the process which was adopted by the Commercial Gas Company, and also as regarded the effect upon the neighbourhood—as to whether, in fact, when the purifiers were opened there was that nuisance created.

TUESDAY, JUNE 5.

Sir E. BECKETT said the committee would recollect that he had stated he did not expect that he should find Mr. Jones a very willing witness against his brethren of the London gas companies; that guess had been verified, and certainly he should not take the responsibility of calling him, although it was open to the committee to call him if they thought proper. There was one thing, however, which had been done. In consequence of the Paris evidence, two or three gentlemen had been sent over to Paris to analyze the gas there, and they would give the result of that analysis.

Mr. Charles Heisch recalled, and examined by Sir E. BECKETT. During the holidays I have been over to Paris with Mr. Wigner and Mr. Shuter. We visited several places there, and tested the gas. With respect to sulphur, on the 22nd of May I found that the gas in Paris, at the Cité du Retiro, Rue du Faubourg St. Honoré, where I had a room placed at my disposal, contained 15.6 grains in the 100 cubic feet. On the 23rd I again tested at the same place. Those tests extended pretty nearly over the whole day, so as to get a fair average, and the gas contained 15.34 grains; and on the 24th at the same place it was 15.12 grains. I also tested on the other side of the Seine, at the Boulevard Mont-Parnasse, and found the sul-

phar to bell-5 grains. I took my own apparatus, which was tested immediately before we went, and immediately after we came back, and we found it quite correct.

Cross-examined by Mr. POPE: I did not visit the gas-works, and do not know what process of purification they were employing or what coal they were using.

Re-examined by Sir E. BECKETT: I agree with the French witnesses that there was no nuisance at all.

By the COMMITTEE: Our tests were made with the Referees apparatus, just as used in our official testing-stations.

Mr. G. W. Wigner recalled, and examined by Sir E. BECKETT.

I made the tests in Paris conjointly with Mr. Heisch, and I also analyzed the liquor which was brought home for that purpose independently of him, and our results agree.

Sir E. BECKETT said that was all the evidence he proposed to trouble the committee with.

Mr. POPE said that Mr. Jones, of the Commercial Gas-Works, was in attendance.

The committee-room was ordered to be cleared. On the counsel and parties being called in,

The CHAIRMAN said: We think it as well to call the manager of the Commercial Gas-Works before Sir E. Beckett addresses the committee.

Mr. Robert Jones, examined by the COMMITTEE.

I am not called by any gentlemen on the opposite side of the table, and I wish it to be understood that I am here alone in deference to the wishes of the committee. I have read Mr. Bramwell's evidence, and, so far as his description of the machinery goes, and the manner of our dealing with the lime, it is quite correct; but he was not correct in saying that we were able to reduce the bisulphide of carbon to 13 grains without creating to some extent an offensive effluvia. The night before Mr. Bramwell's visit the return from the tester of our district gave me an impurity of bisulphide of carbon of 13 grains; but Mr. Bramwell did not see any of the purifiers opened, nor did he see the process of discharging. We had worked for something like two months, preceding the time of Mr. Bramwell's visit, at an average of 1½ grains, and, therefore, so far, he was right about the degree of purity.

The COMMITTEE: As to the possibility of avoiding a nuisance?

Witness: Whilst discharging our purifiers, with that degree of purity of bisulphide of carbon, we had offensive smells at the works; it did not go much beyond the works, but we were complained of by our officers situate some distance from the site of the purifiers. It was impossible for us, with the lime in the state of sulphide of calcium, to have avoided it. We have taken every possible care to discharge the vessels and to carry away the lime without causing any nuisance to the neighbourhood. We have been able to effect a very great deal by the care we have bestowed upon it, but it has been impossible to prevent the smell travelling some distance. Those [pointing to the plan] are the purifiers that we are dealing with, and here, I have often had complaints from the officers—from the secretary especially—that they had a very foul smell in their offices which are situated about 220 yards from the purifiers. Mr. Bramwell's visit was on the 25th of April, and about that time the bisulphide of carbon was 12·7 grains, but owing to the smell being greatly complained of in our offices, I ran the purifiers longer, with a view and a desire to carbonate the lime, and so to destroy that offensive smell. Upon the 26th of April the bisulphide of carbon went up to 14·8, and so it went up constantly until we got to 16·8, 18·2, and 24 grains. Upon the 4th of May it reached 29·3, and upon the 5th to 30 grains; but when we reached that far, I ordered my people to stop that purifier, and to discharge it; and when I saw the lime it was much less offensive than the lime which gave us the results of 12 and 13 grains. It then went down from 30 to 22 upon the 7th, and again upon the 8th to 13·9; and since that time I have been keeping it at from 12 to 11 and 10.

The COMMITTEE: As we understand your evidence, it is this: You have discharged purifiers with a low amount of sulphur, and you have had occasional complaints from your servants, and from nobody else, that there came a foul smell when the purifiers were opened?

Witness: Yes.

Then Mr. Bramwell came on the 25th of April, and his visit was followed by further complaints from your men, which led you to relax the purity which you had previously had. You approached, I think you said, 30 grains, and then discharged the purifier. Was there no complaint made then?—No. When we had got up to 30 grains I ordered the purifiers to be discharged, and the lime was almost innocuous. Some parts of it were wet, and some parts of it were dry, but it had assumed another colour entirely. That was the colour of the lime from a vessel that we discharged on Saturday last [exhibiting a bottle]; the colour of the lime that we discharged on the 5th of May was much lighter; in fact, it had almost come back to its original colour. We could scarcely trace the dark appearance it presents here.

Was the lime equally noxious, the part of it that was dry and the part of it that was wet?—No; I could have stood over it without any inconvenience whatever whilst it was being loaded into carts to be taken away. The lime is not in a very moist state when taken out at any time. Some portions are a little moist; but the major part is dry. The wet lime is the most offensive in smell. There is no greater difficulty in discharging it in a dry state than in a wet state. When I speak of a wet state, I mean a semi-sticky state. I do not think it would be possible to discharge it always in that dry state if we take out the bisulphide of carbon to the extent that we have been doing. Our present maximum is given by the Referees as 30 grains, but that was because we had not our purifiers complete when they made the test. Our purifiers are within a roofed-in building with certain openings to give the men light, and also to give them an amount of air. I put them into those buildings with the intention of confining the smell as much as possible to our own premises, and to some extent it has had that effect. There is a double roof to the building, and in each of the roofs we have six ventilators, three on each roof.

Then the fact is that you have not any great complaint, upon that particular ground, from the men working?—Yes, we have indeed; and the men themselves, since we have been using lime, have applied to me for an increase of wages, and for spectacles, with a view to prevent their eyes being attacked.

Would it not, so far as it is disagreeable for the men, be mitigated if you had a chimney sufficiently tall to create a draught and ventilate the building?—I think not, because we have openings in the walls as well, with ventilators in the roof, so that there is no complaint at all of want of ventilation in the house.

The committee wish to understand how far you question the statement of Mr. Bramwell, which was very much in favour of the way in which the whole of the operations were conducted at your works?—Mr. Bramwell stated everything correctly, except the fact that he met nothing disagreeable himself when he was there, simply because we were not discharging a purifier at that time, and the barge lying near to the works, which was loaded then with the spent lime, was covered over very closely with tarpaulin. At no time, when the works were at rest in that way, would it be possible for you to say that there was a disagreeable odour or smell about them.

Were the complaints as serious when you were working at 17 as when you were working at 8 grains?—No; and that was the reason I gave the order. I ran my purifiers longer, with a view of carbonating the lime and driving the sulphur out; and during that time, whilst we were getting on up to 30 grains, and when we discharged the purifier that had worked up to that, and I had reached my maximum, then the lime came out, and it was in a condition then that not many people would notice.

Does not the result depend very much upon the amount of purification governed by the amount of gas you have to produce, having regard to the size of your purifiers and the number of them, and the facilities, and space, and so on, that you have about you?—In my case, my arrangement of purifiers has been a very recent one, and I have plenty of means to deal with the summer and spring and autumn make. I have another large set of purifiers that I am going to bring into action for the winter. Complaints could not be made against the Commercial Gas-Works, that we had not space or capacity; but notwithstanding that I get the nuisance, if I may be allowed to call it so, although I dislike the word exceedingly.

Do you have any complaints in the neighbourhood?—I had a complaint from the surveyor of the district within the last week, but I do not desire that that should go forward, because it is filling people's mouths out of my own, and they will judge me out of my own mouth.

Examination continued: That which I did was with a view, if possible (and without any reference to my being here to-day at all, for I had no idea that I was going to be placed in this dilemma) of carbonating the lime; and when the lime is carbonated, and the sulphur driven off by the carbonic acid, then it comes out almost innocuous. The longer you run the purifier the more free it is from foul smells, but the gas becomes more impure, of course; there is a greater amount of bisulphide of carbon in the gas.

The COMMITTEE: Does it depend upon running the purifier so many days, or upon opening the purifier after a longer interval?

Witness: Upon running it so many days.

Might you not cease to use the purifier as a purifier, and then not open it for some number of days?—It would make very little difference indeed if we were to take the cover off within a few minutes after the purifier is exhausted. By watching to see what quantity of bisulphide of carbon is left in the purifier after it has ceased its operation, then we might lift the lid either within five minutes or after 24 hours; it would make no difference in the state of the lime. Our purifiers are very large, and we are now only discharging one a week.

Supposing you used it for a week, and did not discharge it till the end of the second week—not using it in the second week, but simply keeping the lime there—would not the nature of the lime be so changed by that as to diminish the nuisance resulting from cleaning it out?—Not materially, I think; besides, we could not spare a purifier for so long as a week. The men have to prepare one after the other; but, notwithstanding that, I believe it would make very little difference indeed.

Before you opened the purifier, had you ventilated it according to the process pursued at Fulham, at Mr. Vernon Harcourt's suggestion?—I do not know the process at all.

A MEMBER of the COMMITTEE: I was at the Fulham works yesterday, and saw a purifier opened, and the whole process gone through from beginning to end. The purifier had been ventilated before it was opened, and when it was opened the lime was in a very dry state. There was a great quantity of sulphur through it, but it had been ventilated, and certainly I could hardly detect any smell at all, though I stood directly where there was a strong breeze, and my coat was covered with this dust. The effect of the ventilation had been, that when the purifier-lid was lifted, of course, there was a slight and rather a disagreeable smell, but none after the purifier-lid was first lifted; and as the three different layers were dug off there was not any serious smell, either within 5 yards, or 20 yards, or 100 yards of the place. Now, do you think that, if you had adopted the plan of ventilating for a certain time—not as long as to run any risk of combustion, or to produce any injury to the purifier—before you opened it you could have avoided the smell at your works, as I saw it avoided at Fulham?

Witness: I have had no experience of that description at all; but, consulting my own feelings, and seeing that this matter is much in the hands of the workmen, I should have some little terror about it. I think it possibly would be successful, and the only fear I should have would be the danger attending it.

Sir EDMUND BECKETT, in commencing his remarks on behalf of the opponents of the Bill, said the present case reminded him a good deal of the course taken on the first general gas Bill relating to the Metropolis in the year 1860. There, as here, different impressions seemed to have arisen at different parts of the case, and the committee expressed opinions which they very candidly allowed to be modified by what took place afterwards, and when they came to a matter of difficult science like this, it was not at all unnatural that that should be the case. He remembered in 1860, on a certain Friday, the committee gave expression to some opinions which delighted the gas companies very much, but on the following Monday morning, after some further evidence, the views of the committee were materially altered, and the result was that the gas Act of 1860 was passed, which was considered then a sort of charter for the public against the gas companies on the one hand, and on the other hand a sort of charter for the gas companies themselves. But some difficulties were found afterwards by those representing the public; and the consequence was that attempts were made, partly by the Board of Trade, partly by the Corporation of London, and partly by the Metropolitan Board of Works, to obtain some modification of the Act of 1860; and after three years discussion in Parliament—namely, 1866, 1867, and 1868—another Act was passed by a committee, presided over for two years running by Mr. Cardwell. This constituted a sort of second charter or settlement of terms between the companies and the public, as represented by the Corporation and the Metropolitan Board of Works. It was necessary to remind the committee that part of the arrangement of 1868 dealt with the sulphur question in a way suggested by the companies themselves; and, as might be remembered, they objected to the enactments of 1860, by which a hard and fast line of 20 grains of sulphur was prescribed, and they suggested Referees. The committee of 1867 and 1868 approved of the suggestion, and the clause appointing the Referees was drawn by the ablest hand they ever had there at drawing clauses—namely, his learned friend, Mr. Burke—so that it could hardly be said that the Referee clause of 1868, if it had any fault at all, erred in the direction of being unfavourable to the gas companies. In point of fact, as appeared by Mr. Evans—the leader of the battle on the other side—the companies thought it an extremely good clause; and it was only because it had not turned out as good as was expected, that they were now trying to alter it. Having entered into an agreement with the Metropolitan Board and the Corporation as lately as 1876, it would be an act of rather rapid retrogression to immediately afterwards try to alter the arrangement with which they were satisfied at the end of the previous year. The course of legislation throughout had been an attempt on the part of Parliament and of the public bodies to keep down the quantity of sulphur in the gas to as low a minimum as possible, and it would require very much stronger evidence than any which had been given to induce the committee to pass a Bill of that kind, if there were nothing else in it. The company protested that they did not mean to throw any reflections upon the Referees, but they

had proceeded throughout to throw as much odium as they could on them, and had applied to them a great variety of epithets. One or two gentlemen on the other side charged them with incompetence, and Mr. Michael cross-examined one of the Referees at great length to prove that they had no practical experience, while Mr. Evans, who did not stick at trifles, took the bull by the horns, and said if they had only acted conscientiously he could get on pretty well, but they did not. Another witness on the other side boldly said they were unfit for their place; indeed, from the beginning to the end of the case, the counsel and pretty nearly all the witnesses who had any excuse for so doing, used language reflecting upon the Referees. It did not appear to have occurred to the company that if the Referees were inefficient, unqualified, unfit for their place, and did not act conscientiously, that the proper thing for them would have been to go to the Board of Trade and say, "Gentlemen, you have appointed officials having all these disqualifications, but you are not bound to reappoint them. Pray do not reappoint these three gentlemen; they are unconscientious, and all these things." There was not a single thing which the company had stated to induce the committee to pass their Bill that they could not have stated to the Board of Trade, and which that Board could not have dealt with. Had there been any proposal to change the Referees? The various public bodies interested had not insisted that the same Referees should be appointed; and if Mr. Evans would tell his story to the Board of Trade, they are bound to assume that the Board of Trade, being a judicial body, would appoint either one or two fresh Referees, or give some chance of their bringing their case before somebody else. A singular thing was, that the Referees should have been satisfactory to the companies during the period when Mr. Evans himself was a Referee, because he contrived so to modify their views that they did not stipulate for anything lower than 40 grains. How Mr. Evans came to be appointed a Referee he (Sir E. Beckett) did not know. He seemed to be not at all the kind of man; but there were underground ways of doing things which gas people knew as well as other people. They got him appointed, but naturally the appointment made such a row that he was obliged to retire, and as soon as he retired a new state of things arose. Then they got "unconscientious Referees," who began to behave ill when they began to carry out the Act which they were intended to carry out, instead of being bullied out of it by a gentleman like Mr. Evans. He was saying that they began to complain, but they did not begin to complain till last year. They took care to get all their money first; they got all their pecuniary arrangements ratified by Parliament, they got their amalgamation with the Imperial, and a variety of their small companies; and they got the price of gas sanctioned by Mr. Forster's committee on the express footing that the extra purification involved a greater price. It was true the company said they were willing to have that matter re-discussed, but the public bodies were not going to hamper themselves as to future proceedings by discussing any detail of that kind. They insisted upon the bargain made as lately as last year, and were not going to discuss financial details. The correspondence showed that the whole matter was in the nature of a personal fight between Mr. Evans and the present Referees. Mr. Evans, indeed, confessed that he could not bully the Referees into submitting to him, as he had succeeded in bullying or persuading them when he was one himself. It was nothing but a personal dispute, between Mr. Evans and those Referees, who was to get the best of it, and if they could carry out of that committee any Bill substantially modifying the present state of things, even to the extent of the 30 or 33 grains, Mr. Evans would say, "I have licked the Referees—I told them I would, and I have." The question was, whether Parliament would help him in doing that. The learned counsel then read several extracts from the evidence given by Mr. Evans, and contended that that evidence so bristled with contradictions that it could not be opened anywhere and contrasted with the statements of the Referees, as to matters of fact, not opinion, without seeing that Mr. Evans was inventing a case for the Bill. It was his Bill throughout, and was a personal fight between him and the Referees. Then they had another excuse, which was inspired by Mr. Evans. The great difficulty which had come upon them quite suddenly and unexpectedly had been the amalgamation with the Imperial. His learned friend said it was the *damnosus hereditas* of the Imperial which had brought it upon them. Why did they buy the Imperial? They bought at the critical period between 1875 and 1876; that was, they got all their financial arrangements through Mr. Forster's committee, and power to divide, not only 10 per cent., but as much more as they could consistently with the sliding scale; and although the sliding scale was complained of at the time, yet Mr. Evans said it had been a very profitable thing for them, in consequence of the fall in the price of coal. Having got it, however, and having waited to see the result of it, they then bought up the Imperial to please themselves, and then they used the Imperial as the excuse for getting rid of the obligation to reduce the sulphur, because it would have beaten even Mr. Evans to find an excuse for getting the free and unadulterated Chartered Company out of that obligation. He knew he would be met with the fact that he had told every committee in Parliament that at Beckton they had the means of making all the gas that they possibly could require out of London, in a place where stinks were indigenous, and therefore the *damnosus hereditas* was necessary. The attention of the committee was seriously asked to the question whether the time had not arrived when the manufacture of gas ought to be turned out of London altogether; and if it should be the case that the company could not make pure gas without creating a nuisance, the true answer to that would be, "Very well, then; make none in London. Make it all at Beckton and at Bow. You have said over and over again that you can; now go and do it,"—and would not that be an enormous benefit to London? So much for the *damnosus hereditas* as regarded the Chartered Company. But the Imperial Company had an existence long before the Chartered Company thought of this scheme, and had been purifying gas since 1860, at any rate, down to 20 grains, and 25 grains, and so on. The Imperial never found any difficulty, and they had not been a company particularly given to submitting to parliamentary requirements. As regarded the question of purification, Mr. Evans said: "We should, if we were allowed to go back to the oxide of iron again, use a little lime for the carbonic acid." If they were allowed to go back! Who ever stopped him using the oxide of iron? It was utter recklessness on the part of Mr. Evans to say that they were obliged to give up using oxide of iron. What obliged them? They might choose to give it up because it would cost them more money to use oxide of iron and lime, but that was no business of any one else's. Surely people who had a ten per cent. dividend, and practically the means of earning as much more as they liked on the sliding scale, were not the people to talk about their poverty. Why ought they not to be called upon to use the best possible means? One of their best witnesses—Dr. Tidy—said he would not regard it as a question of money. Unless he (Sir E. Beckett) was greatly wrong, Mr. Evans seemed to have entirely failed in the basis he laid for the present case. His basis was, that he was obliged to give up using that very thing which another engineer of equal experience said he did use, and used with success. What Mr. Anderson could do at Dover, at Cork, at Waterford, and at some other places, though they were not so large as London, of course Mr. Evans could do; and with regard to the difficulty of getting rid of the lime, that was obviously a mere question of money. The Essex Marshes were big enough and low enough to be able to receive all Mr. Evans's lime if he

chose to send it there. At the same time, two or three witnesses upon the other side said they believed he used about five times as much lime as he need. They might be right, or they might be wrong, or the truth might lie between them; but, whether it was much or little, Mr. Evans must pay for taking it away if he was encumbered with it. Another question was whether Mr. Evans pointed out that difficulty in 1866. Could any human being believe that it came upon him by surprise, and that it was any part of the *damnosus hereditas*, because the lime he had received with that *damnosus hereditas* was lime made at Fulham, St. Pancras, and other places, and had nothing to do with the lime at Beckton? He knew that in 1875, in 1868, and in 1867, and it was really only another trumped-up excuse. Of course it was necessary to his case that Mr. Evans should make out that the Corporation of London and all the chemists upon their side, and even one or two upon his own side, were entirely wrong in saying that there was any importance in getting rid of the sulphur. When it was necessary, he was chemist and everything else, but Mr. Evans denied that there was anything in the sulphuric acid story, although it was proved most distinctly by chemists without end that the sulphur left in the gas, by the aid of the oxygen in the air, multiplied itself into three times its bulk of sulphuric acid; and then at some place or other Mr. Evans said that that was all a delusion, and that the complaints were "rubbish;" but Dr. Tidy, one of the most distinguished witnesses on the side of the gas company, clearly stated that he did not agree with Mr. Evans in saying that the public apprehension about sulphur was a delusion. All through his evidence he said that in the present state of science he thought they ought to be allowed as much as 35 grains, but that if he could see his way to it being reduced even to 10 he would do so. There was also the evidence given upon the Crystal Palace Bill, of Professor Barff, Dr. Frankland, Mr. Pattinson, and others, and with all that staring the committee in the face, what view of the case were they going to take? It was a fairly open question how much sulphur could be got out without making a nuisance; but to talk about the sulphur being no nuisance was mere recklessness of swearing, and they would have to consider how far that reduction, if at all, could take place, and ought to take place. The Metropolitan Board and the Corporation, as representing the public, were not fighting for mere victory; they were fighting because sulphur was a bad thing, and ought to be got rid of, if it could be got rid of without inflicting some corresponding or greater nuisance. He (Sir E. Beckett) did not know how it would be possible, consistent with logic, after having rejected the Crystal Palace Bill, which contained an absolute limit of 20 grains, to pass the present Bill with any modification, giving the Chartered Company something more than 20 grains, whether it be 30, 33, 35, or anything else. It would be a strong result for the company to obtain; but he thought Parliament would have sufficient regard to its own logic not to attend to that, even if the Board of Trade were satisfied. People talked of the Board of Trade as if they were a sort of incarnation of wisdom; but they were not always found to be so. The Board of Trade did not represent the people of London, but the Metropolitan Board and the Corporation of London did, and they flattered themselves that they could judge just as well as the Board of Trade. The committee knew ten times more about it than the board could do, as they had not heard the evidence.

The CHAIRMAN: I am afraid you must not shift the responsibility in that way; the suggestion, be it good or bad, is not in any way referable to the Board of Trade. I thought it as well to consult them as to whether they saw any difficulty in working it out in case it should be adopted, but the responsibility for the suggestion rests entirely with the committee, and I should say more properly with the chairman, and therefore I think you may leave the Board of Trade alone at present.

Sir E. BECKETT said he thought it would not be respectful if he had not said something about them, as many people would rather be abused than not noticed. He hoped the chairman would take the responsibility upon himself, and not think of being influenced by anybody in the Board of Trade. Another suggestion had been made by the committee—viz., that there should be a kind of substitute for the Referees—somebody to be appointed by the Board of Trade to inquire from time to time, and have experiments made at the gas-works; but he would like to know how that person, or those persons, would differ in substance from the Referees, excepting, as he understood, those persons would not be able to act except upon experiments conducted for them by Mr. Evans, who would, doubtless, conduct them with the utmost sincerity; but it must be remembered what Mr. Bramwell's view was of what his position would be if he were a Referee appointed under those conditions. He (Sir E. Beckett), speaking again for the public, entirely dissented from having any persons appointed to judge their rights and interests, upon the condition of being obliged to carry on experiments by the aid of their enemies, because they would have an interest in doing as little as they could, and getting as much as they could; in other words, he required, on behalf of the Referees, the most unlimited discretion. Turning to the question of nuisance, as regarded actual nuisance, he admitted there was plenty, but as to the necessary nuisance he did not admit so much. It was very true that evidence on behalf of gas company was necessarily negative evidence, and therefore, inconclusive, but it was not the less negative evidence, because it was necessarily negative. Negative evidence was very good till it was either helped or contradicted by positive evidence, but when it was met by positive evidence it did not go for much. If there was a distinct proof of one single gas-work in the world where the purity was kept down to anything like 20 grains, with the same kind of coal, without creating a nuisance, that would answer the evidence of every gas company in London, and in every large town in England; but, strange to say, there was none from any other town to the effect that they could not prevent the nuisance. They had had the evidence from the Paris gentlemen about the coal they use—practically it was the same coal as was used in London at the present time—and they kept their sulphur down to 15 grains, and there was no nuisance. The Referees had made a very great mistake in ever trying to teach the gas companies how to do it. If he (Sir E. Beckett) were a Gas Referee, if they asked him, "What do you want done?" he should reply, "Want done? I want the sulphur kept out." "How are we to do it?"—"Go and find out at Nottingham, Leeds, Pontefract, Dover, Newcastle, and all these places, what they are doing; do not ask me to teach you your work. I am here to test what you do, and I am here to learn as well as I can, with such information as I can get, whether the sulphur can be kept out to this extent." The learned counsel read several extracts from Dr. Frankland's evidence on the Crystal Palace District Gas Bill, and contended that that was chemical evidence of the highest eminence, in confirmation of Mr. Anderson's practical evidence, and he thought, with those two things together, there could be no doubt that Mr. Evans was as wrong as he possibly could be, not merely practically but scientifically, in talking about his being obliged to give up the use of oxide for the lime. It was very likely that a good many of the smells which had been mentioned were not pure sulphur smells, the public nose was not very sensitive as to smell, and if they smelt anything unpleasant they would probably conclude it was the sulphur in the lime, because they had heard that the sulphur did cause a nuisance. They also had the evidence of Mr. Loam, given in 1876, who stated that at Nottingham they principally used lime for purifying, although they used oxide of iron in the catch purifiers. He also stated that the farmers came with their carts and took the lime away

as they liked, but they had no complaint as to nuisance. That led to another topic. It was thought worth while by one of the learned counsel to ask this question: "In 1873, when the Corporation and the Board of Works brought in a Bill conjointly for buying up the London Gas Companies, did they put in any limitation as to the purity from sulphur?" and the answer was "No." It was thought a great triumph to get that answer; but why need corporations put restrictions upon themselves? There was the Corporation of Nottingham, who had the gas-works, and they had no restrictions, yet they reduced their sulphur as low as they could, because, of course, the public required it. It was really idle to ask a question of that sort. Dr. Pole, one of the Referees, also gave his positive knowledge as a reason for requiring what he did require of the London Gas Companies. He said that he visited Edinburgh, and found that lime was used entirely there; that the works were in one of the best parts of the town,—between Carlton Hill and Canongate—and that he went carefully over them, and spent some days with the manager. He was living in Princes Street during the time when the wind was blowing from the works towards the hotel, and there was no nuisance, and there was nothing in the gas which gave him reason to suppose that it would be impossible to purify it by lime. Mr. Anderson likewise said that he had been engaged for 30 years in managing gas-works, and he mentioned the things that he had used, and also how he used the lime. [Evidence read.] The committee had thus three distinct processes before them: they had Dr. Frankland's statement that at Manchester they did it without any lime at all, or very little; Mr. Anderson saying that he used both lime and oxide; and Mr. Loam's evidence that he did it with lime; so that there were three different ways of treating it, and all successfully. Mr. Heisch, who was examined in the Crystal Palace case, also stated that the Phoenix Gas Company had, since 1860, complied with the 20 grains condition, as a rule, without creating a nuisance. There was also a clerk of the Lewisham Board, and another gentleman, of the name of Edwards, who said the same thing; therefore there was actually a London Company, complying with the 20 grains condition, and doing it perfectly satisfactorily. There was also the case of Bow, about which Mr. Evans stated that the lime, if exposed to the air, became pure after a certain time, and had not much smell. A reference to Beckton was likewise made somewhere in Mr. Bramwell's evidence, if not in others.

Mr. POPE: Mr. Bramwell was never there.

Sir E. BECKETT said that Mr. Bramwell stated that he had been to Beckton, to Bow Common, and to a good many other works. He also stated that he had seen the process carried out at Beckton without a nuisance.

Mr. POPE: He never saw the process at Beckton in his life. I say that it is not so.

Sir E. BECKETT said that Mr. Bramwell was asked, "Supposing Beckton were in the middle of London, would the lime be a nuisance then?—A. The whole works would be a nuisance. Q. Would not the lime process be a nuisance?—A. I do not believe it need be." Nothing more need be said about Beckton, and, as regarded Bow, Mr. Wigner, as well as Mr. Evans, said there was no nuisance there. As regarded Fulham, it was certainly open to the remark that Dr. Tyndall made, that, when he and his wife were there, and they both had very good noses, although there was every possible means to induce the laws of nature to behave decently, the place would not stink. Then there was Mr. George Livesey, of the South Metropolitan Company, who was not the man to blow his own trumpet, but he told the committee what he managed to do there. He stated that the average result of the testings for the quarter ending Dec. 31, 1876, had been only 17·7 grains in 100 cubic feet. He also stated that in December, 1875, his gas was ten times over the limit of 25 grains allowed during the six winter months, and in the month of January it was ten times in excess; but from the end of January, 1876, up to the end of February of this year, there was not a single excess, and then the excesses came on, although why they came on he never could find out. As regarded Mr. Jones, he (Sir E. Beckett) was glad to hear his evidence, and particularly glad to find that he on no substantial point contradicted Mr. Bramwell, although he could not help thinking that Mr. Bramwell's statement as to what had been done with the purifier immediately before he was there must, from the nature of things, be right rather than Mr. Jones' recollection and thinking. Mr. Hawksley had mentioned another mode of getting rid of the nuisance; at any rate, he said very positively that it could be done, not only from his Nottingham experience, but from other circumstances. His friend, Mr. Richards, who cross-examined Mr. Hawksley, thought the best thing he could do would be to throw a little odium upon that gentleman by suggesting that if the company had come to him first they could have got his evidence; but he (Sir E. Beckett) had a very strong suspicion that there had been some very good reason why they did not call Mr. Hawksley, because it would be the most natural thing that he should be the first person they would go to when they wanted a scientific witness. In 1867 Mr. Hawksley was on the side of the gas companies, and therefore anxious to say everything he could for them; but, in the course of his examination, he said that he thought a better mode of purification had been discovered than had at that time been spoken of, and that was, to continue the use of oxide of iron for taking out the sulphuretted hydrogen, and then only using the lime for the purpose of taking out the remaining bisulphide. His opinion was that by the combination of the two processes, the works could be carried on where they were, but that the effect of the double process meant a cost of about 1d. per 1000 feet more. That was a tolerably good reason why the companies did not ask Mr. Hawksley to give evidence for them; but they might as well have had the decency to look at that matter before they made that charge. Having gone through those different descriptions of the modes of doing this business, he (Sir E. Beckett) thought that if there had been only one instead of about a dozen, that would be a decisive answer to the allegation on the other side that sulphur down to 20 grains could not be got out without creating a considerable nuisance. It was plain that it could, and it was also plain that one of their most valuable witnesses, Dr. Tidy, was convinced that it ought to be done, if it could, though he did not know the means by which it could be done, although other people did. He made a suggestion which appeared to be a very pregnant one. He said they ought to pay for having sulphur in, which probably meant that if they were to be let off a certain amount of sulphur, they should pay some kind of penalty for every 5 grains so let off. Mr. Vernon Harcourt also said he would rather pay twopence more and have the gas pure. There had not been a single scientific witness worth talking about who had attempted to prove that there was any real difficulty in complying with the Act of 1860, much more with the requisitions of the Referees, which were at any rate five degrees easier in winter, and might also be made five degrees easier next winter if they could convince either the present or some other Referees that they ought to be relaxed to that extent; but, on behalf of the two public bodies, he (Sir E. Beckett) protested entirely against that very recent bargain, which was a continuation of a previous bargain, being relaxed now, simply and solely at the instance of Mr. Evans and the Chartered Company.

Mr. ROUND said he did not wish to make any remarks in a partisan spirit, because the Board of Trade, by whose instructions he appeared, desired to express no opinion whatever upon whether it was politic or not

to do that which the gas company were asking the committee to do. But at the same time, inasmuch as the Bill, if it passed, would withdraw from the jurisdiction of the Referees the power vested in them of determining what amount of impurity in the form of sulphur should be allowed in the gas, he thought it was not otherwise than relevant to the question to see how far the Referees had discharged that duty which Parliament had imposed upon them in reference to the legislation affecting gas. He thought there could be but one opinion in the minds of all who had followed this inquiry, that those gentlemen had done themselves infinite credit by the way in which they had discharged their duties in conformity with their instructions, and with the spirit of the Act of Parliament. He thought also that there could be no two opinions that they had an extremely delicate and difficult position to fill, and a somewhat invidious one, which they had succeeded in discharging to the utmost reasonable satisfaction of everybody who had had an interest in the way in which their duties were being discharged. It is quite clear that the Acts of Parliament under which they had jurisdiction provided for more than the entire removal of sulphuretted hydrogen, and that idea could not be better expressed than in the way those gentlemen had themselves expressed it in their letter of March 5, 1877, in which they said that "it is clearly the intention of the Acts now in force, that the gas company shall be required to reduce the amount of sulphur in all forms, as well as wholly to remove sulphuretted hydrogen. The question we have had to decide is, how far this amount can be reduced, considering what is reasonable, and especially the necessity of avoiding nuisance." That was the interpretation—and a correct one—which they had put upon the Act imposing those duties upon them, and it also put them at once right as to the limits within which they had conducted their inquiries. He was perfectly certain that those gentlemen did not require any vindication on his part, for they had amply vindicated their appointment by the Board of Trade as the most competent men that could have been found to undertake the duties imposed upon them; but there had been one or two remarks thrown out by them which ought to have been met in a different way by the promoters of the Bill, and they were mentioned with a view to the justification of the course which the Referees had adopted. Those gentlemen, in the letter referred to, pointed out what, in their opinion, had been the cause of the increase of nuisance which had arisen within the previous six months, although the proportion of sulphur—namely, 20 to 25 grains—had been in operation for four years, and they put forward a very strong opinion upon that point. They found that there was not an uniformity of system at the different works of the company; they found that what was good at one works was not carried out at other works, and it took a two-fold form—first of all, there was the process of opening the purifier, and the mode in which they ventilated the lime, and endeavoured to get the gas free from those impurities. The next thing, distinct altogether from that, was the way in which they removed the obnoxious lime after it had answered (or was supposed to have answered) its purpose. They found that the purifiers were under cover at Kensal Green, Pinlicko, and at Beckton, but that they were not under cover at Fulham, Bromley, and at Haggerston. The inference to be drawn from that was, that if it was a good thing to put them under cover at one place, it would be at all, and the committee were doubtless impressed, to a certain extent, with the view that it would be better that the purifiers should be under cover. Had the promoters proved that that statement was wrong, or had they called any gentleman who could contravert the opinion which the Referees had expressed? Again, the process of removal varied. Fulham, which was deficient in one respect—namely, that the purifiers were not under cover—contrasted favourably with other works as regarded the removal process. The Referees naturally said, "Why can you not take the same precautions at other places with regard to the removal of your refuse as at Fulham?" And it might have been expected that the gas company would have shown why they did not; but they had done nothing of the kind. There was another point, which Mr. Vernon Harcourt mentioned, but which had not been alluded to again in the inquiry, and to which, in justification of these gentlemen, the attention of the committee should be drawn—viz., that they were not to act as the companies' engineers, but to point out to them that, if certain things were not done, the Referees had a right to expect the companies to show how far that which they had done was right; but there had been no such evidence. Mr. Harcourt stated he tried an experiment which was ultimately terminated, not because the process failed, but because of the accident which had happened to the apparatus. Then he said, "My belief is, that if the company were willing to make a trial of this process it would be practicable to overcome the engineering difficulty, but more than I have done in the matter I cannot do; it must rest with the company to try it or not." Subsequently a question was put by the chairman: "You think that it ought to have been followed up?" To which Mr. Harcourt replied: "I think it is an alternative process. I have already expressed my belief that this process of purification by lime is practicable. I think that, with those improvements which Mr. Evans has introduced, it may be continued without nuisance; it accomplishes as complete a purification as the heating process would accomplish." He (Mr. Round) alluded to that part of the evidence more particularly, because it seemed to have been assumed throughout this inquiry that gas could only be purified by lime, and that it necessarily followed that an additional nuisance was created by that lime. The Referees said the alternative process could be adopted, and that they had not advanced anything that was not a practical matter; and if they retired from that room with the impression that nothing they had heard had changed their opinion in any way, it was because the other side had not shown that those testings which had been made from time to time by the Referees had not been fairly carried out. The committee would see how difficult it was for these gentlemen to act if, when going to one work, they found Mr. A. doing one thing, and on going to another work they found Mr. B. doing another, and then on going to another work they found Mr. C. doing a third thing. As they pointed out in one of their letters, they said: "It might naturally be expected that a gas company supplying more than half of London, and having about £7,000,000 of capital, would have some eminent responsible and active head engineer to direct and control their scientific and manufacturing arrangements. But there is no such officer. Mr. Evans (whose great knowledge, ability, and experience are known to the Board of Trade as well as to ourselves) no longer occupies this position; and the management is in each case left to a local superintendent of the special place of manufacture. We have no reason to doubt the competency of these gentlemen for the positions they hold; indeed, we know some of them to be men of ability. But we notice among them a singular diversity of opinion and practice, and some disinclination, perhaps natural, to cope with a problem new to their experience. They have expressed their readiness to try any suggestions made by us; and we have pointed out some of the more obvious defects in the processes we have seen; but it is not our province to act as the company's engineers or chemical advisers. The absence of any well-qualified technical head with whom we could communicate on the general problem has been a source of continual inconvenience, and we are convinced that if the subject were earnestly taken in hand by a person so qualified, all the difficulties attending it would soon disappear." Upon that he would ask, had there been a single tittle of evidence addressed by the other side why there

should not be such an adviser appointed? The Referees having explained in such a lucid and satisfactory manner the way in which they had discharged their duties, he (Mr. Round) felt that it would not be otherwise than becoming in him to point out that the other side had not shown that anything which the Referees had advanced was otherwise than perfectly compatible with what might be done, and that they had discharged their duties in a manner entitling them to credit, and to the great satisfaction of those who appointed them.

The CHAIRMAN: With regard to the remarks you have just made, I would say that, as to the exercise of the discretion vested in the Referees with regard to this question, that is a subject upon which I will express no opinion until the committee deliver their decision upon the whole question before them. As regards their general capacity in fulfilling the office which they hold, that is not a matter into which the committee have any right at all to enter. It would be, I may say, impertinent for them to express any opinion upon that subject; but, so far as regards the manner in which the Referees have given their evidence, I may say, with the concurrence of the others members of the committee, I am sure that it has been entirely frank and satisfactory; and I think, as we asked these gentlemen to attend, not as witnesses upon either one side or the other, but to throw light generally upon the subject, they were quite justified in giving their evidence as they did.

Mr. ROUND: Upon their part I thank you for that expression of opinion.

WEDNESDAY, JUNE 6.

Mr. POPE, in replying upon the whole case, said, he would not follow Sir E. Beckett into the vein of personal observation. It was difficult to recognize his learned friend in his new mantle. They had been accustomed to regard him as the champion of the gas and water companies in Parliament and out of Parliament, in the columns of *The Times*, and in every capacity in which he could bring his versatile genius to bear upon the question; but he had now decently wrapped himself up in the mantle of the Metropolitan Board of Works and the Corporation, although the cloven foot peeped from beneath now and then. His learned friend had hoisted Mr. Evans into a position, with regard to the present question, which must have astonished him. It appeared that the whole case was the invention of Mr. Evans, for the purpose of enabling him to carry on a personal contest between himself and the Referees, and that gentleman had been charged with inaccurate statements and violent language, which should rather have commended him to the attention of his learned friend than have induced him to visit Mr. Evans with his censure. He (Mr. Pope) really thought the best thing he could do was to brush aside all stuff of that kind; and he would again state, as he stated at first, that he did not desire to say anything with regard to the Referees, except to speak of them in terms of the most profound respect. The most which he had said, and the most Mr. Evans had said, though he spoke it in rather plain language, was that the Act of Parliament provided that one member of that tribunal should have a special qualification and a practical acquaintance with the manufacture and supply of gas; and all that had been said with regard to the eminent gentlemen who had been in the box had been, that it did not at all follow that an eminent chemist, or even a professor of physics, was necessarily practically acquainted with the manufacture and supply of gas. Sir E. Beckett had asked that there should be no change in the legislation either of 1868 or of 1876; and so far as his argument was addressed to that view, he (Mr. Pope) would endeavour to deal with it respectfully and with consideration; but beyond that they seemed to have arrived, by general consent, at some notion of what the real question was they had to discuss, and to try whether it was worth while to insist upon the adoption of the lime process of purification for gas. That was really the simple question, and it was not now made in the interest of the company, but it was a question of the balance of advantage or disadvantage in the interest of the public purely. He was not instructed to urge one argument in the interest of the company upon the score of any expense which such a process might occasion, if it was a necessary thing that the lime process of purification should be adopted; but when the committee came to consider the question as a balance of advantages and disadvantages, they must not look at the suggestions which his learned friend had thrown out, but at the facts as they appeared in the evidence. It was not proposed at present to enter upon the general question of whether the presence of sulphur in gas was or was not absolutely injurious. That was a question upon which opinions differed, and might reasonably differ. Chemists of very great eminence on the one side entertained an opinion which was not shared by chemists of equal eminence on the other; but, in a matter which was at least open to grave doubt, in all probability the benefit of that doubt would be given to the public rather than to the company, however onerous the conditions imposed upon them might be. Therefore, as regarded that condition, the committee would not be asked to affirmatively decide that it was of no consequence to the public whether any sulphur impurity existed in the gas or not. But, in the face of the evidence, he (Mr. Pope) thought he was entitled to ask the committee to come to the conclusion, that it was of very little consequence whether the amount of that impurity should be 20 grains or 40 grains as a maximum; whether the average, so to speak, was from 15 to 17, or from 33 to 35; and he was justified in saying that, because Mr. Harcourt himself very frankly said so too. Mr. Harcourt certainly afterwards stated that it did, in his mind, represent a certain pecuniary value on the article or the commodity which he obtained; and that, if he could get perfectly pure gas for 2d. per 1000 feet more than gas containing sulphur impurities, the tendency of his mind would be to prefer the pure gas at the extra price rather than run the risk of the sulphur. But beyond that Mr. Harcourt did not venture to say; on the contrary, he said that it was at least of very little consequence. The learned counsel read the evidence given by Mr. Harcourt on that point, and said he had done so because it seemed to involve the three concessions upon which the company might found their argument. One was that the mischief which the prescriptive maximum sought to cure, and which the lime process was looked upon as necessary to cure, was one of no great consequence to the consumer. It was not, therefore, the great and mischievous evil which the Metropolitan Board and the Corporation seemed to think, inasmuch as the restrictions or prescriptions were to be reasonable. One of the first elements in the consideration of the reasonableness of a proposal was whether the remedy was commensurate with the mischief, or was larger than was necessary, in order to get rid of that inconvenience. The evil of the presence of 20 grains of sulphur, it had been conceded on the other side, was of no great consequence to the consumer; and it was further conceded that if it should turn out that, in order to obtain an advantage, inevitable mischief was occasioned to the whole public, then the figures need not cost the committee much trouble as to what they should be relaxed to, because the alternative was a maximum of 40 grains; and he (Mr. Pope) might say at once, on the part of the company, that whatever might be the view which the committee ultimately entertained as regarded the progress of invention, as regarded the adoption of other processes, and as regarded the invention of machinery by which that might be developed or insisted upon, they would be entirely content if, instead of passing the Bill in its integrity, the suggestion which he ventured to throw out at the commencement should meet with their assent—namely, that the maximum, instead of

being 20, should be relaxed at present to a maximum of 40, or, if it should be preferred, such an average as that represented; leaving it, of course, in the discretion of the committee to deal with other parts of the case in the manner they sketched out in the suggestions which they laid before the parties previous to Whitsuntide. Sir E. Beckett had contended (and in that seemed to lie one of the fallacies of his argument) that it was the duty of the Referees simply to lay down a sort of canon, with which the companies must comply. In other words, his theory was, that if the Referees came to a conclusion in their own minds that a maximum of 20 grains might be prescribed without nuisance, it was their duty to prescribe that maximum, and leave the companies to carry it out at their peril, and if the lime process would not do it, to find out something that would. That was not the intention of the legislation of 1867 or 1868. What was it that Parliament had said was to be the rule in that matter? Not the will of the Referees; not even the opinion of the Referees, however earnestly and however honestly entertained, but it was: "The Gas Referees shall from time to time ascertain with what degree of purity the said company can reasonably be required;" not "absolutely," but "reasonably." The reasonableness of the requisition was to be a matter which was to enter into their consideration. Could it be contended that it would be a reasonable thing for a body of gentlemen, who entertained scientific opinions of their own, simply to force those opinions at the peril of the companies, without being able to suggest a mode by which they could be carried out. In the present case there was a remarkable feature—that there had not been a single instance in which the Referees had suggested anything which could be carried out, which had not been carried out by the companies *bonâ fide*, in good faith. Mr. Harcourt had had an opportunity—perhaps not to the fullest extent he would desire, but at all events to a very considerable extent, and at a very large expense—to carry out what appeared to him a hopeful process, but which had not as yet developed itself into a matter of sufficient practical value to enable him to say, "That is a process which I think you ought to adopt, and if you do adopt it you may accomplish this." All that would be reasonable, but in the meantime where were the company? Were they to be subject to an arbitrary hard and fast dictation on the part of the Referees, however competent, when the Act of Parliament said it must be reasonable, and, therefore, not only reasonable with regard to the make and supply of gas, but reasonable also with regard to the make and supply of gas continuously, and without causing a nuisance. It might be true that there had been days on which, say at Fulham, Professor Tyndall, with his excellent organ, and with the assistance of the olfactory sense of the lady who had accepted his name and fortune, had found it difficult to detect the immediate presence of a nuisance there—it might be from the atmospheric condition; it might be because the process had been working perfectly; or it might be from many other circumstances; but what had to be seen was whether the conditions were such that those circumstances and those conditions were continuous and constant. Of course, if an allegation were sustained such that somewhat heedlessly and incautiously thrown out by Mr. Bramwell, that the processes were purposely made a nuisance, he (Mr. Pope) did not mean to say that that would be a reasonable thing for the company to insist upon as an excuse; but, on the other hand, what was to be looked to, according to legislation, was some process—the lime process, or any other—which could be employed continuously, without at some time or other occasioning a nuisance sufficient to justify the rejection of that process. It must not be a laboratory experiment, but it must be a reasonable process, continuously producing the proper result as a matter of practical manufacture in the hands of ordinary workpeople, and in the condition of an ordinary process, when that process was carried on, on a large scale, for the purpose of the supply of gas to a large district. That was the meaning of it, and that was the reason why Parliament inserted in the clause empowering the Board of Trade to construct the tribunal, that one of its number should be practically acquainted with the manufacture and supply of gas, not because either Parliament or the companies doubted for one single moment that Mr. Harcourt's knowledge, *quâ* knowledge, was of the highest character, both as regarded gas and as regarded the chemical combinations and results which arose from the manufacture, but because of the difficulties in the practical manufacture which were known only to those who had the management of men and the management of large concerns and operations. Those who had been accustomed to Lancashire and places of that kind, know many instances in which the most perfect and beautiful laboratory experiments utterly failed when they came to be applied by comparative rule of thumb, and also through the awkwardness of the ordinary workmen employed. Under those circumstances, how did the position of matters stand? Was it not demonstrated, as far as evidence could demonstrate it, that, continuously, at all events, the lime process could not be conducted without producing the results of nuisance in the neighbourhood of these works? If that were so, the question seemed to be, was the mischief which was of no great consequence—namely, the presence of 20 grains of sulphur—sufficient to justify the committee in forcing upon the public the lime process of purification? That was the issue they had to decide; and, dealing with the matter logically, there was hardly an escape. He (Mr. Pope) ventured to submit that the view which the committee seemed to entertain (though, of course, they pledged themselves to nothing) before Whitsuntide, was one which might well be sustained now, notwithstanding all the suggestions of his learned friend, Sir Edmund Beckett. What did he suggest? First of all, he said there were various means which might be adopted in order to mitigate the nuisance, and so there were. He said the company might enclose the purifiers in a building, but it was difficult to understand the philosophy of that suggestion. The stink might be bottled up for a time, but out it must come some time or other. When Pandora's box-lid was removed, out must come the contents, whatever the consequence to the public; and if a large mass of gas was penned up in a building, it might increase for a time the inconvenience to the workpeople; but out of the windows, or ventilators, or chimneys, it must come at some time or another, unless it was condensed. Of course, it might be that by having a tall shaft, as seemed to be suggested, the contents of the receptacle might be conveyed to a great height, and then distributed in the atmosphere, so as to diminish the smell, by having a larger amount of air through which it could diffuse itself when it fell to the ground; but, after all, the question came back, not whether, by any exercise of human ingenuity, something could be done which would mitigate the nuisance, but was it reasonable to require all those things to be done, when, after all, it was of no great consequence? It did not appear that buildings would obviate the mischief. At Fulham, for instance, there were no buildings over the purifiers, but at Pimlico there were, and at Beckton there were; and it certainly made one raise one's hands in amazement to find Mr. Bramwell talking of Beckton as not being a nuisance in itself, when Beckton was the place where all the lime was carried to, and where it was distributed upon the surface of the land; where the purifiers were worked the longest; and where, according to Mr. Trewby, the inconvenience was felt the greatest. It was also suggested, though they could not tell how, it is not their duty—but somehow, by some other process, the company were to do the thing without a nuisance, and Sir E. Beckett brought forward some portions of the evi-

dence given on the Crystal Palace Bill; but, looking at that evidence and weighing it, he (Mr. Pope) did not believe they did accomplish the sulphur purification without a nuisance, as they thought they did. Knowing Manchester and its gas-works well, and knowing that in Manchester there was no prescription as to the maximum of sulphur impurity, he hesitated to approach the subject with the intrepidity which distinguished his learned friend, who said that at present they accomplished the purification without a nuisance. He (Mr. Pope) would not undertake to say that they were always making a nuisance; but he would undertake to say that when they did not they were not purifying the gas. But, after all, what idle nonsense it was to take cases in which corporations were the owners of gas-works without restrictions as to sulphur impurity as governing a case like the present. He thought it had almost passed to be common knowledge—the Corporation and the Metropolitan Board of Works must know it well enough—that the public would submit at the hands of a public authority to things which they would resent with an outcry if they were in the hands of a private company. If, instead of being The Gaslight and Coke Company, the Corporation were manufacturing the gas, would there have been any outcry upon the part of the public, either as to sulphur impurity or anything else? Clearly not; people looked upon nuisances inflicted upon them by their governing bodies as something which they could not help, and they would not enter into a contest with them. As regarded Dover, there was no analysis of the purity of the gas, except such as Mr. Anderson gave for himself, but, since the adjournment, he (Mr. Pope) had been in a position to ask that gentleman what the real purity of the Dover gas was, and, although not allowed to say it as evidence, if Mr. Anderson came and said he purified his gas below 30 grains of sulphur with lime in the condition in which he produced it, he (Mr. Pope) did not believe it. Then they had Newcastle quoted against them, and it was a pity he had not had the opportunity of cross-examining Mr. Pattinson in that case as well as in the Crystal Palace case, because he would like to have known what the quality of the Newcastle-upon-Tyne gas was during the month of April, and how far there was a supply without a nuisance, and with the amount of purity specified by the Act of Parliament. He would have liked to have asked him, from his own report of last April, whether there was not as much variation as between 6 grains and 30; and, therefore, to talk about those which were irregular in their nature as being authorities with regard to that which was to be a continuous operation, was to quote cases which had no relevancy to the point at issue, and which might be put upon the shelf as not being cases on all fours with the present one. He understood his learned friend to say: "You do it at Fulham; do it everywhere else." But did they do it at Fulham? Undoubtedly occasionally they did—that was to say, there were occasions on which persons had visited Fulham who had not found upon the works that nuisance which they would expect to find. He hoped that when the committee visited Fulham they did not afterwards experience any ill effects from having inhaled sulphuretted hydrogen. But, at all events, it only amounted to the fact that at Fulham there did exist conditions which, under certain circumstances and at certain times, appeared to secure comparative immunity from nuisance. At the same time, as he had already said, occasional immunity from nuisance was not sufficient, unless it could be secured that the circumstances which caused that immunity should be constant and continuous, because that was what the legislation provided. Those who had visited Fulham during the last month had visited it during the best time of the year, to begin with, when the make was smallest, when the atmospheric conditions were at the best, when the damp, close weather, which was the most favourable to the development or propagation of a stink, did not exist, and when there was, comparatively, a breeze which would convey any unpleasantness away faster, and distribute it or diffuse it in the surrounding atmosphere. But they had had the evidence of Lord Charles Thynne, of Mr. Veitch, the nurseryman, and of Dr. Barclay, to prove that at times, at all events, and frequently—although at other times it was minimized—the nuisance existed, and existed with great intensity. [Evidence quoted.] Was not the evidence given conclusive against the ungenerous and unfair theory his learned friend threw out—that because it was their interest to create a nuisance that nuisance was created, and for no other reason. It was as much the interest of the company at Bow, which he quoted as a place where there was no nuisance, as it was anywhere else. It was as much their interest at Fulham as anywhere else, and yet at the very time when, if any interest existed in it, there should be a stink, there was not one. When the Referees were there, if the company had had any interest to make things worse than usual, then would have been the time to have done so. It was quite clear, as a fact, that Mr. Vernon Harcourt and Professor Tyndall had been known to be there as Referees, with a view to ascertain the existence of a nuisance, and finding there was none, or thinking there was none, was the best possible proof of the *bona fides*, at all events, with which Mr. M'Minn was endeavouring to carry out his process; because at the very time when it would be most to his interest that the nuisance should be smelt, the least nuisance was found, and the least nuisance was appreciated. If that was the case, did it not answer the whole matter? Taking the balance of advantage, was it worth while to insist upon a process being adopted in the Metropolis in order to accomplish that which Mr. Harcourt said was in itself of no great consequence when it was accomplished? He (Mr. Pope) ventured to think that that which the chairman had pointed out as the real question in the matter might be answered affirmatively—viz., "that some such relief should be given to the gas company, as on the balance of convenience, because they think that the injury to that part of the public which suffers by the process of lime purification is, on the whole, greater than the inconvenience suffered by the consumers and the public by a slight increase of the maximum of the sulphurous compounds." It was admitted the change from a maximum of 20 to a maximum of 40 grains was all that was necessary to get rid of the lime purification, leaving the committee to deal with the question of future invention in any way they might think fit. His learned friend had suggested that, supposing the committee should come to the conclusion that the disadvantage of the nuisance was greater than the advantage of sulphur purification, they should enforce that sulphur purification, and compel the company to remove their stations outside London; in other words, he would read the Act of Parliament as involving not a "reasonable restriction upon the company," but as involving an intention to compel the sacrifice of property and interest, and capital and convenience, which was necessary in order to exclude from the centres of population the stations of The Gaslight and Coke Company. He (Mr. Pope) hoped the time would come when it might be consistent with the requirements of the company to do away with many of those central stations, and to make their gas outside the large area of population; but it was well known that it could not be done in one station, because the risk and the danger of leaving three-fourths of London in darkness for a night, through an accident at that particular station of manufacture, would be too great to be contemplated, even in the face of his learned friend's favourite grievance, sulphur impurity; but supposing there were to be two or three outside stations, they could not spring up in a day. At that moment, as Mr. Trewby had told them, the capital of the company was being expended in the enlargement of Beckton as fast as they could do so. They could not enlarge Fulham, because, notwithstanding his learned friend's contention that there was no nuisance there, the Imperial had

been twice refused by Parliament leave to enlarge those works, the inhabitants having protested that that enlargement would involve such a nuisance that they would not endure it. The committee were not asked to legislate that day for that which was to be permanent. The company did not say that circumstances might not arise which would justify Parliament and the authorities in dealing with the question of impurity hereafter; but what they did say was, that the suggestion that they were to be forced to remove their existing stations, by the pressure of a thing such as that, would undoubtedly be so monstrous a suggestion that it could not have emanated from the Corporation of London, or the Metropolitan Board of Works, if they desired to deal fairly and reasonably in this matter. What was to be done in the meantime? Whatever enlargements and improvements The Gaslight and Coke Company underwent, what was to be done with regard to those districts which must have gas, and which would have the nuisance, provided the committee insisted upon having that which, after all, was of no great consequence—gas with a maximum of less than 40 grains of sulphur in 100 cubic feet. In conclusion, the learned counsel said that really appeared to be the whole matter, and he therefore ventured to submit that the question stood exactly where it did before the Whitsuntide holidays, and that the committee would do wisely to adhere to the inclination of opinion they then so kindly expressed.

The committee-room was then cleared. After some time the counsel and parties were again called in, and

The CHAIRMAN said: The committee have decided simply to declare that the preamble of the Bill is not proved.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

THURSDAY, JUNE 21.

(Before the MASTER OF THE ROLLS, and Lords Justices JAMES and BRAMWELL.)

TAYLOR v. THE CORPORATION OF ST. HELEN'S.

MR. ROBINSON, Q.C., and MR. MABERLY were for the plaintiff; MR. COTTON, Q.C., and MR. CHRISTIE were for the corporation; MR. E. S. FORD was for the water company.

This was an appeal from a decision of Mr. Little, Q.C., as Vice-Chancellor of the Lancaster Chancery Court. An Act of Parliament was passed in 1843, incorporating the St. Helen's Water-Works Company for the purpose of supplying the town of St. Helen's with water. The Act empowered the company to agree with the owners of the lands, springs, and streams which they were thereby authorized to enter into, purchase, and use for the purposes of the water-works, for the absolute purchase for a consideration in money of any such lands, springs, and streams, and provided that such consideration might be in the form of a perpetual annual rent-charge in lieu of a sum in gross. By a deed poll under this Act, dated the 28th of October, 1844, Mr. Samuel Taylor (who is the Lord of the Manor of Eccleston, and the owner of an estate of considerable extent at Eccleston, lying within the limits prescribed by the Act for the exercise of the powers conferred by it), in consideration of a rent-charge to be paid to him, his heirs, and assigns, by the company, granted to the company, their successors and assigns, "All and singular the water-works, dams, and reservoirs, and intended reservoirs in or upon the lands of Taylor, in Eccleston, which watercourses, dams, and reservoirs, and intended reservoirs, were described in the plan annexed to the deed, and were therein coloured blue (which plan was to form and be deemed a component part of the deed), and also the several springs or streams of water flowing into or feeding the said watercourses, dams, and reservoirs, as indicated in the said plan, together with the right and liberty to and for the company, their successors and assigns, solely to take and use the water from the said springs or streams of water, watercourses, dams, reservoirs, and intended reservoirs, for the purposes of the company." The undertaking and the powers of the company became afterwards vested in the Corporation of St. Helen's, under a lease for a term of 5000 years from Dec. 25, 1850. The principal watercourse included in the grant to the company was in part an artificial covered channel, and in part open. Three weirs were, many years ago, constructed on the open part of it, to prevent floods on the lower lands of Mr. Taylor, to enable him to divert and utilize the flood water. The water diverted by these weirs was carried by channels to, and impounded in, a dam, called the Corn Mill Dam, which was used for the purpose of working the manorial corn-mill belonging to the lord of the manor. Early in the year 1851, plaintiff constructed a new reservoir, called the Eccleston Mere, in order to impound a larger quantity of the water diverted by the weirs, it being more than sufficient for the supply of the Corn Mill Dam. The Eccleston weir covers 32 acres of ground, and on Dec. 31, 1851, Taylor granted a lease of it and the Corn Mill Dam, and the right to take water therefrom, to the St. Helen's Canal and Railway Company. The undertaking and rights of that company are now vested in the London and North-Western Railway Company, and the Mere is used by them as a reservoir for the supply of the Sanitary Canal. At one point of the principal watercourse granted by the deed of October, 1844, where it runs through a covered channel or culvert, there was what is called a "throttle"—that is to say, for a distance of about 40 feet the size of the channel was contracted by its floor being suddenly raised in height 28 inches, the result being that the flow of the water was obstructed, and the level rendered higher at the upper part of the watercourse, so that more water found its way in time of flood, by means of the weirs and channels leading therefrom into the Mere and the Corn Mill Dam, than would have been the case if the throttle had not existed. The corporation, in the year 1875, removed the throttle, and constructed in place of it an enlarged culvert of uniform gradient. The object of this suit, in which Mr. Taylor and the railway company are plaintiffs, was to restrain the corporation from doing this, and to compel them to restore the throttle. The Vice-Chancellor granted a perpetual injunction to restrain the corporation from enlarging the size or altering the level of the watercourse, and ordered them to restore the throttle. Against this injunction the defendants appealed.

The MASTER of the ROLLS, in giving judgment, remarked that the question was as to the true construction of the grant in the deed of October, 1844. The words must be construed according to their ordinary meaning, unless the context showed that a different meaning ought to be given to them, and the old maxim, that if there were any difficulty or obscurity in the construction of a grant, it was to read most strongly against the grantor, had at the present day very little weight. The grant of a watercourse might mean one of three things. It might mean a grant of the easement or right to the flow or running of the water, or a grant of the channel containing the water, or a grant of the land over which the water flowed. Which of these three meanings was to be adopted must depend on the context. In the present case he thought that the grant was of a corporeal hereditament, and that it meant the channel, pipe, or drain which contained the water, and the water contained in it; and if there were nothing else in the deed, the grantees would be entitled to the channel and the water coming into it by ordinary natural means. Of course, the plaintiff

could not grant the water which flowed into the watercourse from land not his own, for that water was not his to grant; but by the grant of the watercourse he granted any water which flowed into it from off his own land. Then he also granted springs of water, which must mean his own springs. A spring was a definite source of water existing in nature, and it might be above or below the ground; a stream was also something running in a defined course, and the plaintiff granted also the streams of water on his own land. That was the extent of the grant. The defendants claimed to be entitled to, not merely the water in the watercourse and the springs and streams of water, but to all the water which could by any possibility get from the plaintiffs land into the watercourse. His lordship thought that the grant extended only to such water as was granted because it was in the watercourse. If a grant was made of vessels containing fluid, the grantee only got the fluid because it was in the vessel. He had no right to enlarge the vessel for the purpose of getting more fluid into it. If it could be shown that all the water on Mr. Taylor's land had been granted independently of its being incidental to the grant of the watercourse, that would imply a reasonable way of getting it, and would imply a right to enlarge the watercourse. But that was not the grant in the present case. The result was that the defendants had no right to enlarge the existing watercourse, and the decree of the Vice-Chancellor must be affirmed.

Lord Justice JAMES concurred, observing that the grant was of a watercourse actually delineated and coloured blue on the plan annexed to the deed, and he was of opinion that nothing was conveyed but what was so delineated and coloured. And he agreed with the Master of the Rolls that in this case the word "watercourse" meant the existing channel, and that there was no right in the defendants to enlarge it.

Lord Justice BRAMWELL also concurred.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

THURSDAY, JUNE 21.

(Before Vice-Chancellor MALINS.)

SUTTON v. THE BARNET LOCAL BOARD.

Mr. LOCOCK WEBB, Q.C., and Mr. BOSANQUET, appeared for the plaintiff; Mr. GLASSE, Q.C., Mr. J. PEARSON, Q.C., and Mr. CHARLES MITCHELL for the defendants.

This was an action brought by the plaintiff, who is a farmer at Totteridge, in the county of Hertford, for an injunction to restrain the Local Board of Barnet from committing a nuisance by allowing the sewage of the district to flow into a stream running by the plaintiff's farm. The injunction was granted by Justice Field in August, 1876, and upon a motion to dissolve that injunction, the defendants gave an undertaking not to continue or repeat any nuisance by causing or permitting the sewage of the district to flow into the stream. A motion was now brought on, on behalf of the plaintiff, that four members of the local board might stand committed to prison for breach of that undertaking, and also that a commission of sequestration might issue against the estate of the defendants, the local board. An action for damages had been brought by the plaintiff against the defendants, which was tried at Hertford, and that action resulted in a verdict for the plaintiff, with £75 damages, and costs. It was not now sought to enforce the commitment of the defendants, but only that they should be ordered to pay the costs. The motion was opposed, on the ground that in a case like this, where the defendants had been doing all in their power to remove the nuisance, it was unjustifiable on the part of the plaintiff to ask that the four members of the board should be committed, and that they ought not to be ordered to pay the costs.

The VICE-CHANCELLOR said it appeared from the evidence in this case that the stream now in question was formerly so pure that the cattle used to drink from it, and that the water was rendered impure and unfit for use by the sewage which was allowed to flow into it from the defendants' works. That a nuisance had been caused was evident from the result of the action at Hertford, and when the defendants moved to dissolve the injunction granted to restrain a continuation of the nuisance, an undertaking was given by the board not to allow this nuisance to continue. The board meeting at which this undertaking was confirmed was attended by the four gentlemen who were now the objects of the motion to commit. It was quite clear that the board had no intention whatever of acting contumaciously; but, on the contrary, that they had done all they could to abate the nuisance. There was, however, no doubt, upon the evidence, that the steps they had taken were not effectual, although the nuisance might, in some degree, have been abated. Under these circumstances the defendants ought never to have allowed this case to go on, but should have submitted and paid the costs, the only object of the plaintiff being to enforce the undertaking already given. If this motion had been merely for a sequestration, it would have been a matter of course; but the plaintiff, not satisfied with that, moved also for the commitment of the personal members of the board who authorized the undertaking. That portion of the application was wholly unnecessary and unjustifiable; and his lordship agreed with the learned counsel for the defendants in thinking that several clauses in the Local Board of Health Act were intended expressly to protect the persons forming the different boards from any personal liability. Under all the circumstances, he should order the local board to pay the costs so far as regarded the sequestration, but he should not give costs against the individual members of the board in respect of the motion to commit.

METROPOLIS GAS SUPPLY.

Dr. Stevenson's report on the gas supplied by The Gaslight and Coke Company to the Vestry of St. Pancras, during the month of May:—Maximum light, estimated by sperm candles, according to the Act—16.8. Minimum light, sperm candles—15.8. Average light, sperm candles—16.1. Traces of ammonia, indicated by turmeric test-paper—Traces only on all occasions. Traces of sulphuretted hydrogen, indicated by lead test-paper—none on any occasion. Sulphur, 10.44 grains per 100 cubic feet.

METROPOLIS WATER SUPPLY.

Major Bolton reports that the state of the water in the Thames and Lea was good during the month of May. The water in the River Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was good during the month. The highest flood state of the river was 1 foot 3 inches above the (6 feet) summer level, and the lowest was 3 inches below summer level. The highest temperature of the water taken at Seething Wells was 58°, and the lowest 48°, while the highest temperature of the air at the same place was 69°, and the lowest 43°. The condition of the water in this part of the river was good on 11 days, indifferent on 18 days, and bad on 2 days during the month. The highest flood state was 2 feet 1 inch above, and the lowest 7 inches above summer level. These observations were made daily at 9 a.m. The rainfall for the month was 2.29 inches.

DR. WALLACE ON THE AITKEN AND YOUNG PROCESS.

The system of enriching poor, or comparatively poor, gas which has been patented by Messrs. Aitken and Young, and which has, during the last twelvemonth, received a great deal of attention from the gas managers in the West of Scotland, has just been reported upon by Dr. Wallace, F.R.S.E., the gas examiner for the city of Glasgow, a gentleman who deservedly ranks high in the science and art of gas manufacture and gas illumination. As the report prepared by that gentleman is one of very great value, we hasten to place a comprehensive summary of it before the notice of our readers.

Dr. Wallace visited the Hamilton Gas-Works, where the apparatus had been erected, at stated intervals from the 26th of March till the 24th of April of the present year, and, with the assistance of the manager, conducted practical experiments with different kinds of coal. [We have been informed that the works were visited by Dr. Wallace on somewhere about ten separate occasions during the progress of the experiments.] The first actual trial was made with the mixture of third-class parrot coal and shale ordinarily used in the works, in the proportion of 65½ cwt. of parrot and 15½ cwt. of shale, or 80.6 and 19.4 per cent. By the ordinary process this mixture yielded gas at the rate of 8870 cubic feet per ton; and, as tested by the standard burner used in Glasgow, the gas had an illuminating power of 22.81 candles, which gives 694 lbs. of sperm as the equivalent of a ton of the mixed material. Employing the same mixture of raw materials, Dr. Wallace then tried the new process for a week, and the result was 9012 cubic feet of 26.60-candle gas per ton of the mixture. The sperm equivalent of a ton of the mixture in this instance was 822 lbs., and the gain was 18.4 per cent. He continued the new process for three days longer, and eventually an illuminating power of 29.2 standard candles was reached; but he did not base any calculations upon this high result. From this and other observations, however, it appeared to Dr. Wallace that the full effect of the new process was only obtained after the lapse of some time, and that, on the other hand, when the old process was resumed the gas did not fall to its normal illuminating power for several days.

As is very proper, Dr. Wallace is careful to give some consideration to the question of the quality of the tar which is finally obtained by this new process. He says that the tar from the analyzer is somewhat thicker and blacker than that ordinarily produced from the same coal, and that it contains, as might be expected, a smaller proportion of volatile hydrocarbons. In the experiments just referred to, the tar obtained by the old process gave 3.8 per cent., and that by the new process 1.7 per cent. of crude naphtha, when distillation was resorted to by the action of open steam. Of course, this is a most important feature to be considered in estimating the value of the new process.

The second series of trials involved the use of Provanhall coal alone. It was of very inferior quality, and contained at least one-fourth of its weight of splint coal. Experimenting first with the new process, which he employed for a week, Dr. Wallace obtained an average yield of 8083 cubic feet of gas per ton of coal, the illuminating power of which was 28.55 candles, the equivalent in sperm being 791 lbs. per ton of coal. The ordinary process was then employed for five days, the results of which were—8235 cubic feet of gas per ton of coal; illuminating power of same, 25.51 candles; sperm equivalent, 720 lbs.; the new process in this instance only showing a gain of 10 per cent. But Dr. Wallace considers it right to say that, by the time this experiment was made, the hydraulic main and all the connexions had been coated with a non-conducting composition—thus preventing, to a certain extent, the absorption of the volatile hydrocarbons by the tar—and that the time allowed for the experiment was too short to secure the full advantage of the new process. He expresses himself as satisfied that, but for these circumstances, a greater gain would have been obtained.

Splint coal alone was then employed for a third series of experiments, but in a few days after they were commenced the complaints as to the quality of the gas were so loud and numerous that the operators were reluctantly compelled to abandon the use of this coal before any satisfactory and reliable results were obtained.

With regard to the means employed for testing the resulting gas, Dr. Wallace remarks that the examinations for illuminating power were made both at the gas-works and at a testing-station, which had been fitted up at the distance of about a mile from the works, and quite outside the town of Hamilton. Trials made there, some of them in very cold weather, satisfied him that the gas was practically permanent, the loss of illuminating power not exceeding from 0.45 to 0.75 of a candle. Dr. Wallace also made estimates of the durability, absorption by bromine, and specific gravity of the gas, and his determinations by these various methods corresponded with the illuminating power observed by the aid of the photometer.

Naturally enough, he adds some remarks on the theory of this new process. The principle which it is desired to establish by means of the process is, that gas tar, condensed in the ordinary way, carries with it a certain proportion of the volatile hydrocarbons included in the general term naphtha; and practical experience, he says, amply bears this out. If gas, he goes on to say, instead of being cooled slowly, is rapidly condensed, for instance, by means of a coil of pipes immersed in cold water, the illuminating power is so much reduced as to make the gas practically useless. Again, if the hydraulic main of a gas-works be exposed to a keen north-east wind, the illuminating power of the gas falls two or three candles. As an illustration of the power of liquid hydrocarbons to absorb vapours of similar compounds existing in gas, Dr. Wallace states that when, many years ago, he attempted to prevent evaporation in his experimental meters by having a thin film of heavy paraffin oil on the top of the water, the gas was deteriorated to a very serious extent. That volatile hydrocarbons in the form of vapour exist in coal gas is well known; indeed, he remarks that the first specimen of benzole ever made was obtained by Faraday by the compression of gas; and the object of the gas manager is to retain these vapours, while separating the heavier compounds in the form of tar. This object is effected in a satisfactory manner by the apparatus employed at the Hamilton Gas-Works, but he is not without hope that experience will suggest some useful modifications of the apparatus, and possibly reduce its dimensions; and he concludes by remarking without reservation that the process is undoubtedly a great step in the art of gas-making.

GAS COAL FOR HOLLAND.—It was rumoured on the Glasgow Exchange last week that orders for a large quantity of Scotch canal coal of the second class, for shipment to Holland, have just been placed by two coal-shipping firms in Glasgow. This fact, along with other causes, has had the effect of reducing the available supply of Scotch canal coal to a considerable extent. It is stated that the large increase in the foreign exportation of that variety of coal this season is principally owing to the low prices that were current in Scotland last year. The owners of the canal collieries, finding the home market so unprofitable, have endeavoured, and so far have succeeded, in developing a trade amongst the gas-consuming cities of the Continent.

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